Journal Of Research Technology & Engineering
www.jrte.org

Mitigating Stress among Construction Labourers during Economic Crises: A Study of the Sri Lankan Construction Industry

* R.N.D Guruge[1], W. D. C. Jayawickrama[2], D. M. Rajapaksha[3]

[1]Faculty of Engineering, NSBM Green University, Sri Lanka
[2]Faculty of Architecture, University of Moratuwa, Sri Lanka
[3]Faculty of Engineering, NSBM Green University, Sri Lanka

Corresponding Author E-mail: romasha.g@nsbm.ac.lk
Received:02 July 2025; Revised:05 July 2025; Accepted: 10 July 225; Available online: 10 July 2025

Abstract: The construction industry is a key driver of economic growth in Sri Lanka. However, the current economic crisis has significantly impacted the industry, resulting in reduced investment, delayed payments, and project cancellations. These challenges have led to increased stress levels among construction labourers, posing a threat to their well-being and the industry's sustainable growth and development. This study aims to address the stress experienced by construction labourers due to the ongoing economic crisis in Sri Lanka. An extensive literature review was conducted to explore the concepts related to stress and labour productivity in the construction industry, identifying stressors and symptoms of stress among construction workers. Additionally, global strategies for reducing stress levels were reviewed for applicability in the Sri Lankan context. The study employed a mixed research approach, including literature review, questionnaire surveys, and expert interviews. Semi-structured interviews and questionnaire surveys were used as primary data collection methods, and the primary data analysis was conducted using manual content analysis, Relative Importance Index (RII), and Weighted Mean techniques. The findings offer important understanding into the elements that cause stress, the symptoms affecting construction labourers, and effective strategies for mitigating stress during economic crises. These insights are crucial for policymakers, construction industry stakeholders, and employers to implement measures that address the challenges faced by construction labourers, ultimately enhancing the industry's productivity and growth.

Index Terms: Construction Industry, Construction Labour, Stress, Economic Crisis, Productivity, Stress Management, Sri Lanka

1 INTRODUCTION

Stress is defined as "a force that deforms bodies" in engineering terms, and in biology and medicine, it refers to the human body's overall approach to responding to all the influences, changes, demands, and strains to which it is subjected [1]. According to Premkumar and Rajkumar, a person's response to stress is influenced by whether they feel in control of the situation or overwhelmed by it [2]. Moreover, many factors can cause stress, including personal difficulties, work-related problems, and major threats in the community [3].

Labor productivity is the main driver of economic growth and development, directly influencing a project's cost, timeline, and physical progress [4]. In most nations, labour costs contribute to 30% to 50% of total project costs, and so are considered an actual measure of the operation's economic success [5]. The construction industry contributes to 6% of the global GDP and is widely regarded as a major economic stimulator. The construction industry in Sri Lanka provides 7.1% of the country's GDP [6]. The key to

enhancing construction productivity lies in boosting the performance of construction labourers and identifying the critical factors that impact their productivity.

However, labour productivity is defined as working efficiency, which is directly influenced by stress [7]. The construction industry is classified as a complex sector including high working demands as well as a dynamic, risky and hazardous profession, all of which contributed to increased stress in the construction industry [8], [9]. Consequently, stressed labourers were more likely to contract major illnesses, leading to lower productivity. Although the COVID-19 epidemic in Sri Lanka is on the wane, it is facing a health catastrophe arising from economic and political crises, in which the threat of stress and lack of health care is high [10]. Consequently, the industry must adopt new strategies to mitigate the impact of the crisis on productivity and reduce stress levels among workers [11].

According to Tijani et al., mental stresses represent a serious threat to construction project safety and performance [12]. The rise in construction-related occupational stress is cause for concern, and even though several studies on occupational stress have been published with results, there is still a shortage of relevant information in Sri Lanka. Moreover, Silva and Abeysekera conducted a case study on the impact of COVID-19 on productivity and safety in the construction industry in Sri Lanka and found that the pandemic has led to a decline in productivity and an increase in stress levels among workers due to the changes in working conditions and safety protocols [13]

Accordingly, a multitude of research has been carried out regarding the concepts of stress and labour productivity separately, but there seems to be limited research that focuses on both these aspects simultaneously and none during the current crisis in Sri Lanka. Stress can impact various working populations in Sri Lanka, which are already facing high unemployment, low productivity, high industry costs, more labor disputes, job losses, and a failing economy. As a result, it is both relevant and beneficial to investigate the influence of stress on construction labour and recommend strategies to reduce the stress level of labour during the current economic crisis in Sri Lanka.

The aim of the study is to lower the stress levels of construction workers caused by the current economic crisis in Sri Lanka.In order to achieve the aim of the study following objectives are formulated,

a)To review the concepts related to stress and labour productivity in the construction industry.

b)To identify the factors contributing to the stress (stressors) of construction labourers in the context of the current economic crisis in Sri Lanka.

c)To investigate the impact of the stress level of construction labourers in the construction industry through the symptoms of stress.

d)To recommend strategies to reduce the stress level of construction labourers in the current economic crisis in Sri Lanka.

2 LITERATURE REVIEW

2.1 Construction Industry

Construction industry firms have always had to navigate economic cycles and develop strategies to mitigate their effects, as the construction sector is more susceptible to economic crises compared to many other industries [12]. Starting in March 2020, many countries stopped economic activities, including construction

projects, due to restrictions [13]. The global construction industry faced numerous challenges, including a shortage of site labor, factory closures, low worker morale, decreased productivity, material shortages, project delays, lack of equipment and materials, border closures, delays or difficulties in getting permits, and changes in the work environment or culture on construction sites [14].

2.2 Concept of Stress

The word "stress" originates from the Latin stringere, meaning to "draw tight," and it is described as a perceived or actual disturbance in the balance of the mind, body, brain, and spirit [15]. Chronic stress has been linked to many health conditions, including anxiety, depression, high blood pressure, and gastrointestinal disorders, as stress ranges from short-term daily hassles to long-term anxiety states that can interfere with health and well-being [16]. A person experiences stress when they perceive a gap between the demands of a situation and their biological, psychological, or social resources [17]. However, the meaning of stress varies for different individuals and under different conditions [18].

2.3 Nature of Stress in the Construction Industry

The construction sector has long been recognised as stressful due to challenging tasks, constrained timelines, complex working relationships, and poor working environments [19]. Work-related stress is a persistent issue in construction and can affect family and personal life [20]. Nearly 70% of workers in construction have experienced stress, anxiety, or depression related to their jobs, and over 10 million working days are lost annually in the UK due to work-related stress [21]. Employees—including architects, project managers, engineers, surveyors, and workers—frequently work under crisis-ridden site conditions with high injury risk, making stress common in daily jobs [22].

2.4 Key factors related to stress in the Construction Industry/ Stressors

The construction sector frequently faces stressors such as extended working hours, limited organisational support, tight project schedules, and safety concerns [23], [24]. Stressors refer to workplace stimuli negatively impacting physical or psychological well-being for a significant majority exposed [25]. Construction workers face stressors differing from the general population due to challenging duties across temporary projects [19]. The five main categories of stress experienced by construction workers are personal, task, organizational, physical, and gender-related stressors [24], [19], [26].

2.5. Symptoms of stress

Symptoms of stress can be categorized into physical, psychological, behavioral, and emotional symptoms [27]–[31]. It is crucial to consult a doctor about these symptoms as they can be vague and resemble medical conditions [32]. Stress can creep up on individuals, leading them to accept it as normal without realizing its impact [33]. Recognizing typical symptoms and warning signs of stress overload is essential, especially due to severe workloads [34].

2.6 Labour productivity in the Construction Industry

It is imperative to create innovative ways to increase productivity, both in terms of labour and management issues, because doing so improves profits and reduces costs [35]. Since "productivity" varies across sectors

and labour is a component of construction, enhancing worker performance is key to improving construction productivity [36]. Construction productivity can be measured by total factor productivity (TFP), which is the ratio of output to total inputs [5].

$$Productivity = \frac{Output\ Quantity}{Labour\ Hours}$$

$$Capital\ Productivity = \frac{Profit}{Invested\ Capital}$$

$$Equipment\ or\ Plant\ Productivity = \frac{Output\ Quantity}{Equipment\ or\ Plant\ Hours}$$

However, this research is focused on labour productivity as PFP.

2.7. Impact of the Stress Level of Construction Labourers on the Construction Productivity

High levels of stress negatively impact job productivity and often lead to workplace incidents [7]. Excessive stress harms performance, but insufficient stress can also reduce it, creating an inverse U-shaped relationship between stress and performance [21], [23], [37]. Labour productivity is influenced by stress, one of the most challenging workplace experiences [38]–[40]. Construction workers, skilled and unskilled, are susceptible to high stress and increased accident risk [41], [42], [20]. Construction labourers face the third-highest global stress levels among professions, experiencing stress 1.7 times more than other industries [43], [44]. Stress affects many life aspects, including attitudes, behaviours, cognition, and physical health, but coping mechanisms vary [45].

2.8. Current strategies to reduce stress factors

Stress management is a continuous and evolving process that involves assessing stress, exploring management options, and developing strategies for stress management [46]. While it is challenging to entirely eliminate stress among construction workers, effective management is essential to optimize their productivity [18]. According to Lazarus and Folkman, construction workers primarily employ three coping behaviors: problem-based coping, emotion-based coping, and meaning-based coping, each influenced by sociological and psychological factors [47]. Meaning-based coping involves eliciting positive emotions and often integrates elements of problem-based or emotion-based coping as essential aspects of the coping process. Problem-based coping entails taking specific actions to address stressful problems or situations, while emotion-based coping focuses on actions that improve one's emotional state [48]–[50].

Problem-based coping behaviours involve efforts to change one's own behaviours or the environment to address stress sources, focusing on situational demands and problem-solving [51], [52]. Examples of stress management techniques include Planful Problem Solving, Positive Reappraisal, Confrontive Coping, Instrumental Support Seeking, and Active Coping [18], [53], [54]. Emotion-based coping behaviours aim to reduce emotional distress and keep motivation high. They help manage feelings like anxiety, anger, or guilt using strategies such as seeking emotional support, expressing emotions, avoiding or denying the problem, controlling oneself, and accepting responsibility [51], [55]–[58]. Meaning-based coping integrates problem-

focused and emotion-focused strategies by fostering positive emotions through spiritual practices and mindfulness, involving attitudes like Present Focus and Non-judgmental Acceptance, and practices like Body Scanning and Breath Meditation [50], [18], [59].

3 RESEARCH METHODOLOGY

A comprehensive literature review was conducted to examine stress and its impact on labour productivity in the construction industry, focusing on the current economic crisis in Sri Lanka. The synthesis encompassed a range of publications including conference papers, theses, dissertations, books, and journal articles. Adopting a mixed research approach, the study aimed to reduce stress levels among construction workers. Factors contributing to stress amidst the economic crisis were explored through questionnaire surveys, highlighting symptoms and impacts on labour productivity. Expert interviews were also conducted to identify strategies for mitigating stress. The research employed qualitative methods to delve into worker experiences and quantitative methods through a questionnaire to analyse stress factors and impacts. By integrating both approaches, the study aimed to enhance the depth and quality of its findings, providing insights into effective interventions for addressing stress among construction labourers in Sri Lanka's current economic context.
11 interviews were conducted with construction experts who have on-site experience working for contractors, and their profiles are presented as follows.

Table I. Profiles of interviewees

Designation	Total Industry Experience	Industry Experience at the site	Type of Organization
Chartered Quantity Surveyor	24 years	15 years	Contractor
Construction Manager	30 years	20 years	Government
Project Manager	8 years	6 years	Contractor
Senior Project Manager	35 years	25 years	Contractor
Quantity Surveyor	5 years	4 years	Contractor
Chief Building Manager	30 years	18 years	Government
Project Engineer	13 years	8 years	Consultant
Project Manager	15 years	12 years	Contractor
Project Manager	8 years	5 years	Contractor
Engineering Assistant	5 years	5 years	Contractor
Site Engineer	8 years	6 years	Contractor

The 2 questionnaire surveys targeted professionals in the construction industry with knowledge of productivity, stress, and labourers working on sites in Sri Lanka. Initially, 45 questionnaires were distributed to professionals, with 30 respondents, resulting in a response rate of 66.67%. To gather data from labourers, researchers visited construction sites, soliciting opinions and assisting in questionnaire completion.

4 RESEARCH FINDINGS

4.1.Factors affecting the stress of the Construction Labourers due to the Economic Crisis

Based on expert opinions gathered through interviews and a literature review, 42 stressors related to construction labourers were identified within the current national context. These stressors were evaluated by seeking input from 30 knowledgeable and experienced respondents in the Sri Lankan construction industry. The significance of strategies in the Sri Lankan context was interpreted using weighted mean values as presented in the following table.

Table II. Interpretation of Mean Values

Scale Range	**Interpretation**
4.20 – 5.00	Very High Significance (VHS)
3.40 – 4.1	High Significance (HS)
2.60 – 3.39	Medium Significance (MS)
1.80 – 2.59	Low Significance (LS)
1.00 – 1.79	Very Low Significance (VLS)

The results obtained are shown in detail in the following table.

Fig. 1.Impact of organizational stressors

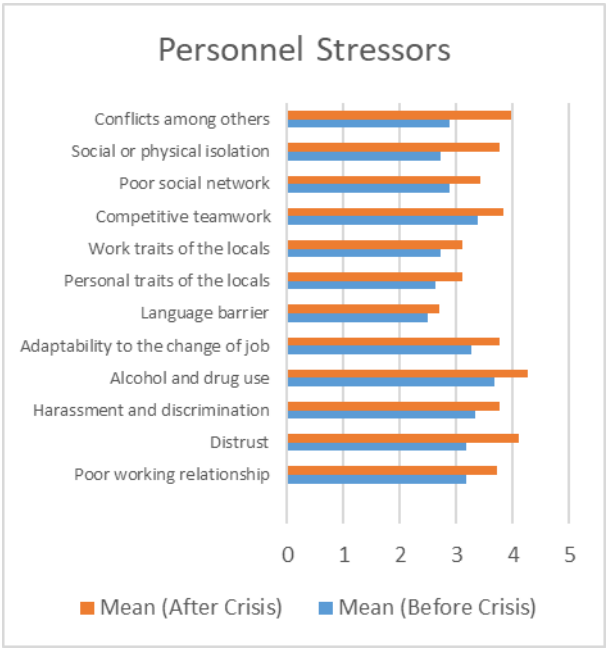

Fig. 2. Impact of personnel stressors

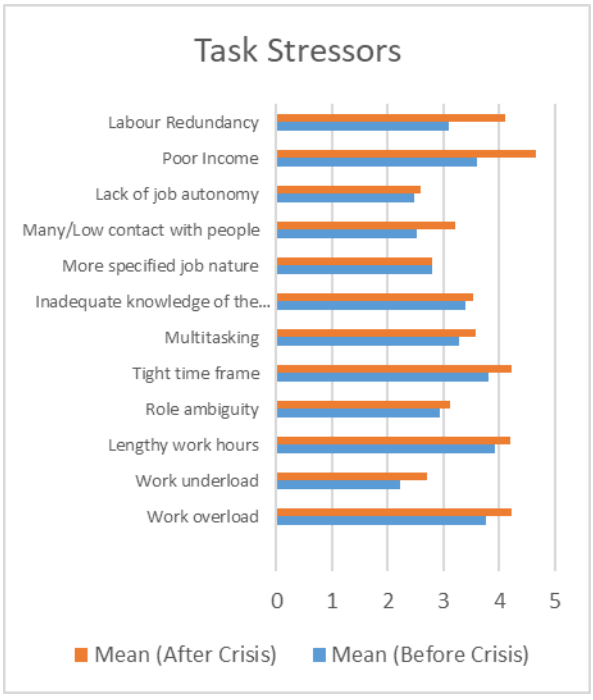

Fig. 3. Impact of task stressors

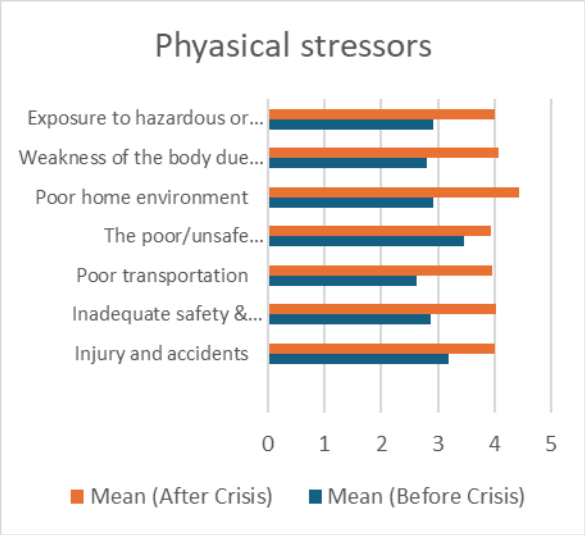

Fig.4. Impact of physical stressors

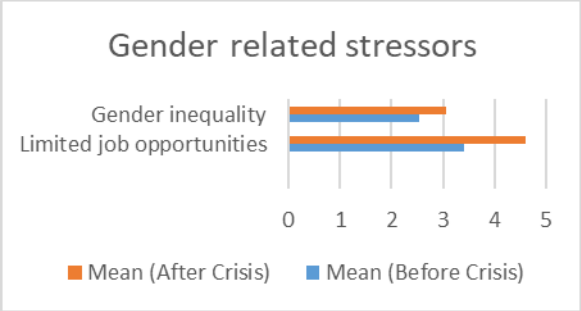

Fig. 5. Impact of gender-related stressors

Based on the data chart, the average mean after the crisis was highest at 3.68, compared to 3.05 before the crisis. This indicates a significant increase in the perceived importance of factors contributing to stress among construction labourers post-crisis. Specifically, respondents highlighted factors such as "job insecurity, poor income, limited job opportunities, poor home environment, alcohol and drug use, work overload, tight time frame, lengthy work hours, distrust" as having a
pronounced impact during the crisis. Conversely, factors like organisation centralisation, gender inequality, lack of job autonomy, and others were cited as having minimal impact after the crisis. Notably, “job insecurity, work overload, lengthy work hours, distrust, and poor home environment” emerged as the primary stressors significantly exacerbating labourers' stress levels during the economic crisis.

4.2.Impact of stress on construction labourers at the site

In this section, the analysis of information obtained directly from the construction labourers through a questionnaire regarding the impacts of stress during the crisis situation in Sri Lanka is presented. Quickly identifying those experiencing stress and recognising its symptoms are crucial. During the current crisis in Sri Lanka, certain symptoms commonly observed among construction site labourers are detailed in the table below. The changes in the reported occurrence of each symptom before and after the economic crisis in Sri

Lanka are also examined separately.

F = Frequency P = Percentage

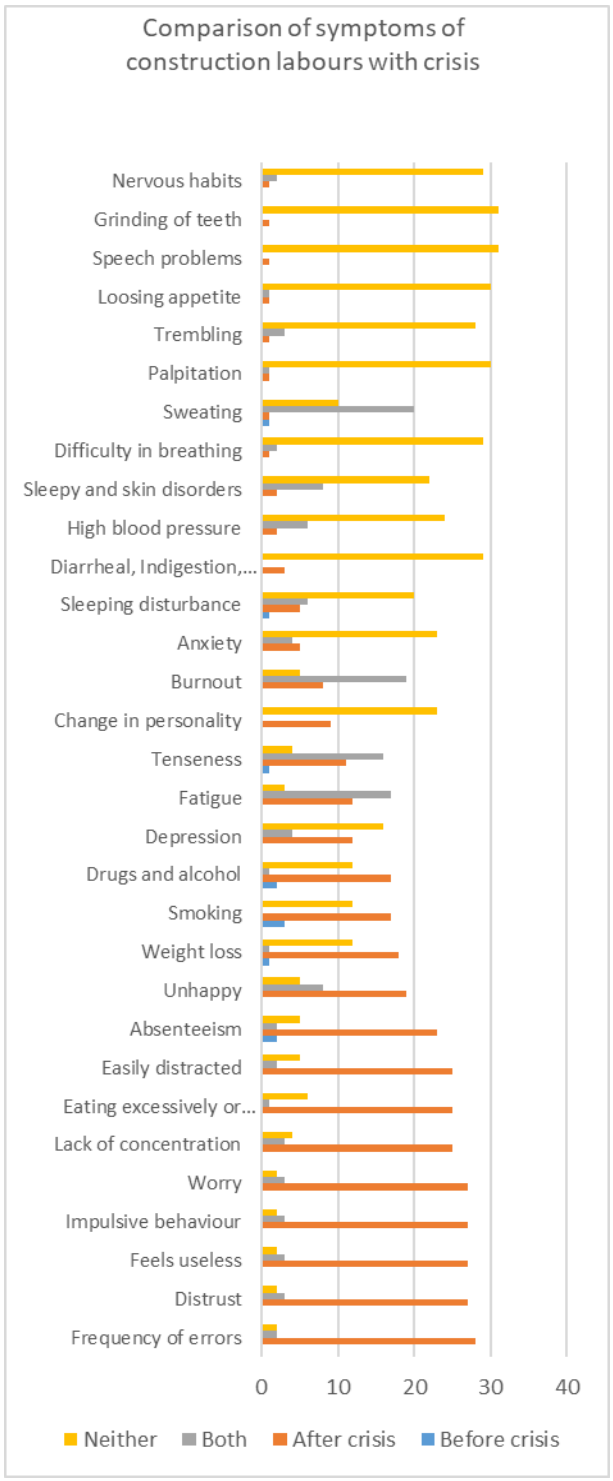

Fig. 6: Comparison of symptoms of construction labourers with the crisis

According to the chart above, symptoms such as increased frequency of errors, distrust, feeling useless, impulsive behavior, worry, lack of concentration, eating excessively or inadequately, being easily distracted, and absenteeism have become more prevalent among construction laborers after the crisis compared to before the current situation in Sri Lanka. Conversely, the least common symptoms following a crisis include difficulty in breathing, sweating, palpitations, trembling, loosing appetite, speech problems, grinding of teeth, and nervous habits, according to the same table.

4.3.Overall analysis of the strategies to reduce the stress level of Construction Labourers at sites during the Current Economic Crisis in Sri Lanka

Through the insights of 30 knowledgeable and experienced respondents in the Sri Lankan construction industry, the practicability of 20 strategies, discovered through expert interviews, was assessed. Various responses were elicited to evaluate the applicability of the recommended strategies to address labour stress in Sri Lanka.

Level of practicability was tested on the five-point Likert scale indicated as 5- “Extremely Practicable”, 4- “Highly Practicable”, 3- “Moderately Practicable”, 1- 2- “Slightly Practicable”, “Not Practicable at All”.Some Common Mistakes

$$RII = \sum \frac{\mathrm{PiUi}}{\mathrm{n(N)}}$$

Were,
n- Number of participants
Pi -Participant’s rank
Ui- Number of participants ranking project factorxS
N- Highest rank

The following table was used to determine the level of the practicability of strategies in the Sri Lankan context using RII values.

Table III. Interpretation of RII values

RII Value	Practicable Level
0-0.200	Not practicable at all (NP)
0.200-0.400	Slightly practicable (SP)
0.400-0.600	Moderately practicable (MP)
0.600-0.800	Highly practicable (HP)
0.800-1.000	Extremely practicable (EP)

The following table shows the results of the analysis.

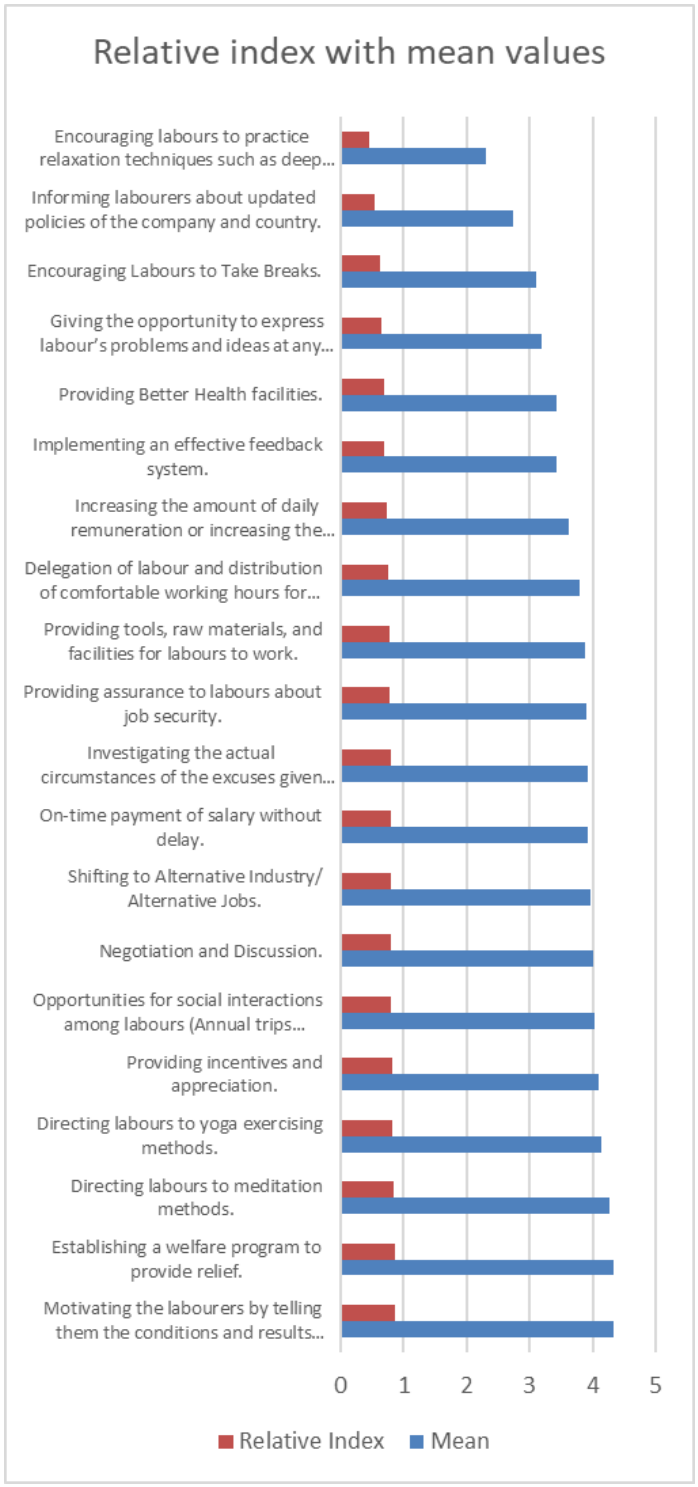

Fig. 7: Relative indexes with mean values of the strategies found

According to the rankings shown in the chart, the strategies "Motivating the labourers by telling them the conditions and results based on how they work" and "Establishing a welfare program to provide relief" are considered the most practicable for the Sri Lankan construction industry to reduce laborers' stress levels during the economic crisis. In addition, strategies such as them “Directing labourers to meditation methods”, “Directing labourers to yoga exercising methods”, “Providing incentives”, “Opportunities for social interactions among labourers” and, “Negotiating and discussion” showed similar Relative Importance Index (RII) values, indicating high practicability. On the other hand, "Informing labourers about updated policies of the company and country", and "Encouraging labourers to practice relaxation techniques" had the lowest RII values compared to the others. However, the table indicates that these strategies were still considered moderately practicable for the Sri Lankan construction context.

5 CONCLUSIONS AND RECOMMENDATIONS

The construction industry in Sri Lanka plays a major role in the country's GDP. However, the ongoing economic crisis has had a severe impact on the industry, leading to reduced investment, delayed payments, and project cancellations. These challenges have heightened stress levels among construction labourers, potentially causing a decline in productivity. This study seeks to identify the specific factors that contribute to stress among construction labourers working on sites in Sri Lanka. It also aims to propose effective strategies to mitigate these stress levels.

The research employed a mixed-method approach, incorporating a literature review, questionnaire surveys, and expert interviews. The findings reveal factors contributing to stress, symptoms of stress, and strategies to alleviate stress levels among construction labourers in Sri Lanka. These insights can aid policymakers, construction industry stakeholders, and employers in implementing measures to address the challenges faced by construction labourers, thereby improving the industry's overall productivity and growth. The study highlights the critical need to address stress levels among construction laborers as a key factor in ensuring the sustainable growth and development of the construction industry in Sri Lanka. By focusing on stress management, the study aims to improve worker well-being, enhance productivity, and contribute to the industry's long-term stability and success. Job insecurity is a significant factor contributing to stress among labourers in the industry. Employers can address this issue by providing long-term contracts, job training and development opportunities, and fair pay. By doing so, employers can help labourers feel more secure in their jobs, thereby reducing stress levels. In addition to tackling job insecurity, effective management and labour collaboration can also help reduce stress in the construction industry. Employers can create a supportive work environment where labourers feel encouraged and empowered. It is crucial for workers to have a safe and open channel to express any concerns or grievances they may have.

Construction labourers often have physically demanding jobs, which can take a toll on their mental and physical well-being. To address this, employers must ensure that labourers have adequate opportunities for rest and recovery. This includes regular breaks during the workday and sufficient time off between shifts. By focusing on the health and well-being of workers, employers can create a safer and more productive work environment. This emphasis on well-being helps reduce accidents, boosts morale, and increases overall productivity, benefiting everyone in the workplace.A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).

REFERENCES

[1] H. Richthoven, *Stress and Human Health*, Berlin: Springer, 2002.

[2] M. Premkumar and R. Rajkumar, "A study on impact of stress on the performance of construction labours," *Int. J. Sci. Eng. Res.*, vol. 3, no. 4, pp. 1–5, 2015.

[3] World Health Organization, *Doing what matters in times of stress: An illustrated guide*. Geneva: World Health Organization, 2020.

[4] S. Palikhe, S. Kim, and J. J. Kim, "Critical success factors and dynamic modelling of construction labour productivity," *Int. J. Civ. Eng.*, vol. 17, pp. 427–442, 2019.

[5] A. M. Jarkas and C. G. Bitar, "Factors affecting construction labor productivity in Kuwait," *J. Constr. Eng. Manage.*, vol. 138, no. 7, pp. 811–820, 2012.

[6] Lake House, "Construction sector contributes 7.1% to GDP," *Daily News*, 2021.

[7] I. Skačkauskienė and R. Pališkienė, "Interface Between Stress and Labour Productivity," in *Occupational Stress*, IGI Global, 2020, pp. 66–83.

[8] A. Enshassi, J. Mohamed, Z. Abu Mustafa, and P. Mayer, "Sources of stress and coping strategies among construction workers in the Gaza Strip," *J. Constr. Dev. Ctries.*, vol. 20, no. 1, pp. 85–106, 2015.

[9] S. W. Poon, S. M. Rowlinson, T. Koh, and Y. Deng, "Job burnout and safety performance in the Hong Kong construction industry," *Int. J. Constr. Manage.*, vol. 13, no. 1, pp. 69–78, 2013.

[10] A. T. Matthias and S. Jayasinghe, "Worsening economic crisis in Sri Lanka: Impacts on health," *Lancet Global Health*, 2022. [Online]. Available: https://doi.org/10.1016/S2214-109X(22)00234-0 (DOI: 10.1016/S2214-109X(22)00234-0)

[11] C. H. Wijayasinghe, "The impact of COVID-19 on the Sri Lankan construction industry: A study on the current situation and the way forward," *Int. J. Sci. Res. Publ.*, vol. 11, no. 6, pp. 604–609, 2021.

[12] L. S. Pheng and L. S. Hou, *The Economy and the Construction Industry*, Singapore: Springer, 2019.

[13] I. Oncioiu et al., "Transforming the COVID-19 threat into an opportunity: The pandemic as a stage to the sustainable economy," *Sustainability*, vol. 13, no. 4, p. 2088, 2021.

[14] O. O. Zaccheus, O. AbdulLateef, K. S. Cheen, and A. B. Folasade, "Evaluation of construction workers' mental health during COVID-19 pandemic in Nigeria," in *Proc. 10th World Constr. Symp.*, 2022, pp. 466–478. [Online]. Available: https://doi.org/10.31705/WCS.2022.38 (DOI: 10.31705/WCS.2022.38)

[15] S. M. Ross, "Resistance for strength," *Holistic Nurs. Pract.*, vol. 34, no. 5, pp. 314–317, 2020.

[16] E. P. Sarafino and T. W. Smith, *Health Psychology: Biopsychosocial Interactions*, 4th ed. New York: Wiley, 2002.

[17] G. Fink, "Stress: Concepts, definition and history," in *The Curated Reference Collection in Neuroscience and Biobehavioral Psychology*, 2016, pp. 549–555.

[18] I. Y. S. Chan, C. Cooper, and M. Leung, *Stress Management in the Construction Industry*, 1st ed., Wiley-Blackwell, 2015.

[19] J. Beswick et al., "An analysis of the prevalence and distribution of stress," Health and Safety Laboratory, RR518, Health and Safety Executive, 2007.

[20] M. Y. Leung, Y. S. Chan, and K. W. Yuen, "Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong," *J. Constr. Eng. Manage.*, vol. 136, no. 10, pp. 1093–1103, 2010.

[21] M. Leung, S. T. Ng, M. Skitmore, and S. Cheung, "Critical stressors influencing construction estimators in Hong Kong," *Constr. Manage. Econ.*, vol. 23, no. 1, pp. 33–44, 2005.

[22] L. Goldenhar, L. J. Williams, and N. G. Swanson, "Modelling relationships between job stressors and injury and near-miss outcomes for construction labourers," *Work & Stress*, vol. 17, no. 3, pp. 218–240, 2003.

[23] D. C. Ganster and C. C. Rosen, "Work stress and employee health: A multidisciplinary review," *J. Manage.*, vol. 39, no. 5, pp. 1085–1117, 2013.

[24] S. S. Leung *et al.*, "Occupational stress, mental health status and stress management behaviors among secondary school teachers in Hong Kong," *Health Educ. J.*, vol. 68, no. 4, pp. 328–343, 2009.

[25] J. A. Ekundayo, "Occupational stress and employees productivity in the workplace," *Int. J. Sci. Res. Educ.*, vol. 7, no. 2, pp. 157–165, 2014.

[26] T. O. Oladinrin, O. Adeniyi, and M. O. Udi, "Analysis of stress management among professionals in the Nigerian construction industry," *Int. J. Multidiscip. Curr. Res.*, vol. 2, no. Jan/Feb, pp. 22–33, 2014.

[27] M. A. Gupta, "Review of somatic symptoms in post-traumatic stress disorder," *Int. Rev. Psychiatry*, vol. 25, no. 1, pp. 86–99, 2013.

[28] O. Amankwah, N. A. B. Agyemang, and L. Martin, "The effect of stress on the job satisfaction and productivity of construction professionals in the Ghanaian construction industry," *Inf. Knowl. Manage.*, vol. 5, no. 5, pp. 42–49, 2015.

[29] N. De Silva, R. Samanmali, and H. L. De Silva, "Managing occupational stress of professionals in large construction projects," *J. Eng. Des. Technol.*, vol. 15, no. 4, pp. 488–504, 2017.

[30] J. H. Kahn and A. M. Garrison, "Emotional self-disclosure and emotional avoidance: relations with symptoms of depression and anxiety," *J. Couns. Psychol.*, vol. 56, no. 4, pp. 573–584, 2009.

[31] L. Robinson, M. Smith, and R. Segal, "Stress management," HelpGuide, 2019. [Online]. Available: https://www.helpguide.org/articles/stress/stress-management.htm

[32] D. Chisholm, "Working yourself sick: The danger of stress overload," *Noted*, 2019. [Online]. Available: https://www.noted.co.nz/health/health/working-yourself-sick-the-danger-of-stress-overload

[33] C. S. A. Siriwardana and J. Y. Ruwanpura, "A conceptual model to develop a worker performance measurement tool to improve construction productivity," in *Constr. Res. Congr. 2012*, pp. 192–201, 2012.

[34] N. Karunarathna and C. Siriwardana, "A tool to assess construction worker productivity," in *Proc. MERCon*, 2018, Univ. of Moratuwa, Sri Lanka.

[35] H. Lingard, "The impact of individual and job characteristics on 'burnout' among civil engineers in Australia and the implications for employee turnover," *Constr. Manage. Econ.*, vol. 21, no. 1, pp. 69–80, 2003.

[36] A. Elfering, N. K. Semmer, and S. Grebner, "Work stress and patient safety: Observer-rated work stressors as predictors of characteristics of safety-related events reported by young nurses," *Ergonomics*, vol. 49, no. 5–6, pp. 457–469, 2006.

[37] C. Anwar, *Labour Mobility and the Dynamics of the Construction Industry Labour Market: The Case of Makassar, Indonesia*. Cuvillier Verlag, 2004.

[38] I. W. H. Fung, C. M. Tam, K. C. F. Tung, and A. S. K. Man, "Safety cultural divergences among management, supervisory and worker groups in Hong Kong construction industry," *Int. J. Proj. Manag.*, vol. 23, pp. 504–512, 2005.

[39] Health and Safety Executive, "Health and safety in construction," *HSE*, 2007. [Online]. Available: https://www.hse.gov.uk/search/search-results.htm?gsc.q=2007%20stress#gsc.tab=0&gsc.q=2007

[40] International Labour Organization, "Construction: A Hazardous Work," *ILO*, 2008. [Online]. Available: https://www.ilo.org/global/lang--en/index.htm

[41] A. Kaklauskas *et al.*, "Web-based Biometric Computer Mouse Advisory System to Analyze a User's Emotions and Work Productivity," *Eng. Appl. Artif. Intell.*, vol. 24, no. 6, pp. 928–945, 2011.

[42] S. S. Leung *et al.*, "Occupational stress, mental health status and stress management behaviors among secondary school teachers in Hong Kong," *Health Educ. J.*, vol. 68, no. 4, pp. 328–343, 2009.

[43] H. Lingard, *Occupational Health and Safety in the Construction Industry*, 1st ed. New York: Taylor & Francis, 2003.

[44] P. Ming, "Emotional symptoms and suicide," *Ming Pao*, 2004.

[45] M. Mokhtariani, M. H. Sebt, and H. Davoudpour, "Characteristics of the Construction Industry from the Marketing Viewpoint: Challenges and Solutions," *Civ. Eng. J.*, vol. 3, no. 9, pp. 701–714, 2017.

[46] F. Lösel and T. Bliesener, "Resilience in adolescence: A study on the generalizability of protective factors," in K. Hurrelmann and F. Lösel, Eds., *Health Hazards in Adolescence*, Berlin: De Gruyter, 1990, pp. 299–320.

[47] R. S. Lazarus and S. Folkman, *Stress, Appraisal, and Coping*. Springer Publishing Company, 1984.

[48] S. Folkman, "Positive psychological states and coping with severe stress," *Soc. Sci. Med.*, vol. 45, pp. 1207–1221, 1997.

[50] R. Djebarni, "The impact of stress in site management effectiveness," *Constr. Manage. Econ.*, vol. 14, no. 4, pp. 281–293, 1996, doi: 10.1080/014461996373368

[51] M. Y. Leung, Y. S. Chan, and K. W. Yuen, "Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong," *J. Constr. Eng. Manage.*, vol. 136, no. 10, pp. 1093–1103, 2010, doi: 10.1061/(ASCE)CO.1943-7862.0000216

[52] I. Y. S. Chan, C. Cooper, and M. Leung, *Stress management in the construction industry*, 1st ed., Wiley-Blackwell, 2012.

[53] R. Haynes and P. Love, "Coping with project stress," *Constr. Innov.*, vol. 4, no. 1, pp. 1–14, 2004.

[54] E. Chung, R. Yiu, and D. Wan, "Stress and coping in the construction industry," *J. Prof. Issues Eng. Educ. Pract.*, vol. 136, no. 3, pp. 137–145, 2010.

[55] W. Schafer, *Stress Management for Wellness*, New York: Wadsworth, 2000.

[56] [Reuse as [16]] R. S. Lazarus and S. Folkman, *Stress, Appraisal, and Coping*, Springer, 1984.

[57] E. M. Chang *et al.*, "The relationships among workplace stressors, coping methods, demographic characteristics and health in Australian nurses," *J. Prof. Nurs.*, vol. 22, no. 1, pp. 30–38, 2006.

[58] J. H. Watts, "Allowed into a man's world: Meanings of work-life balance: Perspectives of women civil engineers as 'minority' workers in construction," *Gender Work Organ.*, vol. 16, no. 1, pp. 37–57, 2007.