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Perilous Work Zones: Unveiling the Factors Influencing Health and Safety Risks in Tanzania's Informal Construction Sites

Benson Rugalema Mwemezi
Building Economics Department, Ardhi University, Dar es Salaam, Tanzania
Email: bmwemezi@yahoo.co.uk

Geraldine J. Kikwasi
Building Economics Department, Ardhi University, Dar es Salaam, Tanzania
Email: gkikwasi@yahoo.com

Sarah Phoya
Building Economics Department, Ardhi University, Dar es Salaam, Tanzania
Email: sarahphoya@gmail.com

Abstract

Informal construction (IC) emerged after the Second World War. Informal economies have largely led to it. IC comprises individuals conducting construction activities that are unregulated despite their economic contribution. IC faces health and safety risks (HSR), but little has been investigated on the factors influencing HSR in IC. This study identified and ranked the factors influencing HSRs in the IC sites (ICS) in Tanzania. Data was collected from 304 mason workers (MW) in ICS through questionnaires based on 24 factors derived from the literature. The study employed the quantitative method. Descriptive and inferential statistics were used for ranking and measuring the significance of factors. Findings revealed that lack of information and knowledge about safety rules, lack of awareness of risk management process and lack of framework and procedures were the significant factors highly influencing informal construction. Conversely, the lack of safety gear, drug abuse on-site and negligence have insignificant effects on informal construction. Moreover, the nature and physical layout of construction sites, labourers working in close proximity/overcrowded sites, and poor construction material arrangements were not significant factors. The study provides insight into the factors influencing HSR in informal construction. This study provides a baseline for developing an empirically grounded health and safety framework. The study will therefore pinpoint systematic HSR management procedures for improving HSR management in IC. Overall, the findings address the Sustainable Development Goals (SDG) 2030 Agenda Numbers 3 and 11, which aim to establish good health and well-being and mobilize sustainable cities and communities.

Keywords: Influencing Factors**,** Health and Safety Risks, Informal Construction Sites, Tanzania
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Introduction

The construction industry (CI) contributes significantly to the level of economic activity and employment in many nations, particularly developing nations, Tanzania inclusive. The degree to which a nation has advanced economically is often measured by its construction activity

(Usukhbayar & Choi, 2020). The CI is acknowledged as both significant and one of the riskiest businesses but invariably a driving force of the economy of any nation. Construction site occupational health and safety (OHS) risks are major issues worldwide but much more so in developing countries (Gervas, 2021). Lingard and Holmes (2001) emphasized that management of occupational health and safety (OHS) in the construction industry is more difficult than in other industries due to the structure and nature of the work. Construction employees are exposed to occupational hazards, which raise their risk of getting occupational illnesses and health syndromes in various ways (Nghitanwa & Zungu, 2017). The study explored the factors influencing health and safety risks (HSRs) in informal construction. The study was inspired by an intellectual drive to support the achievements of the Sustainable Development Goals (SDG) 2030 agenda number 3 and 11. Agenda 3 is aiming at making sure everyone lives a healthy life and encourage wellbeing at all ages. This can be attained through significantly increasing spending in the health sector with a view to improving the health workforce particularly in developing nations. These nations need to have in place effective early warning health risk identification, reduction mitigation and sustainable management measures. Agenda 11 aims to create inclusive, secure, robust, and sustainable cities and human settlements. This foreshadows that by 2030, slums must have been upgraded. Moreover, everyone should have access to decent, affordable and safe homes. This can be achieved with good health and safety risk management in IC since most affordable houses are built using the incremental construction housing model (UN, 2015). The CI is divided into two parts, namely the formal and informal construction sub-sectors. The formal and informal CI do exist in many countries in the world, but more in developing countries where they are still fighting to raise per capita income (Mlinga and Wells, 2002). IC are hardly found in Europe. van Heumen and Roos (2019) claim that there is no scale that would fit all the numerous forms of informality in European integration in the past, present, and future. Zhang (1997) argued that a substantial portion of the building stock in Beijing's older inner-city districts consists of informal construction, constructed over time by the residents themselves. IC has been to a typical feature prevailing in sub-Saharan Africa. The point is substantiated by various studies in the IC construction which focused on the characteristics, extent, administration, and social welfare protection of the workers in IC (Mlinga and Wells, 2002; Mwemezi, 2018; Phoya et al., 2018).

Informal construction (IC) is expressed as unregulated construction activities. It is made up of unlicensed and unregulated individuals and businesses engaged in construction-related activities (Phoya et al., 2018). IC involves construction activities carried out by individuals with or without professional qualifications and without the use of formal construction agreements. The idea of the informal economy, which arose in the reform after the Second World War, gave rise to IC (Mwemezi, 2018). Since then, the economy has been taking advantage of the growth of the IC industry (Nurul Amin, 1987). IC construction involves the construction of small residential houses of one to two storeys, with a budget that remains unknown until the end because construction is essentially incremental (Mwemezi et al., 2023). It is argued that the CI is regulated extensively, leading to an extensive range of elucidations of informality (Wells, 2007). Generally, construction works in developing nations constitute as much as 80% of all employment (Jewell et al., 2005). Therefore, it is important to make sure HSRs for this large workforce from IC are minimized to an acceptable level. Through the CI policy, the Tanzanian Government promotes and recognizes the IC sector as a vital component of the construction industry due to its capacity to provide employment for different types of construction activities (URT, 2003). Despite their wide recognition, workers in IC experience unfavourable welfare circumstances. The workers in the IC are completely exposed to OHS risks. Sychareun et al. (2016) claimed that informal workers face considerable risks and vulnerabilities due to the conditions of their employment and work where there is no regulating organ.

The IC is still constrained by poor management of the HSRs workforce. IC is characterized by the small scale and lack of authority-organized organization of the construction activity (Aikaeli, 2014). It is predominantly characterised by the use of artisans who are not recognized by any professional board. Due to high informality, workers in the IC tend to work as individuals without any associations that could stand to fight for their rights. In the IC, labourers frequently think of themselves as both employees and entrepreneurs. This is due to the fact that, after being recruited by an employer, they work for them, albeit occasionally they receive their own tasks, allowing them to choose their own hours. Employers frequently care more about how quickly employees can execute their tasks than they do about their health issues (Birchall, 2001). Since artisans in IC are working without having a contract, it becomes very difficult when disputes arise between the client and the artisan. A significant section of the informal workforce is employed in the formal construction sector, and poor occupational health and safety results are embedded at human costs (Ahmed et al., 2018). The development of skills, social protection, employment creation, and occupational safety and health (OSH) policies should all be prioritized to protect the well-being of employees in the informal economy (Valentina, 2014). The informal sector is well known for having hazardous workplace conditions, lax health regulations, and widespread environmental and occupational risks. The majority of workers reside in underdeveloped areas where there are few fundamental welfare and health services. Most people are also ignorant of their legal rights, workplace safety resources, or protections that are accessible to them (Basu et al., 2016). There is a lack of research on the health and safety hazards associated with operations in the informal sector (Basu et al., 2016). It is recommended that the national governments should create adequate legislation and allocate the required funds for hazard control and health surveillance in order to protect the health of these workers in IC in the best possible way (Naidoo et al., 2009).

It is well known that numerous research projects have been done on IC, focusing on its characteristics, the relationship between formal and informal construction, informal employment, and the like. Conversely, despite the prevalence of many studies done on OHS in construction, we are still unaware of what influences HSRs in IC. Scholars such as Phoya et al., (2011); Ng'ang'a et al., (2014); Okoye, (2018) conducted studies which identified a number of HSR in construction. Some HSRs include injury or death due to falling from height (slips and trips), sickness due to poor drinking water or poor toilet facilities, skin sanitizers and irritants (cement), among others. The factors influencing health and safety risks (HSRs) in IC have not been well addressed in previous studies. This research gap may be attributed to the existing top-down management approach that has failed to devise sustainable health and safety risks interventions and resolutions impacting negatively IC. The top-down approach for managing risks to health and safety in construction depends on higher-ranking officials setting more expansive goals that trickle down to the lower-level workers' responsibilities. Given this scenario, it becomes cumbersome for higher-ranking officials to understand the health and safety issues afflicting workers in IC since they are not registered and not recognised. There is a need for a bottom-up approach that can explore these issues for improving health and safety in IC. This study addressed the sustainable development Goals (SDG) 2030 agenda Number Three and Eleven which are aimed to attain good health and well-being and mobilization of sustainable cities and communities, respectively. Hence, this research identified and rank the factors which significantly influence HSRs in IC.

Literature Review

Health and Safety Risks in Construction

Occupational HSR relates to an evaluation of risks that could endanger, injure, kill, or make a worker sick in a certain workplace. Statistics on the accidents on construction sites demonstrate how vital the construction industry sector is globally, and how urgently and completely the site safety protocols need to be updated. Accidents do not only happen; they also originate from dangerous behaviour, an unfavourable work environment, or a combination of both. Most accidents are caused by a combination of dangerous behaviours, unsafe working conditions, and/or other contributing factors(Abdul et al., 2008; Williams et al., 2018; Ahmed, 2019). However, there have been numerous difficulties in locating reliable data on workplace accidents in undeveloped countries (Shewiyo et al., 2021). Among the HSRs in construction workplaces are working at heights, falling objects, moving objects, slips, trips, and falls, noise, hand-arm vibration syndrome, material handling, collapsing trenches, and electric shock. Abukhashabah (2020) highlighted that, many of these accidents and injuries are caused by ignorance, a lack of safety training, human error, inexperienced labour, inadequate supervision, negligence, apathy, and outright recklessness, along with poor and ineffective site management. Failure to manage HSRs normally leads to poor performance of the workforce which results in poor quality of work, time wastage and increased cost of construction. Therefore, there is a great need for the project actors to make sure HSRs are minimized or eliminated for the project to be successful.

Factors Influencing Health and Safety Risks in Construction

Construction industry HSRs have gained international significance attested by the latest research carried out. In order to bring some benefit to this relatively new field, more attention is needed. Construction projects are facing a number of health and safety risks that have negative effects on individual workers and the project objects at large. In that view, a considerable number of studies have been done focusing on investigating the factors influencing HSRs in construction. Based on a survey done by Ismail et.al. (2012) on the factors influencing HSRs in construction sites, the most significant safety factors identified were: personal awareness, closely followed by communication. In order to explore the HSR issues in the construction industry, a number of studies have been done addressing HSR and management. These include Kheni et.al., (2008); Chileshe and Dzisi (2012); Phoya (2012).

Generally speaking, studies on the factors influencing health and safety risk management have focused on the formal construction industry, but less on investigating the situation in the informal construction. Studies such as Williams et al. (2018) and Ahmed (2019) have identified improper use/defective tools and machines, poor construction material arrangements, a lack of equipped first aid kits in workplaces, and a lack of practical experience with health hazards as the critical factors influencing health and safety risk in construction sites. Their studies were limited to formal construction.

Alhajeri (2019) and De Silva and Wimalaratne (2012) observed that the successful implementation of health and safety risk management in construction depends on factors such as engaging inexperienced labourers at construction sites, tiredness, a lack of information and knowledge about safety rules, a lack of safety gear, Implementation costs (lack of money), and a lack of training on health hazards issues.

The studies by Abdul Rahim et al. (2008), Mahmoudi et al. (2014), Chileshe and Kikwasi (2013), Ramya and Ramadasan (2016), Asibey et al. (2021), and Muoz-La Rivera et al. (2021) also revealed that health and safety risk management in construction sites can be mitigated and consequently abated if the factors such as lack of awareness of the risk management process, improperly fixed scaffolding or unprotected edges, unsupported health and safety culture, lack of framework and procedures, and lack of warning system/sign could be adequately explored and linked to the practitioners of the industry for implementation.

Inferably, the studies cited in the preceding paragraphs focused much on the construction industry in general. There was therefore a research gap on the relative importance of the factors influencing health and safety risk management in the informal construction sector. Table 1 shows a list of some critical factors influencing health and safety risk in the construction sector based on the previous studies.

Table 1: Literature summary on the factors influencing hsrs in construction

	Factors Influencing HSRs	**Previous studies**
FHSR1	Lack of information and knowledge about safety rules	(Okoye et al., 2016; Adebiyi et al., 2020)
FHSR2	Lack of safety gears	(De Silva & Wimalaratne, 2012)
FHSR3	Lack of training on health hazards issues	(Alhajeri, 2011)
FHSR4	Nature and physical layout of the construction sites	(Sarah Phoya, 2012)
FHSR5	Poor Construction materials arrangement	(Williams et al., 2018; Ahmed, 2019)
FHSR6	Improper use/defective tools and machines	(Williams et al., 2018; Ahmed, 2019)
FHSR7	Labourers working in close proximity/overcrowded sites	(Williams et al., 2018)
FHSR8	Engaging inexperienced labourers at construction sites	(Ahmed, 2019)
FHSR9	Bad weather/expose too much to the sun for a long time	*(*Williams et al., *2018;* Adul Hamid et al., *2018)*
FHSR10	Improperly fixed scaffolding/Unprotected edge	(Ramya & Ramadasan, 2016)
FHSR11	Unreliable income of casual workers forces them to under risky jobs	(Ahmed, 2019)
FHSR12	Negligence	(Williams et al., 2018)
FHSR13	Lack of warning system/sign	(Abdul Rahim et al., 2008)
FHSR14	Drug abuse on site	(Williams et al., 2018)
FHSR15	Tiredness	(Alhajeri, 2011; Williams et al., 2018)
FHSR16	Lack of welfare facilities (Clean water, toilet and the like)	(Kheni et al., 2008; Muiruri & Mulinge, 2014; Ng'ang'a et al., 2014)
FHSR17	Lack of awareness of risk management process	(Chileshe & Kikwasi, 2013)
FHSR18	Lack of practical experience on health hazards	(Williams et al., 2018)
FHSR19	Lack of framework and procedures	(Mahmoudi et al., 2014; Asibey et al., 2021)

FHSR20	Availability of specialist in health and safety risk management	(Abdul Rahim et al., 2008)
FHSR21	Unsupported health and safety culture	(Muñoz-La Rivera et al., 2021)
FHSR22	Lack of coordination between parties involved	(Abdul Rahim et al., 2008; Ahmed, 2019)
FHSR23	Implementation costs (lack of money)	(Ahmed, 2019)
FHSR24	Lack of equipped first aid kits on workplaces	(Williams et al., 2018)

Research Methods

Research Approach and Design

The overriding objective of the study was to determine the variables that affect HSRs in IC sites. To realize the objective, the quantitative research approach was used. The study adopted a cross-sectional design (survey) with the aim of getting most informal workers' minds through questionnaires. This design has the advantage of dealing with more than one case and is relatively quick and inexpensive to conduct. Using this method, we can measure prevalence and study the association between multiple exposures and outcomes (Bryman, 2012; Wang & Cheng, 2020). The approach was chosen because it uses a bigger sample size and does not rely on human interpretations, making its results likely to be generalized to an entire population or a subgroup (Creswell, 2014). In addition to sampling, data processing takes less time since it makes use of statistical software like SPSS (Connolly, 2007). The approach puts a lot of emphasis on measuring something or variables that are present in the social realm. The technique is suitable for research in IC where there is a large sample to be studied.

Population and Sampling Design

Precise sources should be taken into account when gathering accurate and trustworthy data. The MW in the IC were used as the study population in this paper. The IC workers, especially MW, are not registered and it is difficult to identify the informal construction sites. Therefore, IC is characterized by an unknown population. This study's sample size was calculated using the Cochran formula for an unknown or infinite population, expressed by the following formula (as indicated in equation 1 suggested by Kothari, 2004).

$$n_0 = \frac{Z^2 * p * q}{e^2} \qquad (1)$$

where:
n_0 stands for the sample size
Z2 is the selected critical value of desired confidence level,
e is the preferred level of precision,
p is the estimated proportion of an attribute that is present in the population, and q is 1- p.
Data adopted for sampling in this study includes the maximum variability, which is equal to 50% (p =0.5) and taking (Z) 95% confidence level with ±5% precision (Cochran, 1977). The calculation for the required sample size for this study is shown in equation 2.
Then, p = 0.5 and hence q =1-0.5 = 0.5; e = 0.05; z =1.96

$$n_0 = \frac{(1.96)^2 * (0.5) * (0.5)}{(0.05)^2} = 384 \qquad (2)$$

Consequently, the study's sample size was 384. Mason (2010) recommends that a sample size of a quantitative study should not be lower than 30 participants. Using the criteria, this sample was suitable. Due to the homogeneity of the research population, the sample was fairly dispersed among five municipalities found in Dar es Salaam. Snowball sampling method was used to choose particular informal workplaces for data collection.

Data Collection

The initial questionnaires were pre-tested before the study had been conducted . The underlined motives for conducting a pre-testing was to test and improve the questionnaires in order to ensure that the respondents would have no trouble responding to them and that data collection would go smoothly (Bryman, 2012). Through a pre-testing, the list of factors influencing HSRs compiled from the literature was enhanced for the survey questionnaire. The questionnaires comprised three sections including a brief overview of the study, demographic information and factors influencing health and safety risk management in informal construction sites. Considering personality attributes of the IC personnel whose language was not English, the questionnaires were translated from English to Kiswahili. The questionnaire was translated and revised in accordance with the three steps of development and translation processes suggested by Tsang et al., 2017. The three steps in this process were as follows: preliminary considerations, development /translation process and validation (Tsang et al., 2017). Closed-ended questions were employed because they are excellent for acquiring quantitative and factual data and because the range of possible answers is constrained (Fellows & Liu, 2015). Furthermore, they are easier to use online because they usually require only a single keystroke or mouse click to respond, and are less cognitively demanding.
The respondents were asked to rate how much they agree with the factors influencing HSRs in ICS using a Likert scale with 5 points, whereby 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The Likert scale had the direction of "agree/disagree" and the intensity of "strongly" or "not," and it measured both of these and it can identify respondents' thoughts about their attitudes (Albaum, 1997).

Forms from the KOBO toolbox were used to collect the data. Employing online forms made it simple to gather, store, and manage the study data. It makes the respondent finish the survey without skipping any questions eliminating characteristics of missing data in research (Nampa et al., 2020). The method is significant in remote areas or in situations where the internet connection is dubious, such as in ICS (Poloju et al., 2022). It is appropriate for gathering data at IC sites because it can be operated even in the offline mode. Singh (2013) acknowledged the use of mobile data collection forms as a questionnaire instrument. A total of 384 set of questionnaires were distributed. Finally, a total of 304 responses were received, indicating a response rate of 79.17%. In view of ugenda and Mugenda (2003) 50% of the responses are adequate for study and exposure; a response rate of 60% or above is excellent, and one of 70% or higher is remarkable. Based on these facts, the response rate obtained for this study was adequate.

Data Analysis

In the present study, the data was analysed using the Statistical Product and Service Solutions (SPSS) version 26. Descriptive and inferential statistics were used in ranking and measuring objectively the relative significance of the CI factors mentioned. Frequency analysis and measures

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of central tendency were used to rank the factors influencing HSRs in ICS. Parametric tests (a one-sample t-test) measured the significance of factors influencing HSRs in IC workplaces. Approximating 95 % confidence level, the cut-off point for a 5-point scale was established at "3.5" ($\mu = 3.5$), where μ is the test value. The methodology's basis was to determine significance in order to capture the relevant factors affecting HSRs in IC (Forza, 2002). Drawing on the Ling and Nguyen (2013) proposition, the cut-off point for the five-point scale was set at “3.5” ($\mu=3.5$) to measure the extent to which the factors influencing HSRs under investigation were critical. The value of “3” was regarded as the middle point on a five-point Likert scale, equivalent to the identification of 50 per cent of the factors influencing HSRs in IC. Given the lack of enough knowledge on the factors influencing HSRs in IC studies in Tanzanian, a value higher than 50 per cent for the measurement of the criticality of the variables was deemed appropriate. To that end, the μ value of 3.5 and the procedures for the single-sample t-test were conducted as suggested by Cronk (2019). The same methods have been used in other studies such as Kavishe, Chileshe & Jefferson (2019) and Chileshe et al. (2022). The analysis for the single-sample t-test was carried out using the methods proposed by Cronk (2018). It was supposed that Ho: $p \leq 0.05$ and H1: $p > 0.05$. The responses from each respondent were independent from one another and were reasonably normally distributed (Kavishe, 2017).

Results

Reliability Analysis

The Cronbach's Alpha reliability test was used to determine the reliability and internal consistency of the survey tool used to collect the data. Various methodologists agree that the Alpha values above 0.70 are acceptable (Hair et al., 2014). Regarding the factors influencing HSRs in IC, the Cronbach's alpha coefficients were determined to be 0.89, demonstrating a high level of internal consistency of the instrument.

Survey Sample Characteristics

Table 2 displays six characteristics of the 304 respondents. These are location of the sites, gender, age, education qualification, position on the site and work experience in construction as presented in table 2.

Table 2: Demographics of the respondents

Characteristics	Frequencies	Percentages (%)
Location of the sites		
Ubungo	65	21.4%
Kinondoni	60	19.7%
Ilala	51	16.8%
Temeke	66	21.7%
Kigamboni	62	20.4%
Total	**304**	**100.00%**
Sex		
Male	290	95.4%
Female	14	4.6%
Total	**304**	**100.0%**
Age		

12-17	17	5.6%
18-35	141	46%
36-45	100	33%
46-55	35	11.5%
Above 55	11	3.6%
Total	**304**	**100.0%**
Education qualifications		
Primary education	109	35.85%
Primary education Vocation skills	74	24.34%
Secondary education	57	18.75%
Secondary education Vocation skills	61	20.07%
Higher education	3	0.99%
Total	**304**	**100.0%**
Position of the respondent at the sites		
Gang leader	84	27.6%
Skilled labour	92	30.3%
Unskilled labour	128	42.1%
Total	**304**	**100.0%**
Experience in construction workplaces		
0-5	62	20.4%
6-10	86	28.3%
11-15	91	29.9%
16-20	38	12.5%
Above 20	27	8.9%
Total	**304**	**100.0%**

As shown in Table 2, out 304 respondents, 65 respondents (21.4%) were from Ubungo Municipal Council (MC), 60 (19.7%) were from Kinondoni MC, 51 (16.8%) were from Ilala MC, 66 (21.7%) were from Temeke MC and finally 62 respondents (20.4%) were from Kigamboni MC. This denotes that there was a fair circulation of the questionnaires to all MCs and there was no domination or bias of one place. Therefore, the results present well information from IC from Dar es Salaam. Table 2 also shows that, majority of respondents 290 (95.4%) were males while 14 (4.6%) were females. The construction industry is noted for having more male involvement than females, which contributes to the domination of men. This portrays that involvement of females in the informal construction is worse as compared to formal construction. Furthermore, the findings reveal that the age between 18 and 35 years old was high among most of the responders (n = 141; 46%), followed by the age between 36 and 45 (n = 100; 33%). This implies that this is the working age of IC workers. Moreover, it was noted that there were 17 (5.6%) respondents aged below 18 who were involved in the survey.

This shows that the IC sector, like other informal sectors, is associated with child labour (Kadonya et al., 2002). Findings showed that the majority of the respondents (n = 109; 35.85%) had attained primary education. These are followed by those with primary education with vocational skills (n = 74; 24.34%) and secondary education with vocational skills (n = 61; 20.07%). Few respondents (n = 3; 0.99%) had higher education. The distribution of gang leaders, skilled labour, and unskilled labour was 27.6 percent, 30.3 percent, and 42.1 percent, respectively. Generally, unskilled labour constitutes the majority. This is a reflection of their education qualifications already discussed. In terms of the working experience in the construction sector , the distribution was evenly for respondents with experience from 0 to 5 years, 6 to 10 years, and

11 to 15 years, which was 20.4 percent, 28.3 percent, and 29.9 percent, respectively. Those with experience from 16 to 20 and above 20 were the minority with 12.5 percent and 8.9 percent, respectively.

Overall Ranking of Factors Influencing Hsrs in IC

The mean score analysis and one-sample t-tests of the 24 factors influencing HSRs in IC as identified from various studies are displayed in Table 3. Table 3 illustrates that 21 out of 24 factors influencing HSRs are statistically significant with a p-value that is less than 0.05. This is supported by their mean. Most of the factors had the mean score above 4.00.The means ranged from 4.52 for lack of information and knowledge about safety rules as the most ranked significant indicator to 4.48 for lack of framework and procedures as a least ranked significant factor. The nature and physical layout of the construction sites, labourers working in close proximity/overcrowded sites and poor construction materials arrangement were revealed as not significant factors with the mean scores 3.45, 3.42 and 3.41, correspondingly to their p-values 0.413, 0218 and 0.559 respectively which are greater than 0.05. This implies that they are not significant.

Table 3: Results of one-sample t-test for the factors influencing HSRs in construction

FHSR	Mean score	SD	Rank	Test value (μ = 3.5) *t*	*df*	Sig 2-tailed	Mean difference	95% Confidence interval of the difference		Significant (*p* <0.05)
								Lower	Upper	
FHSR1	4.52	0.703	1	18.824	303	**0.000**	1.020	0.94	1.10	✓
FHSR17	4.50	0.766	2	22.674	303	**0.000**	0.997	0.91	1.08	✓
FHSR19	4.48	0.766	3	22.379	303	**0.000**	0.984	0.90	1.07	✓
FHSR23	4.42	0.680	4	23.616	303	**0.000**	0.921	0.84	1.00	✓
FHSR24	4.37	0.814	5	18.603	303	**0.000**	0.868	0.78	0.96	✓
FHSR21	4.33	0.662	6	21.748	303	**0.000**	0.826	0.75	0.90	✓
FHSR15	4.31	0.843	7	16.805	303	**0.000**	0.813	0.72	0.91	✓
FHSR10	4.30	0.624	8	4.838	303	**0.000**	0.803	0.73	0.87	✓
FHSR18	4.25	0.636	9	20.476	303	**0.000**	0.747	0.67	0.82	✓
FIHSR13	4.23	0.713	10	23.616	303	**0.000**	0.730	0.65	0.81	✓
FHSR22	4.23	0.739	11	17.159	303	**0.000**	0.727	0.64	0.81	✓
FHSR11	4.22	0.664	12	21.748	303	**0.000**	0.717	0.64	0.79	✓
FHSR16	4.22	0.890	13	14.106	303	**0.000**	0.720	0.62	0.82	✓
FHSR8	4.05	0.841	14	20.476	303	**0.000**	0.549	0.45	0.64	✓
FHSR9	4.03	0.863	15	22.379	303	**0.000**	0.526	0.43	0.62	✓
FHSR3	3.90	0.368	16	17.867	303	**0.000**	0.401	0.36	0.44	✓
FHSR6	3.88	0.964	17	14.106	303	**0.000**	0.382	0.27	0.49	✓
FHSR20	3.81	1.126	18	4.838	303	**0.000**	0.313	0.19	0.44	✓
FHSR2	3.77	1.455	19	2.460	303	**0.001**	0.273	0.11	0.44	✓
FHSR14	3.76	1.457	20	18.603	303	**0.002**	0.260	0.10	0.42	✓
FHSR12	3.70	1.446	21	17.159	303	**0.014**	0.204	0.04	0.37	✓
FHSR4	3.45	1.049	22	3.109	303	0.413	-0.049	-0.17	0.07	×
FHSR7	3.42	1.069	23	22.674	303	0.218	-0.076	-0.20	0.04	×
FHSR5	3.41	1.074	24	16.805	303	0.136	-0.092	-0.21	0.03	×

Notes: Results significant at 95% when p<0.05; *df*= Degree of freedom=303; STD=Standard deviation; TNR=Total Number of Respondents

The topmost ranked significant factors identified were *lack of information and knowledge about safety rules*. This was ranked first with the means =4.52, SD=0.703, t (303) =18.824, p = 0.000 < 0.05). Then followed by a *lack of awareness of risk management process* with scores (mean=4.50, SD=0.766, t (303) =22.674, p = 0.000 < 0.05). The third-ranked factor was *lack of framework and procedures* that scored (mean=4.48, SD=0.766, t (303) =22,379, p = 0.000 < 0.05). The least ranked significant factors were lack of safety gears with scores (mean=3.77, SD=1.455, t (303) =2.460, p = 0.000 < 0.05), followed by drug abuse on site which scored the mean=3.76, SD=1.457, t (303) =18.603, p = 0.000 < 0.05). The lastly was negligence which scored the mean=3.70, SD=1.446, t (303) =17.159, p = 0.000 < 0.05).

Discussion

Factors Influencing Health and Safety Risk in Informal Construction

The three ranked most and least factors influencing HSRs in IC are discussed here as shown in Table 3. The most ranked significant factor influencing HSRs in the IC was 'lack of information and knowledge about safety rules' which had a mean of 4.52 and was statistically significant (t (303) = 18.824, p = 0.000 < 0.05). This implies that most of the actors in the IC are not well informed about the health and safety rules and they have little knowledge on the same. This relatively contradict findings reported by (Okoye et al., 2016; Adebiyi et al., 2020). Their research shows that although construction employees have a moderate understanding of health and safety advice, they do not always follow it. This is not how it is in IC, where majority of workers lack knowledge and information on health and safety. Workers have a right to accurate information from their employers on the threats to their health and safety as well as safety precautions relating to their work activities. The presentation of this information must be done in ways and with terminology that is simple for the staff to understand (ILO, 1992). The process of intervening to improve health and ensure a safe working environment on construction sites has been constrained by a lack of such knowledge and expertise (Phoya, 2012).

The second most ranked significant factor was 'lack of awareness of risk management process.' This finding is supported by the claim made by Nnadi et al. (2018) that in construction, there is a lack of awareness of the risk management processes. Therefore, risk management practices should be used at all stages of a construction project. All participants to the project should have a thorough grasp of the risks involved. It is explained that construction organizations are not aware of the risk management processes. Lack of awareness of risk management processes can yield delays and cost overruns in construction (Chileshe & Kikwasi, 2013). The third most ranked significant factor was 'lack of framework and procedures'. It is evident that the IC lacks the framework and procedures that can guide HSRs. The construction policy of Tanzania recognizes the IC but does not provide for a proper framework for operation (URT, 2003). This factor is also supported by various studies (Mahmoudi et al., 2014; Asibey et al., 2021) who researched on development of framework for improvement of health and safety in construction sites. In general, the introduction of a framework may help construction stakeholders quickly pinpoint problem areas on site and implement the necessary corrective actions to make the place safer and healthier (ILO, 1992).

In the lower quartile, lack of safety gears, drug abuse on site and negligence were the least significant factors influencing HSRs in IC. Furthermore, factors such as nature and physical layout of the construction sites, labourers working in close proximity/overcrowded sites and poor construction materials arrangement were not significant due to the fact that, most of the IC sites have less plants and equipment to endanger the layout issue. The sites also have few workers who cannot make congestion at site and most of the materials are brought in very small portion due to uncertainty of material cost estimation by artisans.

Conclusion

This study explored the factor influencing HSRs in ICS in Dar es Salaam, Tanzania. An extract of the literature review was carried out to obtain HSRs influencing factors which were then ranked using descriptive statistics. Based on the findings, the highly ranked factors influencing HSRs in IC were: (1) lack of information and knowledge about safety rules, (2) lack of awareness of the risk management process, and (3) lack of framework and procedures. These findings reflect the actual situation of HSRs in IC. The least ranked HSRs were: (1) lack of safety gears, (2) drug abuse on site, and (3) negligence. Though these are the least ranked factors, they were statistically significant in influencing HSRs in IC. Findings of one sample t-test show that a total of 21 HSRs factors in IC in Dar es Salaam are statistically significant. Only 3 factors were found not to be statistically significant due to the nature of IC.

Contribution and Implications

Through identification and ranking of the factors influencing HSRs in IC, this study contributes to the Goal Number Three of the Sustainable Development Goals 2030 agenda by helping CI practitioners to understand the key factors that are influencing HSRs in IC for effective HSRs in the course of practice within the Tanzania construction sector. This research has several implications for both practitioners and government. In the first place, it provides a baseline for the development of a health and safety framework for effective HSRs management in IC. Moreover. the study raises awareness of the rules and procedures of HSRs in the informal workplace.. Information and communication on health and safety awareness are critically important for practitioners, researchers and the Government at large.

Limitations and Proposals for Further Study

The study had a limited scope, focusing as it did on the factors influencing HSRs in IC. The study was also done in Dar es Salaam only. Therefore, future studies could explore the same topical aspect, but focus instead on other trades and regions. With regards to the highly ranked factors revealed by this study, future research need to be conducted in the following areas: development of the framework for HSRs in IC, assessment of the adequacy of material estimates by the artisans in IC and assessing the extent of health and safety knowledge held, information and communication in IC.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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