

IMPROVING THE MENTAL HEALTH STATUS OF PROJECT MANAGEMENT PRACTITIONERS IN THE ARCHITECTURE, ENGINEERING, AND CONSTRUCTION SECTORS DURING COVID-19 PANDEMIC

A Research Report by:

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Further information

For more information on this research, please visit Centre for Smart Modern Construction (c4SMC) website at: <https://www.westernsydney.edu.au/c4smc>

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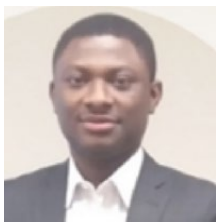
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EXECUTIVE SUMMARY

The consequences of the coronavirus (COVID-19) pandemic have given rise to unforeseen psychosocial risks in project management (PM) practices in the architecture, engineering and construction (AEC) project organizations, resulting in a decline in mental health among PM-practitioners. This decline in mental health among PM-practitioners is considered to be a significant problem with substantial economic and social effects. Given the negative effects of poor mental health on projects, identification of causes and proper interventions to tackle this problem becomes vital. Several studies have been conducted to explore these risks and organizational interventions for poor mental health. However, the existence of COVID-19-related psychosocial threats had limited the capacity of traditional interventions.

The development of organizational interventions requires the capture of the sources of the risks that can trigger poor mental health. There is scant research focused on improving the mental health status of PM-practitioners in the AEC project organizations during and after the pandemic. This study aims to identify the mental health status of PM-practitioners in the AEC project organizations and define ways to improve it. This has been achieved through a close examination of COVID-19 psychosocial risks, an exploration of organizational interventions and the development of a psychosocial risk management framework.

This research adopted the job-demand-resources (JDR) theory to underpin the psychosocial risk management framework. Literature reviews and expert forums were conducted to examine COVID-19 psychosocial risks and explore potential organizational interventions. Moreover, by using Structural Equation Modelling (SEM) techniques, hypothetical relationships between COVID-19 psychosocial risks, organizational interventions and mental health were tested to develop a psychosocial risk management framework.

Nineteen relevant COVID-19 psychosocial risks for the mental health in AEC projects were identified. Among the psychosocial risks, “Lacks leadership knowledge and skills”, “Fears of losing job”, and “Difficulty in balancing personal and work needs” are ranked as the three most critical COVID-19 psychosocial risks in the AEC project organization. The least critical COVID-19 psychosocial risks include “Difficulty in managing project cost”, “Difficulty in managing project contracts” and “Disruption to supply chain”.

It has also been found that twenty organizational interventions were suitable for mitigating COVID-19-related conditions that may lead to poor mental health. Out of the twenty organizational interventions, “Hiring additional PM practitioners to distribute project workload”, “Providing training on how to balance work and family” and “Providing additional childcare supports” have been ranked as the three most effective interventions for promoting mental health. In contrast, the least effective organizational interventions included “Enforcing the use of personal protective equipment”, “Providing support for working remotely”, and “Providing support for working remotely”.

The perception of PM-practitioners about their AEC project environment revealed that the three strongest indicators to stress during COVID-19 are “Not feeling confident about one’s ability to handle problems”, “Not feeling that one was on top of things”, and “Unable to control irritations”. In comparison, “Feeling that one was unable to control the important things”, “Feeling difficulties in one’s PM-oriented work”, and “Feeling that one could not cope with all the things” are the least strong indicators to stresses for PM practitioners during the COVID-19 pandemic.

Further data analysis using SEM has revealed that the changed working environment due to the COVID-19 pandemic negatively impacted PM-practitioners’ mental health. It has also been confirmed that organizational interventions positively supported PM practitioners,

thereby further upholding the JDR theory. In addition, this study has ruled out the potential moderation effect of organizational interventions on the relationship between COVID-19-related psychosocial risks and mental health.

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1 Introduction

Late-March 2020, the novel coronavirus pandemic outbreak, COVID-19, forced Australian government to order the closure of construction sites across the states and people to work from home, unless they had jobs of high necessity (Australian Government Department of Health 2020). In the construction industry, architecture, engineering and construction (AEC) project organizations are mostly hit by the pandemic because of their engagement in various projects that entail a large supply chain and multiple parties in delivering them (Weatherly 2020). Disruption in supply chain of materials and workers to construction site has introduced new management system in AEC projects (Steele 2020). Management of multiple project parties remotely due to closure of construction sites sparked unprecedented risks that were new to AEC projects. The situation was even worse as AEC project organizations struggled to transit into new form of budget, quality and time management system due to unplanned changes in project management (Steele 2020; Weatherly 2020). COVID-19 is not going away soon in Australia (WorkSafe Victoria 2020). Unprecedented changes due to COVID-19 pandemic introduces new psychosocial risks for mental health of project management (PM) practitioners in AEC projects (Association for Project Management 2020). Irrespective of structure of working environment during the pandemic, PM practitioners are exposed to COVID-19 related psychosocial risks such as isolation, increased workload, stress of using new technologies, work family conflicts, longer working hours, risk of domestic violence and job insecurity (Houseman 2020; International Labour Organisation Office 2020).

Poor mental health is a significant problem with tremendous economic effects. For instance, Australia business loses \$10.9 billion annually for neglecting the mental health of their workers (PricewaterhouseCoopers 2014). Similarly, for construction workers incapacitated after a non-fatal suicide, the cost expended by the Australian construction industry is

approximately \$3.27m per annum (WorkCover Queensland 2017). Quantification of negative repercussions of poor mental health justified urgent needs for novel mental health management practices that considered COVID-19 related psychosocial risks in AEC project organizations. Tackling psychosocial risks in project environment becomes fundamental to ameliorate the sources of poor mental health in AEC projects, which underpins the development of mental health management practices for PM practitioners.

Despite the urgent need for mental health management practices during COVID-19 era, it is surprising that there were limited mental health studies in AEC project organizations to tackle psychosocial risks that trigger poor mental health. For instance, Haynes and Love (2004) and Bowen et al. (2014) established coping mechanisms as a mitigating strategy for poor mental health among project managers. Love and Edwards (2005) posited that social supports can reduce psychosocial risks and promote the positive mental health among project managers. In another study, a company management system informed of project management and staff management institutions was confirmed to mitigate psychosocial risks and burnout among construction project professionals (Yang et al. 2017). While acknowledging the contributions of the previous studies in revelation of psychosocial risks and mitigating practices, studies are rare that analyse the psychosocial risks introduced by COVID-19 and examine organizational interventions to address the mental health problem in the AEC project organizations in Australia. Hence, the problem now is how to improve the mental health of PM-practitioners in the Australian AEC project organizations due to psychosocial risks introduced during the COVID-19. Therefore, this research aims to improve mental health status of project management practitioners in AEC projects during COVID-19.

To achieve the research aim, the below questions need be answered:

1. What are the COVID-19 related psychosocial risk factors causing poor mental health among PM-practitioners in AEC projects?
2. What are the COVID-19 related organizational interventions for mitigating psychosocial risk factors in AEC projects?
3. How do COVID-19 related psychosocial risk factors and COVID-19 related organizational interventions impact mental health separately and in combination?

The corresponding research objectives include:

1. To explore COVID-19 related psychosocial risk factors causing poor mental health among PM-practitioners in AEC projects.
2. To evaluate organizational interventions for mitigating psychosocial risk factors in AEC projects.
3. To establish psychosocial risk management framework for mental health of PM practitioners in AEC projects.

This report is presented as follows. Section 2 reports on the literature review. In Section 3, a theoretical framework guiding the study was developed. Sections 4 explain the research design and data collection process for the study. Data analysis was presented in Section 5, followed by the establishment of a SEM model in Section 6. In Section 7, detailed discussion was presented, followed by the concluding remarks in Section 8.

2 Literature Review

2.1 Mental Health

Over the couple of decades, there is a disagreement among scholars on the conceptualization of mental health in the workplace. Some consider the absence of work stress or mental illness as a good mental health among workers, while others regard the good mental health as possession of sense of well-being and meaningful life (Ryff et al. 2006). Kamardeen and Sunindijo (2017) conceptualized mental health to comprise anxiety, depression, and stress. Nevertheless, substantial empirical evidence has criticised the assumption that an absence of mental illness is equivalent to a mentally healthy workplace (Bowen et al. 2014a; Keyes and Martin 2017).

Given the criticism regarding the definition of mental health as the absence of mental illness, mental health should be redefined as a positive sense of well-being and an underlying belief in others' dignity and worth (Leung and Chan 2012b). Moreover, Al-Maskari et al. (2011) defined mental health as the 'state of well-being in which every individual realizes his or her own potential, can cope with the normal stress of life, can work productively and fruitfully, and is able to make a contribution to her or his community'. Mental health is crucial for the health of workers and positively influences the onset of mental illness, physical problems, and the recovery process. In a working environment, mental health has a positive relationship with job satisfaction (Meliá and Becerril 2007).

2.2 Mental Health in AEC Sector

Design of the AEC project organization that involved the engagement of multiple organizations in project delivery exposes PM-practitioners to poor mental health. Management of multiple contractors and projects concurrently resulted to psychosocial risks,

which include long hours, project overload and poor work-life balance causing poor mental health. Numerous studies reported the pervasiveness of mental health among the PM-practitioners, sparking burst in literature on mental health management. Complexity involved in the design nature of the AEC projects makes it difficult to develop a unique intervention for preventing the psychosocial risk and promotion of mental health. Hence, it is apparent that the inherent characteristics of the design of AEC projects contributes to the poor mental health among PM-practitioners.

2.3 Mental Health in Project Management

Project management roles are stressful managerial responsibilities compare to other managerial due to high emphasis placed on certain project management activities, including budget management, stakeholders' engagement, and schedule management. Stringent budget, unrealistic project deadline and prioritization of stakeholders' values expose PM-practitioners to excessive work stress. PM-practitioners work in unhealthy work conditions such as long work hours, resources sharing among multiple projects, poor communication within the project teams and project role overload, which are antecedent to poor mental health. The nature of project management activities encourages the promotion of poor mental health in the AEC sector.

2.4 COVID-19 Psychosocial Risk

In project based organizations, psychosocial risks becomes inevitable because of the adopted project organization design that inherent certain social, organizational and physical

characteristics spurring poor mental health. Complexity and dynamism of the project organizational design that called for engagement of multiple organizations with different organization goals, involvement in multifarious projects concurrently and demands of project stakeholders contributed to psychosocial risks in project based organizations. Psychosocial risk refers to aspect of work organization, design and management that have the capacity to infringe harm on individual health and safety aswell as adverse organizational outcomes, such as reduced productivity and sickness absence (Leka and Cox 2008). Limitation in COVID-19 related mental health studies in AEC project organizations spurred the literature review of general workplace COVID-19 psychosocial risks, which is further subjected to expert opinion to reveal the COVID-19 psychosocial risk in AEC project organization.

2.5 Organizational Interventions

Development of COVID-19 related mental health management practices for project managers in AEC project organization should be subjected to critical analysis of extant studies and practitioners' management practices for COVID-19 to unpack innovative practices for promoting mental health. Over a couple of decades, researchers proffered organization supports as effective organizational interventions to alleviate psychosocial risks and poor mental health among construction professionals. The findings assisted construction community to comprehend various organizational interventions for promoting positive mental health among project managers. Recently, studies have shown that focusing on proximal factors such as coping mechanisms and organizational supports impede identification of distant mental health management practices shaping the psychosocial risks causing mental health. Distant factors such as organizational culture and human resources management inherent in project organizational design are attributed to the sources of

psychosocial risk causing mental health, therefore limiting the effectiveness of coping mechanisms and organizational supports in tackling psychosocial risks.

Limitation of coping mechanisms and organizational supports in addressing poor mental health called for a concept that captures distant factors influencing psychosocial risk causing poor mental health in AEC project organizations. Project organizational design is the concept attributed to the distant factors responsible for psychosocial risks triggering poor mental health in AEC project organization. AEC firms willing to promote positive mental health among project managers must take into cognizance their project organization design in identifying mentally healthy project management practices for promoting positive mental health. Organizational design principles provide various elements influencing psychosocial risks in AEC projects to promote the development of project management practices for reducing psychosocial risks including COVID-19 related.

3 Theoretical Framework

3.1 Job-Demand-Resources Theory

The research problem of this study, which is improvement of mental health of project management practitioners through mitigation of COVID-19 related psychosocial risks underpinned the application of job-demand-resources (JDR) theory. JDR theory is one of most prominent theories for addressing occupational health and safety. JDR theory posits that lack of resources to balance job demands is the predictors of poor mental health among workers (Demerouti et al. 2001). Drawing on the theory, organizational interventions can mitigate the COVID-19 related psychosocial risk in promoting mental health in AEC project

organization. Based on this, three hypotheses were proposed. **Figure 3.1** below presents the theoretical framework guiding the study.

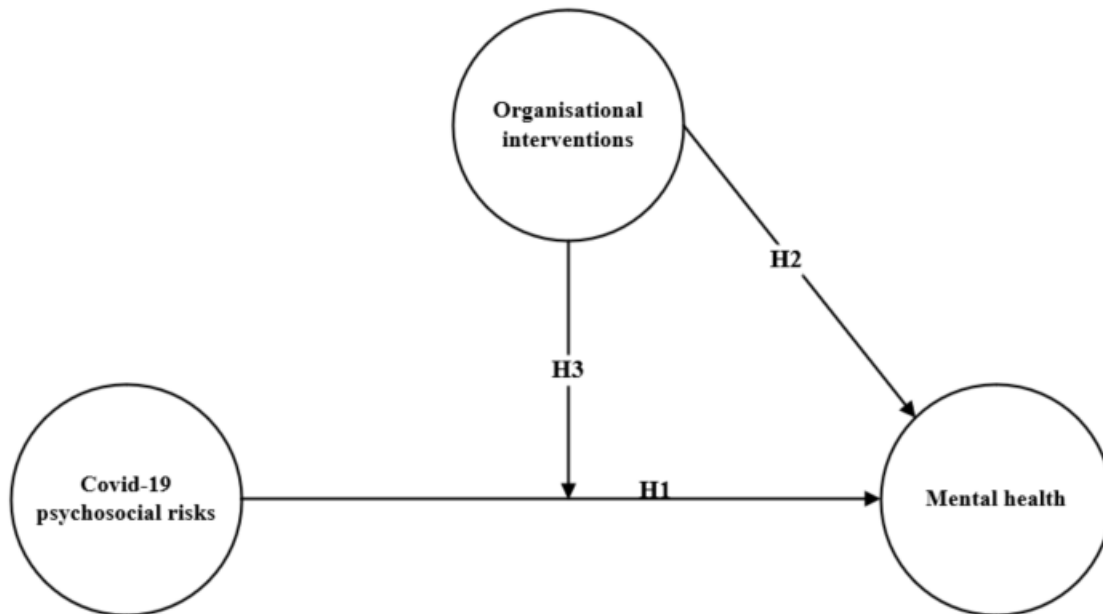


Figure 3.1: Theoretical model

3.2 Hypotheses formulation

3.2.1 Impact of COVID-19 Psychosocial Risks on Mental Health

Considerable amount of research established psychosocial risks triggering poor mental health among project managers in the construction industry to facilitate robust mental health interventions. These psychosocial risks include long working hours, increased workload, reduced rest period and work-family conflict. However, evolvement of COVID-19 introduced additional psychosocial risks, including social isolation, teleworking, featured of losing jobs, reduction in revenues, fear of catching the COVID-19 virus, changes in procurement management procedures, changes in project planning and management and others impose

strain on project managers in AEC project organizations, thereby causing poor mental health. Psychosocial risks are strong antecedents to poor mental health in construction project environment; however, contextuality of the project must take into consideration during development of mental health management for combating psychosocial risks.

Stretching back to over 20 years of mental health research in the construction industry, enormous studies perceived psychosocial risks as generic factors without considering the project context, thereby challenging the applicability of the extant mental health interventions to AEC project organizations. Identification of COVID-19 psychosocial risk in the context of project-based organizations is the initial process for development of organization project management practices for promotion of positive mental health of PM practitioners in AEC project organizations. Previous mental health studies unfolded the importance of identification of psychosocial risks in design of interventions for prevention of psychosocial risks in work environment. Limitation in COVID-19 related mental health studies in AEC project organizations spurred the literature review of general workplace COVID-19 psychosocial risks, which is further subjected to expert opinion to reveal the COVID-19 psychosocial risk in AEC project organization. Therefore, it is hypothesized that

H1: COVID-19 psychosocial risks negatively impact mental health

3.2.2 Impacts of organizational interventions on mental health

Organizational interventions are organizational resources that promote positive mental health through mitigation of psychosocial risks and improvement of cognitive state of workers. According to (Gray et al. 2019), organizational interventions work effectively in promoting mental health and happiness of health care workers because they addresses the source of

psychosocial risks and induces resources for positive mental health. Organizational interventions that manifest as work process or model reduces burnout and improve the mental health of workers. Changing of work processes or model is an innovative organizational intervention for mental health (Gregory et al. 2018; Peters et al. 2020). Organizational interventions via organizational design changes the operational process and project management practices, which in turn improve the mental health of project managers (Tijani et al. 2022; Yang et al. 2017). Therefore, it can be hypothesized that

H2: Organizational interventions positively impact mental health

3.2.3 Moderating effect of organizational interventions

Drawing on JDR theory, organizational resources positively moderate the impact of job demand on the workers' mental health (Demerouti et al. 2001). Lack of resources to alleviate the negative effects of job demand on workers trigger excessive burnout, which result into poor mental health. Based on theory, the negative impact of COVID-19 psychosocial risks on mental health can be moderated by the organizational interventions. Thus, it is hypothesized that

H3: Organizational interventions moderate the effect of COVID-19 psychosocial risk on mental health

3.3 Operationalization of the constructs

The constructs of the theoretical framework are operationalized for further examination in this section.

3.3.1 *COVID-19 psychosocial risks*

Table 3.1 presents the measurement items for COVID-19 psychosocial risk based on the combination of extensive literature and expert forum. Integration of the two methods revealed various items used for measuring COVID-19 psychosocial risks in AEC project organizations. Based on literature review and expert forum, this study operationalized COVID-19 psychosocial risks into nineteen measurement items. The measurement items were codified from CORISK 1 to CORISK 19 in AEC project organizations, and the measurement standard was a five-point Likert scale.

3.3.2 *Organizational interventions*

Operationalization of a construct is crucial to confirm the measurement items for designing data collection instruments. Critical literature review and expert forum have shown various items for measuring organizational interventions. In this study, organizational interventions are operationalized into twenty measurement items, presented in **Table 3.2**. The measurement items were codified from COOPM 1 to COOPM 20, and the measurement standard was a five-point Likert scale.

Table 3.1. Operationalization of COVID-19 psychosocial risk

Code	COVID-19 psychosocial risks definition	References
CORISK 1	Unsafe project environment.	(Ho et al. 2020; Xiang et al. 2020)
CORISK 2	Challenges due to working from home.	(Alsharif et al. 2021; Ho et al. 2020; Xiang et al. 2020)
CORISK 3	Overwhelmed by managing different projects.	(Kniffin et al. 2021; Ramarajan and Reid 2013; Sonta 2020)
CORISK 4	Lack of leadership knowledge and skills.	(Dirani et al. 2020; Stiles et al. 2021)
CORISK 5	Lack of access to additional tools and equipment.	(Alsharif et al. 2021; CDCgov 2020)
CORISK 6	Disruption to supply chain.	(Alsharif et al. 2021; Raoufi and Fayek 2021; Sonta 2020)
CORISK 7	Social isolation.	(Brooks et al. 2018; Tavares 2017; World Health Organization and International Labour Organization Office 2021)
CORISK 8	Difficulty in balancing personal and work needs.	(Hamouche 2020; Pirzadeh and Lingard 2021; van der Molen et al. 2018)
CORISK 9	Lack of training to learn various communication tools.	(CDCgov 2020; van der Molen et al. 2018)
CORISK 10	Difficulty in adjusting to new schedules.	(Pamidimukkala and Kermanshachi 2021)
CORISK 11	Fear to catch corona virus.	(International Labour Organisation Office 2020)
CORISK 12	Difficulty in collaborating with project team members.	(Koch and Schermuly 2021)
CORISK 13	Difficulty in managing project stakeholders.	(Koch and Schermuly 2021; Sonta 2020)

Code	COVID-19 psychosocial risks definition	References
CORISK 14	Difficulty in managing project resources.	(Koch and Schermuly 2021; Sonta 2020)
CORISK 15	Fears of losing job.	(Brooks et al. 2018; Tavares 2017; World Health Organization and International Labour Organisation Office 2021)
CORISK 16	Difficulty in managing project time.	(Koch and Schermuly 2021; Sonta 2020)
CORISK 17	Difficulty in managing project cost.	(Koch and Schermuly 2021; Sonta 2020)
CORISK 18	Difficulty in managing project contracts.	(Koch and Schermuly 2021; Sonta 2020)
CORISK 19	Change project delivery methodology.	(Kniffin et al. 2021; Ramarajan and Reid 2013; Sonta 2020)

Table 3.2. Operationalization of organizational interventions

Code	Organizational interventions	References
COOPM 1	Providing support for working remotely.	(Hamouche 2020; Kniffin et al. 2021; Pamidimukkala and Kermanshachi 2021)
COOPM 2	Providing flexible work schedules.	(Alsharif et al. 2021; Pamidimukkala and Kermanshachi 2021; World Health Organization and International Labour Organization Office 2021)
COOPM 3	Providing training on how to detect and manage stress.	(Deloitte 2020)

Code	Organizational interventions	References
COOPM 4	Providing training on how to enhance use technologies for project delivery.	(Firm 2021; Raoufi and Fayek 2021)
COOPM 5	Establishing a system to maintain effective communication.	(Safapour et al. 2020)
COOPM 6	Providing routine COVID-19 screening.	(McKinsey & Company 2020; Stiles et al. 2021)
COOPM 7	Regularly disinfecting the project workplace.	(McKinsey & Company 2020; World Health Organization and International Labour Organisation Office 2021)
COOPM 8	Enforcing the use of personal protective equipment.	(World Health Organization and International Labour Organisation Office 2021)
COOPM 9	Providing additional childcare supports.	(McKinsey & Company 2020)
COOPM 10	Providing training on how to manage and balance work and family.	(Alsharif et al. 2021; Kniffin et al. 2021)
COOPM 11	Providing unlimited access to self-care apps.	(Deloitte 2020; McKinsey & Company 2020)
COOPM 12	Hiring additional PM practitioners to distribute project workload.	(Deloitte 2020)
COOPM 13	Offering specific pandemic-related leaves.	(McKinsey & Company 2020)
COOPM 14	Providing Employee Assistance Program.	(McKinsey & Company 2020)
COOPM 15	Providing additional technical facilities for virtual and remote work.	(Kniffin et al. 2021)
COOPM 16	Encouraging the sharing of ideas and suggestions to improve project delivery.	(Koch and Schermuly 2021)

Code	Organizational interventions	References
COOPM 17	Encouraging the adoption of non-tradition project delivery methodologies.	(Koch and Schermuly 2021)
COOPM 18	Taking additional measures to manage the supply chain of materials.	(Sharma et al. 2016; Stephany et al. 2020)
COOPM 19	Managing and maintained collaboration between PM practitioners and stakeholders.	(Koch and Schermuly 2021)
COOPM 20	Providing additional PM training.	(Pamidimukkala and Kermanshachi 2021)

3.3.3 Mental health

Given that the absence of work stress is considered a good mental health (Leung et al. 2007; Love et al. 2010), this study used Perceived Stress Scale-10 (PSS 10) for work stress designed by Cohen et al. (1983), to measure mental health in this study. PSS 10 is a self-report psychological instrument for measuring the degree to which individuals' situations are appraised as stressful (Cohen et al. 1983; Remor 2006). The measuring instrument has been used by past studies in Australia (Foster et al. 2018; Ribeiro Santiago et al. 2020). Other countries such as UK, Denovan et al. (2019) and US, Smith and Emerson (2014) also used the instrument for mental health. **Table 3.3** presents the operationalization of mental health.

Table 3.3. Operationalisation of mental health(Cohen et al. 1983)

Code	Mental health
STRE 1	How often have you been upset.
STRE 2	How often have you felt that you were unable to control the important things
STRE 3	How often have you felt nervous and “stressed”
STRE 4	How often have you felt confident about your ability to handle the problems
STRE 5	How often have you felt that things in your PM-oriented work were going your way.
STRE 6	How often have you found that you could not cope with all the things.
STRE 7	How often have you been able to control irritations.
STRE 8	How often have you felt that you were on top of things.
STRE 9	How often have you been angered because of things.
STRE 10	How often have you felt difficulties in your PM-oriented work.

4 Research Design

Following the recommendations of (Saunders 2019), a combination of qualitative and quantitative research design was adopted to answer the research objectives of this study. The methodological step for the research design is presented in **Figure 4.1**.

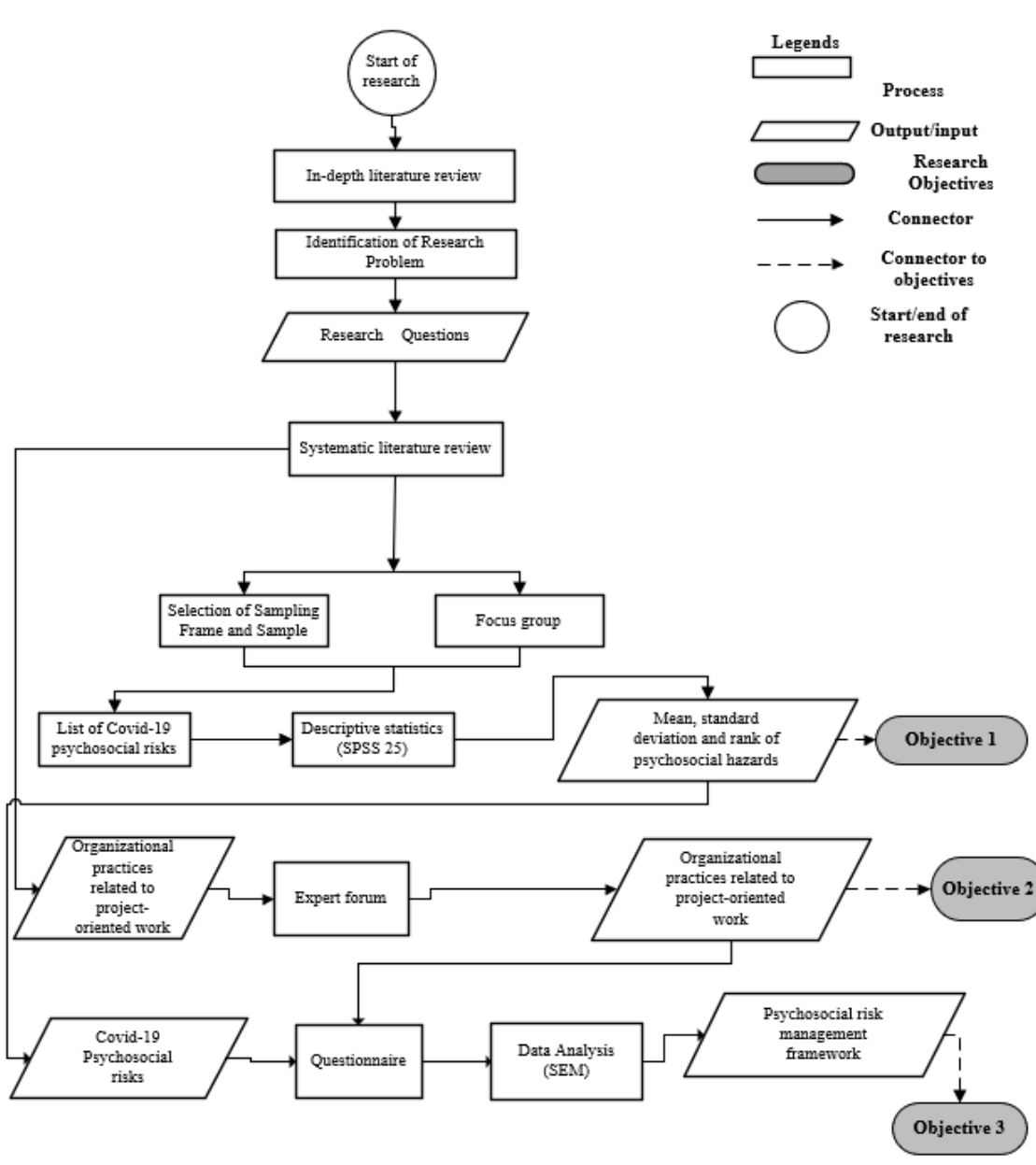


Figure 4.1: Research methodological map

4.1 Systematic literature review process

Given the scanty studies on COVID-19 related psychosocial risk and organizational interventions influencing the mental health of PM-practitioners in the AEC project organization, a comprehensive literature review was conducted to reveal COVID-19 related psychosocial risk and organizational interventions from high-risk industries. Literature review is one of the effective methodologies for understanding the current state of arts of a topic (Li et al. 2014). A three-stage approach was adopted for the literature review process. In stage 1, a high reputable journals, conferences and government documents were searched through Scopus, Web of Science and government websites. The stage 2 involved visual examination of the retrieved journals, conference papers and government documents in stage 1 to remove irrelevant documents. Out of the 50 journals, conference papers and government documents retrieved from stage 1, 35 were recovered for further examination after visualization of the abstract of the documents. Further, an in-depth reading of the 35 journals, conference papers and government documents was carried out in the stage 3. By doing that, 21 relevant journals, 1 conference paper and 2 government documents were found relevant to this study. The review of the documents identified the COVID-19 related psychosocial risk and organizational interventions influencing the mental health.

4.2 Expert opinion method

Expert opinion method is a method of collecting reliable information from experts on a certain subject (Hallowell and Gambatese 2010). It offers validity and reliability of the research when it is mandatory to gather evidence of the research (Bogner et al. 2009; Cuhls 2005). Hence, opinion of competent experts on the subject matter underpinned the basis for

embracing serious discussion, including implementation of innovation recommended by experts in order to obtain the relevant results (Cuhls 2005; Iriste and Katane 2018). Generally, the process seeks judgement by selected experts through brainstorming, which mitigated some of the expected bias. Moreover, careful selection of experts determines the reliable outcomes of the expert opinion method. In this research, the identified on COVID-19 related psychosocial risk and organizational interventions from the literature review were subjected to expert opinion for further analysis.

4.2.1 Selection process for expert opinion

As recommended by (Karakhan et al. 2021), a two-step process is involved in the selection of experts from the project management industry to contribute to the identification of COVID-19 related psychosocial risk and organizational interventions.

In the first step of the selection process, the industry experts consisted of PM-practitioners were chosen from the researchers' network of professionals. As is typical expert opinion method, the sampling method involved is convenience sampling; therefore, inference to the whole of the Australian AEC industry population might be limited. Through the researchers' network of professionals, a list of 9 potential experts was created. This number of experts is sufficient as the minimum number of experts required is seven (Linstone 1985).

In the second step of the selection process, an email was sent to the 9 experts who gave their consents to participate in the research. The email requested information concerning their qualifications, education, project management experience and so forth. The consent form and project participant information sheet were also attached to the email to seek their consent. The aim of requesting this information is to establish whether the contacted experts are

qualified to provide information on COVID-19 related psychosocial risk and organizational interventions. **Table 4.1** depicts the profile of the experts who partake in the expert forum.

Table 4.1. Experts' profile

Experts	Education	Sector	PM-oriented works experience	Number of projects	Professional membership
EXP 1	Master's degree	Engineering	16 years above	21 projects above	PMI
EXP 2	Master's degree	Construction	6 years	16 projects	AIPM
EXP 3	Master's degree	Construction	16 years above	10 projects	Not disclosed
EXP 4	Master's degree	Construction	16 years above	20 projects	Not disclosed
EXP 5	Diploma	Construction	10 years	11 projects	Not disclosed
EXP 6	Master's degree	Construction	11 years	6 projects	AIPM and PMI
EXP 7	Master's degree	Engineering	16 years above	21 projects above	Not disclosed
EXP 8	Master's degree	Architecture and Construction	16 years above	21 projects above	AIPM
EXP 9	Master's degree	Engineering	16 years above	21 projects or above	AIPM

4.2.2 Online expert forum

A questionnaire survey was designed as a data collection instrument as part of expert opinion process. The survey aims to collect information from the expert panel concerning the COVID-19 related psychosocial risk and organizational interventions related to the mental health of PM-practitioners in the AEC project organization. Before sending the questionnaire to experts, the questionnaire was piloted with four individuals (two from academics and two from industry) who were not selected on the expert forums.

The experts were asked to suggest the applicability of the identified the COVID-19 related psychosocial risk and organizational interventions in the literature in the AEC project organization. Moreover, the experts were given the opportunity to include additional factors

that were not added to the survey. Hence, additional six risk factors were included in the 13 identified COVID-19 related psychosocial risks from the literature, making a total of 19 COVID-19 related psychosocial risk for poor mental health. As for COVID-19 related organizational interventions, all the 20 identified factors identified from the literature were considered applicable to the mental health of PM-practitioners in the AEC project organization without any addition.

4.3 Questionnaire survey development

To obtain a broader opinion from the PM-practitioners, the 19 COVID-19 related psychosocial risk and 20 COVID-19 related organizational interventions practices identified through the combination of literature review and expert opinion were used to design a questionnaire survey. Additionally, an established measurement scale PSS-10 score was used to develop questions for measuring the mental health of PM-practitioners. The questionnaire consists of four sections. The first section included respondents' demographic information (e.g. educational qualification, work experience, project-related experience), second section covered information on COVID-19 related psychosocial risk, third section included information on COVID-19 related organizational interventions practices and fourth section covered information on mental health. Accordingly, respondents were asked to indicate the level of agreement using a five-point Likert scale (between 1= strongly disagree and 5 = strongly agree) for each item found in the section.

4.3.1 Validity and reliability of the survey

Content validity of the questionnaire was established on the basis that the measurement items regarding COVID-19 related psychosocial risk and organizational interventions practices are underpinned by both literature review and expert opinion. Face validity of the questionnaire was established through a pilot study in which the data collection instrument was sent to experts through an email to identify problems concerning the wordings of the questions, appropriateness of the questions in relation to AEC projects and evaluation of the completion time. Three experts with 5 years in project management and one associate professor in project management with 5 publications in mental health were involved in the pilot study.

Reliability of the questionnaire can be confirmed with variables showing Cronbach's alpha values greater than 0.7 (Hair et al. 2019). Reliability of the measurement items for COVID-19 related psychosocial risk, organizational interventions and mental health were evaluated and generated Cronbach's alpha values of 0.719, 0.967 and 0.804 respectively.

4.3.2 Sampling and data collection

Convenience sampling was selected in recruiting PM-practitioners to provide reliable information on the mental health in the AEC project organization during COVID-19. The sampling method was chosen because of time frame of the research and easiness to access the respondents. Further, there is an absence of construction associations register on the numbers of AEC firms in Australia; therefore, selecting of convenience sampling is appropriate for this research.

Of the 200 online surveys distributed among AEC firms in Australia, 58 valid responses were received with a response rate of 29%. The sample size is sufficient for this research based on 10 times rule, which indicate that the sample size should be equal to 10 times the largest number of structural paths directed at a particular construct in the structural model (Hair et al. 2016). In this research, the largest number of structural paths is three; hence, the sample size is $10 \times 3 = 30$. Therefore, 30 sample size is required for this study. Nevertheless, 58 sample was used for this research., showing the sufficiency of the sample size.

5 Results and Analysis

Data collected through the questionnaire survey were analysed using SPSS version 27 and Structural equation modelling (SEM). First, Cronbach's alpha coefficient was used to test the internal consistency among measurement items within a collection instrument to assess the internal reliability of the questionnaire (Cronbach 1951). The Mean score analysis was also conducted to determine the relative importance of each item for mental health, COVID-19 psychosocial risk and organizational interventions.

SEM is characterized by its potential to estimate multiple and interdependent relationships, presentation of latent constructs in interdependent relationships, and account for measurement error in the estimation process (DiLalla et al. 2000). SEM has been used in various mental health studies as an analytical tool in exploring the relationships among latent variables (Bowen et al. 2014a; Leung et al. 2008c). In this research, SEM was applied to examine the interactive relationships between COVID-19 related psychosocial risk, COVID-19 related organizational interventions practices and mental health. SEM is classified into two types: covariance-based (CB-SEM) and partial least-squares (PLS-SEM). In this

research, PLS-SEM was considered appropriate than CB-SEM because it is suitable for non-distribution data and smaller sample size (Falk and Miller 1992; Hair et al. 2016). The PLS-SEM analytical process selected was implemented through Smart PLS 3.2.8 software as it meets the requirement for this research (Hair et al. 2016).

5.1 Respondent profiles and affiliations

5.1.1 Gender of the respondents

The respondents' gender is shown in **Table 5.1**. It is apparent that most respondents are male (45) in AEC sector. Moreover, most of the male respondents came from the construction sector (30). This indicates that construction industry is a male dominated industry.

Table 5.1. Gender of the respondents

Gender	Architecture	Engineering	Construction	Total
Male	4	11	30	45
Female	1	1	11	13
Total	5	12	41	58

5.1.2 Age of the respondents

As indicated in **Table 5.2**, most respondents (13) are within 36 – 45 years age and least respondents (5) are 66 years above. Majority of the respondents within 36 –45 years are from the construction sector and minority of them from the architecture sector. This shows that matured project management practitioners involved in providing relevant information to the research.

Table 5.2. Age of the respondents

Age	Architecture	Engineering	Construction	Total
16 – 25 years	2	1	5	8
26 – 35 years	1	4	6	11
36 – 45 years	1	2	10	13
46 – 55 years	1	2	9	12
56 – 65 years	0	2	7	9
66 years above	0	1	4	5
Total	5	12	41	58

5.1.3 Educational qualification

The respondents' educational qualifications are shown in **Table 5.3**, most respondents bagged Master's degree (19) and least of them completed vocational education (1). Moreover, most of the respondents are from the construction (14), followed by engineering (4) and architecture sector (1).

Table 5.3. Qualifications of respondents

Education	Architecture	Engineering	Construction	Total
High school	1	1	0	2
Vocational education	0	0	1	1
Diploma	1	1	4	6
Bachelor's degree	2	4	12	18
Master's degree	1	4	14	19
Doctoral degree	0	2	10	12
Total	5	12	41	58

5.1.4 Years worked in PM-oriented works

Table 5.4 shows that most respondents (28) had worked in project management for 16 years above or above. Majority of the respondents with 16 years or above project management experience are from construction sector and minority of them are from architecture sector (1).

Table 5.4. Years of PM-oriented works

Years	Architecture	Engineering	Construction	Total
0 – 5 years	3	1	7	11
6 – 10 years	1	4	7	12
11 – 15 years	0	1	6	7
16 years or above	1	6	21	28
Total	5	12	41	58

5.1.5 Professional bodies affiliated

The respondents' affiliated project management bodies are listed in **Table 5.5**. Most respondents (24.4%) are affiliated with AIPM, and less of them are affiliated with APM.

Table 5.5. Professional bodies

Professional bodies	Frequency	Percentage
Project Management Institute (PMI)	9	10.9
Australian Institute of Project Management (AIPM)	20	24.4
Association of Project Management (APM)	1	1.2
Australian Institute of Quantity Surveyors (AIQS)	7	8.5
Australian Institute of Building (AIB)	12	14.6
Chartered Institute of Building (CIOB)	2	2.4
Royal Institution of Chartered Surveyors (RICS)	4	4.9
Engineers Australia (EA)	11	13.4
Australian Institute of Architects (AIA)	2	2.4
Association of Consulting Architects Australia (ACAA)	2	2.4
Building Designers Association of Australia (BDAA)	3	3.7

Professional bodies	Frequency	Percentage
Others	3	3.7
None	6	7.3
Total	82	100.0

5.1.6 Number of projects worked during the pandemic

Table 5.6 indicates that most respondents (30) had completed 1 – 5 projects, followed by 11-50 projects and 16 – 20 projects respectively. Majority of the respondents who completed 1-5 projects are from the construction sector and least from the architecture sector.

Table 5.6. Number of projects

Projects	Architecture	Engineering	Construction	Total
1 – 5 projects	2	5	23	30
6 – 10 projects	2	5	13	20
11 – 15 projects	0	1	3	4
16 – 20 projects	1	1	2	4
Total	5	12	41	58

5.1.7 Types of projects worked on during the pandemic

Table 5.7 shows that most respondents involved in private projects (22). Majority of the respondents who engaged in the private projects are from the construction sector (15) and least of them from the architecture sector (1).

Table 5.7. Projects during pandemic

Project types	Architecture	Engineering	Construction	Total
Public	2	2	17	21
Private	1	6	15	22

Project types	Architecture	Engineering	Construction	Total
Equally in both sectors	2	4	9	15
Total	5	12	41	58

5.1.8 Sectors of the industry involved during the pandemic

As shown in **Table 5.8**, majority of the respondents worked in the construction sector (70.7%), followed by engineering sector (20.7%) and then architecture sector (8.6%).

Table 5.8. Sectors during pandemic

Construction sectors	Frequency	Percentage
Architecture	5	8.6
Engineering	12	20.7
construction	41	70.7
Total	58	100.0

5.1.9 Sectors are mainly involved during the pandemic

As indicated in **Table 5.9** during the pandemic, majority of the respondents worked in the construction sector (41) followed by engineering sector (12) and then architecture sector (5).

Table 5.9. Mainly sectors during pandemic

Sectors	Architecture	Engineering	Construction	Total
Residential building	2	1	9	12
Commercial building	3	3	9	15
Urban development	0	1	1	2
Infrastructure	0	6	15	21
Institution	0	1	5	6
Others	0	0	2	2
Total	5	12	41	58

5.1.10 Employment basis during the pandemic

Table 5.10 shows that majority of the respondents are employed as ongoing staff (39) and least of them as casual staff (1) during the pandemic.

Table 5.10. Employment basis

Employment	Architecture	Engineering	Construction	Total
Ongoing	4	9	26	39
Limited term or contract	1	2	15	18
Casual	0	1	0	1
Total	5	12	41	58

5.1.11 Employment status during the pandemic

As indicated in **Table 5.11**, during the pandemic, most of the respondents are employed full time (52) and least of them as part time (6).

Table 5.11. Employment status

Employment status	Architecture	Engineering	Construction	Total
Full time	5	9	38	52
Part time	0	3	3	6
Total	5	12	41	58

5.1.12 Years working in your organization

Table 5.12, shows that most respondents (25) had worked in their organization within 1 – 5 years and least of them (1) within 16 – 20 years. Majority of the respondents who worked

within 1- 5 years are from construction sector (17), followed by engineering sector (4) and architecture sector (4).

Table 5.12. Work experience

Years	Architecture	Engineering	Construction	Total
1 – 5 years	4	4	17	25
6 – 10 years	1	7	12	20
11 – 15 years	0	1	8	9
16 – 20 years	0	0	1	1
21 years or above	0	0	3	3
Total	5	12	41	58

5.1.13 Number of people employed

As shown in **Table 5.13**, most respondents (21) are working in an organization that employed 20 -199 employees and least of them (8) in organization that employed 4 employees. This shows that majority of the respondents worked in large AEC sectors.

Table 5.13. People employed

Number	Architecture	Engineering	Construction	Total
0 - 4	1	2	5	8
5 - 19	2	2	7	11
20 - 199	2	6	13	21
200 and over	0	2	16	18
Total	5	12	41	58

5.1.14 Average annual turnover in recent years

As shown **Table 5.14**, majority of the respondents (15) worked in AEC firms with average turnover of \$100 million or above and least of them in AEC firms with \$2 million to <\$5 million turnover.

Table 5.14. Annual turnover

Turnover	Architecture	Engineering	Construction	Total
Less than \$50,000	0	2	1	3
\$50,000 to <\$200,000	0	0	3	3
\$200,000 to <\$2 million	0	1	7	8
\$2 million to <\$5 million	1	0	0	1
\$5 million to <\$10 million	0	2	0	2
\$10 million to <\$100 million	0	1	1	2
\$100 million or more	0	2	13	19
Don't know	2	3	14	15
Total	3	11	39	53

5.2 Expert Forum Results and Analysis

Table 5.15 presents the result of expert forum that confirmed the applicability of the COVID-19 psychosocial risks identified in the literature. Nine experts critically examined the applicability of COVID-19 psychosocial risks in triggering poor mental health among PM-practitioners in the AEC project organization. Overall, nineteen COVID-19 psychosocial risks were confirmed to be responsible for poor mental health in the AEC project organization. Moreover, **Table 5.16** depicts the result of the expert forum that established the applicability of the organizational interventions revealed from the literature. In total, twenty

organizational interventions were considered adequate to improve the mental health of PM-practitioners in the AEC project organization.

Table 5.15. Expert opinion on COVID-19 psychosocial risks

COVID-19 Psychosocial risks	Experts								
	1	2	3	4	5	6	7	8	9
1. Safe project environment during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Challenges due to working from home during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Being overwhelmed by managing different projects during COVID-19 period.	✓	✓	X	X	✓	✓	✓	✓	X
4. Employers' leadership knowledge and skills to manage PM practitioners during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Accessibility to additional tools and equipment to manage project(s) during COVID-19.	✓	✓	✓	X	✓	✓	✓	✓	✓
6. Disruption to project supply chain of materials during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
7. Social isolation when working from home during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
8. Ability to balance personal, family-related and work-related needs while working from home during COVID-19 period.	X	✓	✓	X	✓	✓	✓	✓	✓
9. Lack of specific training on various communication tools during COVID-19 period.	✓	✓	X	X	✓	✓	✓	✓	✓
10. Need to adjust oneself to new work schedules due to Covid-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
11. Fears to catch corona virus in the project environment during COVID-19 period.	X	✓	✓	X	✓	✓	✓	✓	✓
12. Trouble in collaborating with project team members during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
13. Challenges in managing project stakeholders during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
14. Trouble in managing project resources due to working from home during COVID-19 period.	X	✓	X	✓	✓	✓	✓	✓	✓
15. Fears of losing job due to the COVID-19 pandemic.	✓	✓	✓	X	X	X	✓	✓	✓
16. Significant project delay due to COVID-19 pandemic.	✓	✓	✓	✓	X	✓	✓	✓	✓

COVID-19 Psychosocial risks	Experts								
	1	2	3	4	5	6	7	8	9
17. Costs associated with changing delivery methodologies to manage COVID-19 across projects (Provided by Expert 2)	X	✓							
18. Trouble in managing project contracts due to variations caused by the pandemic.	✓	✓	✓	✓	✓	✓	✓	✓	✓
19. Changes in delivery methodologies caused by managing COVID-19 on projects (Provided by Expert 2)		✓							

✓ = Applicable, X = Not applicable

Table 5.16. Expert opinion on organizational interventions

Organizational interventions	Experts								
	1	2	3	4	5	6	7	8	9
1. Offering support to PM practitioners who worked remotely during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Providing flexible work schedules to promote social distancing during COVID-19 period	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Providing training on how to detect and manage stress during COVID-19 period.	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Providing training on how to enhance the use of technologies for project delivery during COVID-19 period	✓	✓	X	✓	✓	✓	✓	✓	✓
5. Establishing a system to maintain effective communication between PM practitioners, project teams, leadership and stakeholders during COVID-19 period.	✓	✓	X	✓	✓	✓	✓	✓	✓
6. Providing routine COVID-19 screening to PM practitioners	✓	✓	✓	✓	✓	✓	✓	✓	X
7. Regularly disinfecting the project workplace environment during COVID-19 period.	✓	✓	X	✓	✓	✓	✓	✓	X
8. Enforcing the use of personal protective equipment in the project environment during COVID-19 period.	✓	✓	✓	✓	X	✓	✓	✓	✓
9. Providing additional childcare supports for PM practitioners during COVID-19 period.	X	✓	✓	X	✓	✓	✓	✓	✓
10. Providing training on how to manage and balance work and family during COVID-19 period.	X	✓	✓	✓	✓	✓	✓	X	✓
11. Providing unlimited access to self-care apps for mental health and psychological support (e.g Digital mental health app and	✓	✓	✓	✓	✓	✓	✓	✓	✓

Organizational interventions	Experts								
	1	2	3	4	5	6	7	8	9
or therapy) to PM practitioners during COVID-19 period.									
12. Hiring additional PM practitioners to distribute project workload during COVID-19 period.	✓	✓	X	✓	X	✓	✓	✓	✓
13. Offering specific pandemic-related leaves (e.g. vaccination leave, leave for self-isolation) for PM practitioners COVID-19 during the project delivery.	✓	✓	✓	✓	✓	✓	✓	✓	✓
14. Providing Employee Assistance Program (EAP) to help alleviate the distress associated with work-family conflict during COVID-19 period.	✓	✓	X	✓	✓	✓	✓	✓	✓
15. Providing additional technical facilities for virtual and remote work during COVID-19 period.	✓	✓	X	X	X	✓	✓	✓	✓
16. Encouraging PM practitioners to share ideas and suggestions to improve project delivery during COVID-19 period.	✓	✓	✓	✓	X	✓	✓	✓	✓
17. Encouraging the adoption of agile PM methodologies to promote autonomy, social interactions and breaking down of project activities in various phase during COVID-19 period.	✓	✓	X	✓	✓	X	✓	X	X
18. Taking additional measures to manage the supply chain of materials for project delivery.	✓	✓	✓	✓	X	X	✓	X	✓
19. Managing and maintaining collaboration between PM practitioners and stakeholders during COVID-19 period.	✓	✓	X	✓	X	✓	✓	X	✓
20. Providing additional PM training (e.g Quality management, Budget management and Time management) during Covid-19.	✓	✓	X	✓	X	✓	✓	X	X

✓ = Applicable, X = Not applicab

5.2.1 Mean score ranking

Mean score ranking analysis was conducted to determine the mean values and ranking of each mental health item, COVID-19 psychosocial risk and organizational intervention in the

AEC project organization. The analysis commenced by presenting the tables for coding the measurement items for mental health, COVID-19 psychosocial risks and organizational interventions, followed by tables presenting the mean values and ranking of the constructs furnished by the architecture, engineering and construction sectors. **Table 3.1, Table 3.2 and Table 3.3** show the coding for mental health, COVID-19 psychosocial risks, respectively.

Table 5.17 depicts the mean score analysis for each measurement items for perceived stress level by PM-practitioners in the AEC project organization. However, if two or more indicators had the same mean score, the higher rank would be assigned to the indicator with lower standard deviation (SD) (Field 2013). Overall, the mean score shows that the measurement items for perceived stress level ranged between 3.43 and 4.55. As indicated in **Table 5.17**, the mean values furnished by the architecture sector ranged from 2.80 to 4.60, whereas the mean values given by the engineering and construction sectors ranged from 3.46 to 4.33 and 3.39 to 4.66, respectively. It has been found that the top three stresses for PM practitioners during COVID-19 are “How often have you felt confident about your ability to handle problem “(STRE 4), “How often have you felt that you were on top of things” (STRE 8), and “How often have you been able to control irritations” (STRE 7). However, “How often have you felt confident about your ability to handle problem “(STRE 4) is shown to be the top highly ranked perceived stress across the three sectors. Moreover, architecture and engineering sectors rated “How often have you felt that you were on top of things” (STRE 8) as the third perceived stress across the two sectors, while the construction sector positioned it as first. The differences in the perceived stress might be attributed to the differences in project complexity and structure of the organization, which is consistent with Gustavsson (2016)’s findings on the impacts of project characteristics on project overload. In contrast, “How often have you felt difficulties in your PM-oriented work” (STRE 8), “ How often have you felt difficulties in your PM-oriented work”, (STRE 10), and “How often have you found

that you could not cope with all things” (STRE 6) are the three bottom stresses for PM practitioners during COVID-19.

Table 5.18 presents the mean score analysis and rankings for each COVID-19 psychosocial risk in the AEC project organization. Overall, the mean scores indicate that the COVID-19 psychosocial risk ranged between 1.91 and 3.24. As shown in **Table 5.18**, the mean values provided by the architecture sector ranged from 2.00 to 3.40, whereas the mean values furnished by the engineering and construction sector ranged from 1.83 to 3.33, and 1.83 to 3.34, respectively. Based on the results, “Lacks leadership knowledge and skills” (CORISK 4), “Fears of losing job” (CORISK 15), and “Difficulty in balancing personal and work needs” (CORISK 8) are the top three COVID-19 psychosocial risks in the AEC project organization. However, “Fears of losing job” (CORISK 15) is the top highly ranked risk in both the architecture and engineering sectors and second rated risk in the engineering sector. Moreover, the architecture, engineering and construction sectors positioned “Lacks leadership knowledge and skills” (CORISK 4) at fourth, fifth and first respectively. Similarly, “Difficulty in balancing personal and work needs” (CORISK 8) was ranked as fifth by both architecture and construction sectors and second by the engineering sector. The differences in the rating can be attributed to differences in leadership styles and commitments of the organizations to promotion of positive mental health among PM-practitioners, which is consistent with Kuoppala et al. (2008) and Jain et al. (2019) findings that confirmed the positive impact of leadership styles and organizational commitment to well-being of workers. Contrarily, it has been found that bottom three COVID-19 psychosocial risks are “Difficulty in managing project cost” (CORISK 17), “Difficulty in managing project contracts” (CORISK 18) and “Disruption to supply chain” (CORISK 6).

Table 5.17. Mean score ranking for mental health

Code	Architecture			Engineering			Construction			Total		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
STRE 1	3.20	1.095	9	3.88	1.691	8	3.88	1.691	6	3.83	1.523	6
STRE 2	3.20	1.095	8	4.00	1.044	5	3.63	1.799	8	3.67	1.616	8
STRE 3	3.60	1.517	5	3.75	1.865	9	3.95	1.673	5	3.88	1.676	5
STRE 4	4.60	0.548	1	4.33	1.557	1	4.61	1.531	2	4.55	1.465	1
STRE 5	4.00	1.225	4	4.17	0.835	2	4.27	1.415	4	4.22	1.285	4
STRE 6	3.20	1.095	7	3.46	1.872	10	3.46	1.872	9	3.43	1.666	10
STRE 7	4.60	0.548	2	3.92	0.669	7	4.37	1.529	3	4.29	1.338	3
STRE 8	4.60	0.548	3	4.08	0.793	3	4.66	1.797	1	4.53	1.570	2
STRE 9	3.40	1.342	6	4.00	0.739	6	3.73	1.761	7	3.76	1.579	7
STRE 10	2.80	1.095	10	4.00	1.477	4	3.39	1.656	10	3.47	1.592	9

Table 5.18. Mean score ranking for COVID-19 psychosocial risks

Code	Architecture			Engineering			Construction			Total		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
CORISK 1	2.80	1.304	9	2.67	1.303	8	2.59	1.271	11	2.59	1.271	11
CORISK 2	2.80	1.304	8	2.50	1.000	11	2.54	1.286	13	2.24	1.041	16
CORISK 3	3.00	1.225	6	2.08	0.669	18	2.90	1.281	6	2.74	1.208	6
CORISK 4	3.20	0.837	4	2.92	1.084	5	3.34	1.175	1	3.24	1.129	1
CORISK 5	2.00	0.707	19	2.42	0.669	15	2.71	1.123	9	2.59	1.027	12
CORISK 6	2.20	1.789	15	2.08	0.996	17	1.83	0.972	19	1.91	1.048	19
CORISK 7	3.40	1.140	2	2.67	0.778	9	2.51	1.121	15	2.62	1.073	10
CORISK 8	3.20	0.447	5	3.08	1.165	2	3.05	1.332	5	3.07	1.226	3
CORISK 9	3.20	1.095	3	3.08	1.165	3	3.07	1.226	3	2.76	1.081	5
CORISK 10	2.40	0.548	14	2.83	1.115	7	3.07	1.226	4	2.69	1.143	8
CORISK 11	2.60	1.140	10	1.83	0.718	19	2.56	1.343	12	2.41	1.243	15
CORISK 12	3.00	0.707	7	2.92	0.900	6	2.85	1.315	7	2.88	1.186	4
CORISK 13	2.60	0.548	12	2.42	0.793	14	2.73	1.162	8	2.66	1.052	9

Code	Architecture			Engineering			Construction			Total		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
CORISK 14	2.40	0.894	13	2.42	0.900	13	2.54	1.185	14	2.50	1.096	13
CORISK 15	3.40	1.517	1	3.33	1.155	1	3.17	1.395	2	3.22	1.338	2
CORISK 16	2.00	0.707	18	2.17	0.718	16	2.20	1.030	17	2.17	0.939	18
CORISK 17	2.20	0.837	16	2.50	1.168	12	2.17	0.946	18	2.24	0.979	17
CORISK 18	2.20	0.837	17	2.58	1.084	10	2.49	1.075	16	2.48	1.047	14
CORISK 19	2.60	0.894	11	3.08	0.996	4	2.61	1.152	10	2.71	1.100	7

Table 5.19 illustrates the mean score analysis and rankings for each organizational intervention in the AEC project organization. Overall, the mean scores indicate that the organizational interventions ranged between 2.16 and 3.29. As shown in the **Table 5.19**, the mean value furnished by the architecture sector ranged from 2.00 to 3.40, whereas the mean values provided by the engineering and construction sectors ranged from 2.33 to 2.83 and 2.05 to 3.44, respectively. It has been found that the top three organizational interventions for improving PM-practitioners' mental health during COVID-19 are "Hiring additional PM practitioners to distribute project workload" (COOPM 12), "Providing training on how to balance work and family" (COOPM 10) and "Providing additional childcare supports" (COOPM 9). However, "Hiring additional PM practitioners to distribute project workload" (COOPM 12) is shown to be most highly ranked organizational intervention across the architecture and construction sectors, and secondly ranked intervention in the engineering sector. Moreover, "Providing training on how to balance work and family" (COOPM 10) was ranked eighth by the architecture sector, fifth by the engineering sector and second by the construction sector. Furthermore, "Providing additional childcare supports" (COOPM 9) was positioned at sixteen, fifteen and third position in architecture, engineering and construction sectors, respectively. The differences in ranking can be attributed to the project complexity and organizational size, which influence the development of organization interventions for mental health. This is consistent Martin et al. (2016) and Parker et al. (2017)'s findings that established the impact of company size and organizational design on workplace mental health interventions. In contrast, the bottom three organizational interventions in the AEC project organization are "Enforcing the use of personal protective equipment" (COOPM 8), "Providing support for working remotely" (COOPM 2), and "Providing support for working remotely" (COOPM 1).

Table 5.19. Mean score ranking for organizational interventions

Code	Architecture			Engineering			Construction			Total		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
COOPM 1	2.40	1.140	15	2.42	0.900	16	2.05	1.161	20	2.16	1.105	20
COOPM 2	2.00	0.707	20	2.33	0.778	19	2.22	1.151	18	2.22	1.044	19
COOPM 3	2.80	1.483	5	2.50	1.087	12	2.85	1.295	5	2.78	1.257	5
COOPM 4	2.60	1.517	9	2.50	0.798	13	2.66	1.237	9	2.62	1.167	9
COOPM 5	2.40	1.673	13	2.50	0.798	14	2.46	1.075	14	2.47	1.063	15
COOPM 6	2.60	1.140	12	2.67	0.651	7	2.66	1.217	10	2.66	1.101	8
COOPM 7	2.20	1.304	18	2.67	0.651	8	2.44	1.246	15	2.47	1.143	16
COOPM 8	2.40	0.894	17	2.25	0.622	20	2.20	1.145	19	2.22	1.027	18
COOPM 9	2.40	0.894	16	2.50	0.674	15	3.12	1.208	3	2.93	1.122	3
COOPM 10	2.60	1.517	8	2.67	1.073	5	3.12	1.249	2	2.98	1.235	2
COOPM 11	3.00	1.414	3	2.75	0.965	3	2.87	1.189	4	2.85	1.145	4
COOPM 12	3.40	1.517	1	2.75	1.055	2	3.44	1.324	1	3.29	1.298	1
COOPM 13	2.80	1.483	6	2.75	0.965	4	2.51	1.247	12	2.59	1.200	11

Code	Architecture			Engineering			Construction			Total		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
COOPM 14	3.00	1.414	2	2.83	1.115	1	2.41	1.204	16	2.55	1.202	12
COOPM 15	2.80	1.483	4	2.58	0.900	9	2.49	1.186	13	2.53	1.143	13
COOPM 16	2.80	1.140	7	2.33	0.778	18	2.68	1.150	8	2.62	1.105	10
COOPM 17	2.60	1.140	11	2.67	0.888	6	2.80	1.188	6	2.76	1.113	6
COOPM 18	2.40	1.342	14	2.42	0.793	17	2.56	1.097	11	2.52	1.047	14
COOPM 19	2.20	0.837	19	2.58	0.669	11	2.29	1.006	17	2.34	0.928	17
COOPM 20	2.60	1.517	10	2.58	0.900	10	2.78	1.235	7	2.72	1.182	7

6 Structure Equation Modelling (SEM) Results and Hypotheses Testing

PLS-SEM is evaluated in two stages: measurement model and structural model. Measurement model focused on evaluation of adequacy of individual measurement items in capturing their related constructs through assessing internal consistency, convergent validity, and discriminant validity of the specified variables. Structural model concentrates on assessment of the relationships between latent variables that formulated the models (Hair et al. 2012).

6.1 Measurement model evaluation

Measurement model was assessed through evaluation of reliability and validity of the constructs. Confirmatory factor analysis (CFA) was used for evaluating internal consistency reliability, convergent validity and discriminant of constructs to evaluate the capacity of measurement items in capturing their constructs (Anderson and Gerbing 1988).

6.1.1 *Internal consistency reliability*

Internal consistency reliability are assessed through Cronbach's alpha (Cronbach 1951), and composite reliability (Werts et al. 1974). The Cronbach's alpha reliability and composite reliability values are within the range of 0 and 1; a higher value shows higher reliability level. The threshold value for Cronbach's alpha reliability and composite reliability is 0.7 based on recommendation by (Hair et al. 2016).

6.1.2 Convergent validity

Outer loadings and average variance extracted (AVE) were used to assess the convergent validity of constructs in this research. As indicated in **Table 6.1**, **Table 6.2** and **Table 6.3** the outer loading of each measurement item was above 0.4, which is the acceptable value to be retained from the constructs based on the suggestion by Hair et al. (2016). The AVE of each variable was above the recommended threshold of 0.500 (Kline 2015). Hence, the results demonstrate the satisfaction of measurement model for convergent validity.

Table 6.1. Measurement model assessment for mental health

Code	Measurement items	Loading	Ranking	Statistics
STRE 1	How often have you been upset.	0.784	8	Cronbach's alpha 0.804 Composite Reliability 0.593 AVE 0.699
STRE 2	How often have you felt that you were unable to control the important things	0.959	1	
STRE 3	How often have you felt nervous and "stressed"	0.923	2	
STRE 4	How often have you felt confident about your ability to handle the problems	0.677	10	
STRE 5	How often have you felt that things in your PM-oriented work were going your way.	0.860	4	
STRE 6	How often have you found that you could not cope with all the things.	0.836	5	
STRE 7	How often have you been able to control irritations.	0.742	9	
STRE 8	How often have you felt that you were on top of things.	0.834	6	
STRE 9	How often have you been angered because of things.	0.792	7	
STRE 10	How often have you felt difficulties in your PM-oriented work.	0.913	3	

Table 6.2. Measurement model assessment for COVID-19 psychosocial risks

Code	Measurement items	Loading	Ranking	Statistics
CORISK 1	Project environment has been safe.	0.842	1	Cronbach's alpha 0.719 Composite
CORISK 2	Faced with challenges due to working from home.	0.220	17	
CORISK 3	Overwhelmed by managing different projects.	0.676	7	

Code	Measurement items	Loading	Ranking	Statistics
CORISK 4	Organization lacks leadership knowledge and skills.	0.724	4	Reliability 0.669 AVE 0.530
CORISK 5	Access to additional tools and equipment.	0.612	10	
CORISK 6	Disruption to supply chain of materials.	0.219	18	
CORISK 7	Experienced social isolation.	0.512	13	
CORISK 8	Project management practitioners balance personal, family and work.	0.652	8	
CORISK 9	Organization provided training.	0.605	11	
CORISK 10	Project management practitioners adjusted to new work schedules.	0.695	5	
CORISK 11	Project management practitioners did not fear to catch corona virus.	0.497	14	
CORISK 12	Difficulty in collaborating with other project management practitioners.	0.793	2	
CORISK 13	Challenges in managing stakeholders.	0.681	6	
CORISK 14	Trouble in managing resources.	0.617	9	
CORISK 15	Fears of losing job.	0.786	3	
CORISK 16	Experienced significant project delay.	0.349	16	
CORISK 17	Experienced significant project cost overrun.	0.382	15	
CORISK 18	Trouble in managing project contracts.	0.553	12	
CORISK 19	Change project delivery methodologies.	0.180	19	

Table 6.3. Measurement model assessment for organizational interventions

Code	Measurement items	Loading	Ranking	Statistics
COOPM 1	Organization has supported PM practitioners.	0.998	2	Cronbach's alpha 0.967 Composite Reliability 0.960 AVE 0.558
COOPM 2	Organization has provided flexible work schedule.	0.999	1	
COOPM 3	Organization has provided training on how to detect and manage stress.	0.756	7	
COOPM 4	Organization has provided training on how to use technologies.	0.663	10	
COOPM 5	Organization has established a system to maintain effective communication.	0.895	5	
COOPM 6	Organization has provided routine COVID-19 screening.	0.556	18	
COOPM 7	Organization has regularly disinfected the project workplace.	0.634	12	
COOPM 8	Organization has enforced the use of personal protective equipment.	0.712	8	
COOPM 9	Organization has provided additional childcare supports.	0.529	19	
COOPM 10	Organization has provided training on how to manage and balance work and family.	0.711	9	
COOPM 11	Organization has provided unlimited access to self-care apps.	0.612	14	
COOPM 12	Organization has hired additional PM practitioners.	0.583	16	

Code	Measurement items	Loading	Ranking	Statistics
COOPM 13	Organization has offered specific pandemic-related leaves.	0.486	20	
COOPM 14	Organization has provided Employee Assistance Program.	0.642	11	
COOPM 15	Organization has provided additional technical facilities.	0.907	4	
COOPM 16	Organization has encouraged PM practitioners to share ideas.	0.630	13	
COOPM 17	Organization has encouraged the adoption of non-tradition project delivery methodologies.	0.605	15	
COOPM 18	Organization has taken additional measures to manage the supply chain of materials.	0.561	17	
COOPM 19	Organization has managed and maintained collaboration.	0.996	3	
COOPM 20	Organization has provided additional PM training.	0.790	6	

6.1.3 Discriminant validity

Cross-loadings and Heterotrait-monotrait (HTMT) ratio of correlation are two measured used to establish discriminant validity of the constructs (Hair et al. 2016). **Table 6.4** shows the results for the discriminant validity. The results satisfied the discriminant validity of variables as the indicators loaded higher on the construct they were specified to measure when compared to others in the specified model. Additionally, HTMT was used to assess the discriminant validity of constructs. HTMT value for correlation between two latent variables should be not greater than 0.9 (Henseler et al. 2015).

Consequently, the results shown in **Table 6.5** established the discriminant validity of the constructs as HTMT values are less than 0.9 and the construct COVID-19 psychosocial risk, organizational interventions and mental health are different from each other.

Table 6.4. Cross loading analysis of the constructs

	COVID-19 psychosocial risks	Mental health	Organizational interventions
CORISK 8	0.652	0.489	0.248
CORISK10	0.695	0.521	0.470

	COVID-19 psychosocial risks	Mental health	Organizational interventions
CORISK11	0.497	0.372	0.010
CORISK 12	0.793	0.594	0.293
CORISK 13	0.681	0.511	0.199
CORISK 14	0.617	0.463	0.266
CORISK 15	0.786	0.589	0.467
CORISK 16	0.349	0.262	0.206
CORISK 17	0.382	0.287	0.087
CORISK 18	0.553	0.415	0.209
CORISK 19	0.180	0.135	0.031
CORISK 2	0.220	0.165	0.021
CORISK 3	0.676	0.507	0.008
CORISK 4	0.724	0.543	0.381
CORISK 5	0.612	0.459	0.555
CORISK 6	0.219	0.164	0.010
CORISK 7	0.512	0.384	0.017
CORISK 9	0.605	0.454	0.004
STRE 1	0.608	0.784	0.494
STRE 10	0.677	0.913	0.610
STRE 2	0.694	0.959	0.658
STRE 3	0.620	0.923	0.686
STRE 4	0.586	0.677	0.362
STRE 5	0.615	0.860	0.599
STRE 6	0.612	0.836	0.566
STRE 7	0.571	0.742	0.473
STRE 8	0.704	0.834	0.464
STRE 9	0.579	0.792	0.537
COOPM 1	0.543	0.717	1.088
COOPM 10	0.324	0.468	0.711
COOPM 11	0.136	0.403	0.612
COOPM 12	0.156	0.384	0.583
COOPM 13	0.119	0.32	0.486
COOPM 14	0.223	0.423	0.642
COOPM 15	0.429	0.598	0.907
COOPM 16	0.245	0.415	0.630
COOPM 17	0.222	0.398	0.605
COOPM 18	0.123	0.370	0.561
COOPM 19	0.403	0.656	0.996
COOPM 2	0.543	0.747	1.135
COOPM 20	0.316	0.520	0.790
COOPM 3	0.299	0.498	0.756
COOPM 4	0.234	0.437	0.663
COOPM 5	0.396	0.589	0.895
COOPM 6	0.060	0.366	0.556
COOPM 7	0.304	0.418	0.634
COOPM 8	0.304	0.469	0.712
COOPM 9	0.035	0.348	0.529

	COVID-19 psychosocial risks	Mental health	Organizational interventions
COOPM1	0.457	0.631	0.842

Table 6.5. Heterotrait monotrait ratio of correlations (HTMT)

	COVID-19 psychosocial risk	Mental health	Organizational interventions
COVID-19 psychosocial risk	-	-	-
Mental health	0.693	-	-
Organizational interventions	0.396	0.618	-

6.2 Structural model evaluation

The structural model was evaluated by conducting path analyses to estimate the relationships between constructs. That is, the structural model was developed to assess the interact relationships between COVID-19 psychosocial risk, organizational interventions and mental health. The final results show that two out of three hypotheses proposed are significant ($p < 0.01$) (see **Table 6.6**). R^2 is used to estimate the model's predictive power. The R^2 value of all the endogenous variables is higher than 0.50, confirming the theoretical model has higher explanatory power.

In addition to the R^2 value, predictive accuracy of the structural model was further assessed the effect size (f^2) to examine the predictive accuracy. As shown in **Table 6.7**, the explanatory power of f^2 is above the threshold value of 0.02 (Hair et al. 2016), showing that the the theoretical model has explanatory power for the relationships between COVID-19 psychosocial risk, organizational interventions and mental health. Moreover, predictive relevanace (Q^2) was assessed through Blindfolding test to estimate the degree to which the path model predicts the initial observation value. Table 6.8 presents the result of Q^2 .

Table 6.6. Summary of hypotheses for the model

Hypotheses	Path coefficient	t values	p values	Hypotheses validation
H1: COVID-19 psychosocial risk negatively impact mental health.	-0.536	3.397	0.005	Supported
H2: Organizational interventions positively impact mental health.	0.347	3.563	0.000	Supported
H3: Organizational interventions moderate the effect of COVID-19 psychosocial risk on mental health.	-0.130	1.398	0.165	Not supported

Table 6.7. Summary of hypotheses for the model

Hypotheses	f ²
H1: COVID-19 psychosocial risk negatively impact mental health.	0.005
H2: Organizational interventions positively impact mental health.	0.000
H3: Organizational interventions moderate the effect of COVID-19 psychosocial risk on mental health.	0.165

Table 6.8. Predictive power from the Q square of the dependant variable (Q2)

Hypotheses	SSO	SSE	Q ² = (1-SSE/SSO)
COVID-19 psychosocial risk	1102.000	1000.000	0.090
Mental health.	580.000	305.248	0.474
Organizational interventions	1160.000	1100.000	0.052

6.2.1 Relationship between COVID-19 psychosocial risk and mental health

The association between COVID-19 psychosocial risk and mental health was tested through SEM model. The results show that there is a significant negative correlation between COVID-19 psychosocial risk and mental health ($\beta = -0.536$, t-value = 3.397, p = 0.005). This

means that COVID-19 psychosocial risk have negative effects on mental health, providing evidence to support hypothesis **H1**.

6.2.2 Relationship between organizational interventions and mental health

SEM underpinned the testing of the relationship between organizational interventions and mental health. Organizational interventions have significant and positive effect on mental health ($\beta = 0.347$, $t\text{-value} = 3.563$, $p = 0.000$). Hence, hypothesis **H2** is supported.

6.2.3 Moderating effect of organizational interventions on the relationship between COVID-19 psychosocial risk and mental health

The moderating effect of organizational interventions on the relationship between COVID-19 psychosocial risk and mental health was tested via SEM model. The results indicate that there is no significant negative moderating impact on the association between COVID-19 psychosocial risk and mental health ($\beta = -0.130$, $t\text{-value} = 1.398$, $p = 0.165$). This means that organizational interventions has no capacity to reduce the negative effect of COVID-19 psychosocial risk on the mental health of PM-practitioners, which provides evidence to reject hypothesis **H3**.

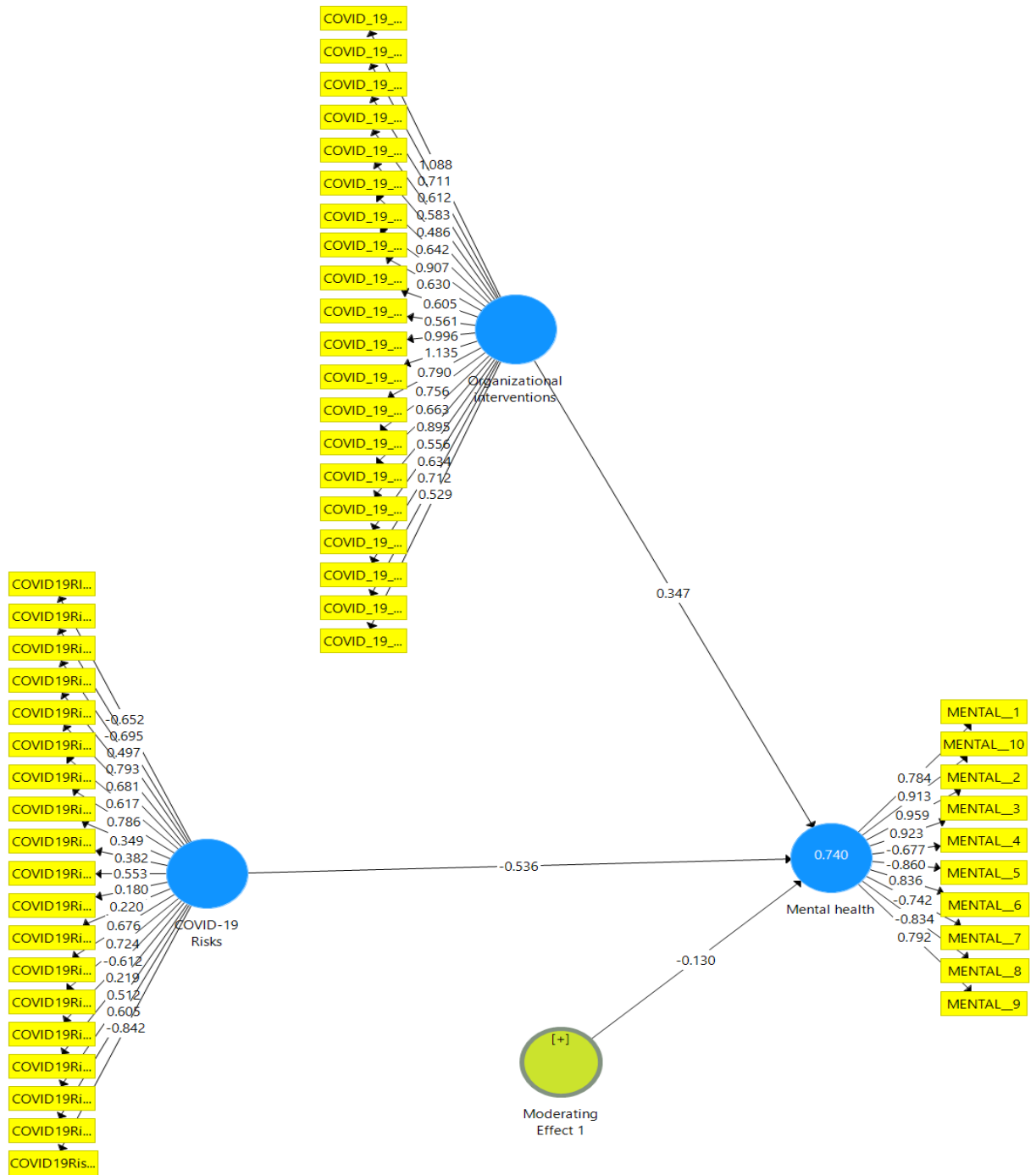


Figure 6.1. Final SEM model

7 Discussion

7.1 Mental health

The results of the outer loading analysis for mental health construct revealed that “How often have you felt that you were unable to control the important things” (STRE 2) is the stress item with highest loading follow by “How often have you felt nervous and stressed” (STRE 3), “How often have you felt difficulties in your PM-oriented work” (STRE 10), “How often have you felt that things in your PM-oriented work were going your way” (STRE 5) and “How often have you found that you could not cope with all the things” (STRE 6), respectively. However, the bottom five stress items with lowest loadings are “How often have you found that you could not cope with all the things” (STRE 6), “How often have you been angered because of things” (STRE 9), “How often have you been upset” (STRE 1), “How often have you been able to control irritations” (STRE 7) and “How often have you felt confident about your ability to handle the problems” (STRE 4).

The result establishing STRE 2, STRE 3, STRE 10, STRE 5 and STRE 6 as the top five stress items with highest loading is consistent with extant studies that reported the top five stress items as critical factors responsible for poor mental health among construction professionals (Leung et al. 2015; Senaratne and Rasagopalasingam 2017). Perception of workers about the stress items in their working environment significantly determine their mental health (Cohen et al. 1983); therefore, it is unsurprising that the outer loading analysis established the stress items as the top five items that defined the mental health construct. Moreover, the confirmation of STRE 6, STRE 9, STRE 1, STRE 7 and STRE 4 as bottom five stress item is consistent with Lee and Jeong (2019)’s findings on the perception of teachers on the stress items in the educational learning environment.

7.2 COVID-19 psychosocial risks causing poor mental health

Based on the results, the top five COVID-19 psychosocial risks with highest loadings are “Unsafe project environment” (CORISK 1), “Difficulty in collaborating with project team members” (CORISK 12), “Fears of losing job” (CORISK 15), “Lack of leadership knowledge and skills” (CORISK 4) and “Difficulty in adjusting to new work schedules” (CORISK 10). However, the bottom five COVID-19 psychosocial risks with lowest loadings are “Difficulty in managing project cost” (CORISK 17), “Difficulty in managing project time” (CORISK 16), “Challenges due to working from home” (CORISK 2), “Disruption to supply chain” (CORISK 6) and “Change in project delivery methodology” (CORISK 19).

The results confirming CORISK 1, CORISK 12, CORISK 15, CORISK 4 and CORISK 10 as the top five COVID-19 psychosocial risks with higher loadings is consistent with Koch and Schermuly (2021) and World Health Organization and International Labour Organization Office (2021)’s findings on critical COVID-19 psychosocial risk causing poor mental health. Moreover, the establishment of CORISK 17, CORISK 16, CORISK 2, CORISK 6 and CORISK 19 as bottom five COVID-19 risks was supported by Koch and Schermuly (2021)’s findings on the strength of the influence of the risks on employee exhaustion.

7.3 Organizational interventions for mental health

The results of the outer loading analysis for the organizational interventions construct revealed that “Providing flexible work schedules” (COOPM 2) is the intervention item with the highest loading followed by “Providing support for working remotely” (COOPM 1), “Managing and maintaining collaboration between PM practitioners and stakeholders” (COOPM 19), “Providing additional technical facilities for virtual and remote work”

(COOPM 15) and “Establishing a system to maintain effective communication” (COOPM 5), respectively. However, the bottom five interventions with lowest loadings are “Hiring additional PM practitioners to distribute project workload” (COOPM 12), “Taking additional measures to manage the supply chain of materials” (COOPM 18), “Provide routine COVID-19 screening” (COOPM 6), “Providing additional childcare supports” (COOPM 9) and “Offering specific pandemic-related leaves” (COOPM 13).

The results establishing COOPM 2, COOPM 1, COOPM 19, COOPM 15 and COOPM 5 as the top five organizational intervention items with higher loadings is consistent with (Koch and Schermuly 2021) and Tijani et al. (2022)’s findings that reported the strong influence of the project organizational strategies in promoting positive mental health in the AEC sector. Further, the confirmation of COOPM 12, COOPM 18, COOPM 6, COOPM 9 and COOPM 13 as bottom five organizational interventions is consistent with the findings of Koch and Schermuly (2021) on the strength of the positive impact of the project management practices on employee well-being during COVID-19.

7.4 Psychosocial risk management framework for mental health of PM-practitioners

Job demand resources (JDR) theory underpinned the development of a theoretical framework showing the interactive relationships between COVID-19 psychosocial risk, organizational interventions and mental health. The SEM results indicate that JDR theory has a strong theoretical concept to explain the impact of organizational interventions on causes of poor mental health among PM-practitioners in the AEC project organization.

7.4.1 Impact of COVID-19 psychosocial risk on mental health

Consistent with previous studies (Bowen et al. 2014c; Leung and Chan 2012b; Tijani et al. 2020a), that confirmed the negative link between psychosocial risk and mental health, this research found significant positive association between COVID-19 psychosocial risk and mental health. This research finding echoed the adverse effect of psychosocial risk introduced by COVID-19 on the mental health of PM-practitioners. The findings of (Bowen et al. 2014c), shows that presence of psychosocial risk in a project environment contributed to the poor mental health among construction project professionals. Psychosocial risks pose threats to the mental health of project managers due to imbalance between project workload and organizational resources (Love and Edwards 2005; Senaratne and Rasagopalasingam 2017). Our findings substantiated and added to previous findings by confirming the negative impacts of COVID-19 psychosocial risk on the mental health of PM-practitioners in the AEC project organization.

7.4.2 Impact of organizational interventions and mental health

As proposed in hypothesis **H2**, the result show that organizational interventions are positively correlated with mental health ($\beta = 0.347$, $t\text{-value} = 3.563$, $p = 0.000$). This result indicates that organizational interventions can improve the mental health of PM-practitioners exposed to COVID-19 psychosocial risk in the AEC project organization. This finding can be explained by Yang et al. (2017), who found that company management systems mitigate job burnout among project managers. Company management systems are organizational interventions for preventing psychosocial risk and promotion of positive mental health (Lamontagne et al. 2007; Tijani et al. 2021; Yang et al. 2017). According to Lamontagne et al. (2007),

organizational interventions serve as primary interventions for work stress reduction among workers. Our findings support extant knowledge on the critical role of organizational interventions in controlling the pervasiveness of psychosocial risk causing poor mental health in workplace.

7.4.3 Impact of moderating effect of organizational interventions on the relationship between COVID-19 psychosocial risk and mental health

Inconsistent with past studies (Bowen et al. 2014a; Leung et al. 2008c), that found that organizational interventions moderate the negative correlation between COVID-19 psychosocial risk and mental health, this study found negative moderate effects of organizational interventions between the relationship between COVID-19 psychosocial risk and mental of PM-practitioners. The finding of Leung et al. (2008c), showed that organizational interventions can reduce the negative impact of psychosocial risk on mental health. Implementation of organizational interventions provide resources for mitigating the adverse effect of psychosocial risk on the mental health of workers (Bowen et al. 2014a; Parker et al. 2017). Therefore, it is likely that the negative moderating effect of organizational interventions on the link between COVID-19 psychosocial risk and mental health is due to differences in COVID-19 related organizational interventions identified in this study and current organizational interventions confirmed by extant studies to promote positive mental health. Majorly, the extant organizational interventions focused on organizational supports Love et al. (2010), company management system Yang et al. (2017), and organizational justice as organizational interventions Yang et al. (2018), for reducing psychosocial risk and improving mental health; therefore, the negative moderating effect may be attributed to the components of COVID-19 related organizational interventions.

8 Conclusions

Poor mental health among PM-practitioners in the AEC firm is a significant problem that received a greater attention among practitioners, researchers and government due to social and economic implications. However, the emergence of COVID-19 introduces additional psychosocial risks causing the poor mental health, thereby requiring the examination of the COVID-19 related psychosocial risks, organizational interventions that captures the additional psychosocial risks and psychosocial risk management framework for mental health. Therefore, this study aims to improve mental health status of PM-practitioners in AEC projects during COVID-19 by exploring the COVID-19 psychosocial risks, organizational interventions and develop a psychosocial risk management framework for mental health. To achieve this aim, this study conducted both literature review and expert forum to explore the COVID-19 psychosocial risk and organizational interventions. Moreover, to develop the psychosocial risk management for mental health, this study draws on JDR theory to test the hypothetical relationships between COVID-19 psychosocial risks, organizational interventions and mental health.

This study found that nineteen relevant COVID-19 psychosocial risks are predictors of poor mental health among PM-practitioners in AEC projects. Among the psychosocial risks, “Lacks leadership knowledge and skills” (CORISK 4), “Fears of losing job” (CORISK 15), and “Difficulty in balancing personal and work needs” (CORISK 8) are the top three ranked COVID-19 psychosocial risks in the AEC project organization. However, the top bottom three COVID-19 psychosocial risks are “Difficulty in managing project cost” (CORISK 17), “Difficulty in managing project contracts” (CORISK 18) and “Disruption to supply chain” (CORISK 6).

Based on empirical analysis, this study established twenty relevant organizational interventions for tackling COVID-19 psychosocial risks. Out of the twenty organizational interventions, three organizational interventions: “Hiring additional PM practitioners to distribute project workload” (COOPM 12), “Providing training on how to balance work and family” (COOPM 10) and “Providing additional childcare supports” (COOPM 9) have been ranked as the top three interventions for promotion of mental health. In contrast, the bottom three organizational interventions in the AEC project organization are “Enforcing the use of personal protective equipment” (COOPM 8), “Providing support for working remotely” (COOPM 2), and “Providing support for working remotely” (COOPM 1).

Based on the perception of PM-practitioners about their project environments, top three stresses for PM practitioners during COVID-19 are “How often have you felt confident about your ability to handle problem “(STRE 4), “How often have you felt that you were on top of things” (STRE 8), and “How often have you been able to control irritations” (STRE 7). However, “How often have you felt difficulties in your PM-oriented work” (STRE 8), “How often have you felt difficulties in your PM-oriented work”, (STRE 10), and “How often have you found that you could not cope with all things” (STRE 6) are the three bottom stresses for PM practitioners during COVID-19.

Our findings unfold the negative correlation between COVID-19 psychosocial risks and mental health. There is a strong correlation between two constructs, confirming the critical role of COVID-19 psychosocial risks on mental health of PM-practitioners in AEC projects during COVID-19 era. This research further shows that organizational interventions positively impact mental health, which the supported JDR theory on the influence of organizational resources on mental health. This study further established innovative result by

showing that organizational interventions negatively moderate the relationship between COVID-19 psychosocial risks and mental health.

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APPENDIX A: CONSENT FORM FOR EXPERT FORUM



Consent Form – General (Extended)

Project Title: Improving the Mental Health of Project Management (PM) Practitioners in Architecture, Engineering and Construction (AEC) Projects during Covid-19 Pandemic

This study has been approved by the Human Research Ethics Committee at Western Sydney University. The ethics reference number is: H14637

I hereby consent to participate in the above named research project.

I acknowledge that:

- I have read the participant information sheet (or where appropriate, have had it read to me) and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s
- The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

I consent to:

Participating in the expert forum

I consent for my data and information provided to be used in this project and other related projects for an extended period of time.

I understand that my involvement is confidential and that the information gained during the study may be published and stored for other research use but no information about me will be used in any way that reveals my identity.

I understand that I can withdraw from the study at any time without affecting my relationship with the researcher/s, and any organizations involved, now or in the future.

I understand that my participation in this study will have no effect on my relationship with the researcher/s, and any organizations involved, now or in the future. I understand that I will be unable to withdraw my data and information from this project. *focus group information cannot be withdrawn. Information provided will be non-identified*

Signed:

Name:

Date:

Return address: B.Tijani@westernsydney.edu.au

What if I have a complaint?

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through Research Engagement, Development and Innovation (REDI) on Tel +61 2 4736 0229 or email humanethics@westernsydney.edu.au.

Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

APPENDIX B: INVITATION LETTER FOR EXPERT FORUM
WESTERN SYDNEY
UNIVERSITY



EXPERT FORUM FOR THE IDENTIFICATION OF PSYCHOSOCIAL RISKS AND MANAGEMENT STRATEGIES FOR PROJECT MANAGEMENT (PM) PRACTITIONERS IN ARCHITECTURE, ENGINEERING, AND CONSTRUCTION AEC PROJECT ORGANIZATION DURING COVID-19 PANDEMIC

Dear Sir/Madam,

Our research aims to develop mental health management framework for Architectural, Engineering and Construction (AEC) project organizations to improve mental health of project management practitioners. Management strategies related to project management (PM) oriented work and psychosocial risks for mental health management were identified in this research.

Early questionnaire survey was developed based on extensive literature review Your feedback concerning comprehensiveness and applicability of the questions in related to mental health management in AEC projects is important.

Your kind participation at this validation stage is highly appreciated to bring this research to a conclusion. Should you have queries regarding this research study, please do not hesitate to contact Assoc/Prof. Xiaohua Jin by email B.Tijani@westernsydney.edu.au

Yours faithfully

Xiaohua Jin



Participant Information Sheet – Expert Forum – General (Extended)

Project Title: *Improving the Mental Health of Project Management (PM) Practitioners in Architecture, Engineering and Construction (AEC) Sector during COVID-19 Pandemic*

Project Summary:

Unprecedented changes due to COVID-19 pandemic have introduced new psychosocial risks for mental health of project management (PM) practitioners in the architecture, engineering and construction (AEC) sector. This research is aimed at improving mental health status of PM practitioners in the Australian AEC sector during COVID-19 pandemic by evaluating psychosocial risk factors and their interventions, thereby establishing a psychosocial risk management framework. The research objectives are attained through an expert forum and industry questionnaire survey. The resultant mental health management framework is expected to help improve mental health status of PM practitioners in AEC sector.

You are invited to participate in this study being conducted by researchers including Associate Professor Xiaohua (Sean) Jin (Western Sydney University), Doctor Robert Osei-Kyei (Western Sydney University), Professor Srinath Perera (Western Sydney University), Mr James Bawtree (PMLogic) and Mr Bashir Tijani (Western Sydney University).

How is the study being paid for?

This study is sponsored by Project Governance and Controls Symposium (PGSC), Australia.

What will I be asked to do?

You will be asked to participate in an online expert forum to provide feedback concerning

the applicability and comprehensiveness of the identified psychosocial risks and management practices related to mental health of PM practitioners in the AEC sector during the COVID-19 pandemic. The expert forum will be conducted online via emails.

How much of my time will I need to give?

Approximately 20 minutes.

What benefits will I, and/or the broader community, receive for participating?

Designing and implementing mental health management practices that promote positive mental health is paramount in shaping PM practitioners' social life, productivity and project performance. The psychosocial risks and management practices identified and the psychosocial risk management framework developed in this research will benefit PM practitioners, project-based organizations and the AEC sector by contributing to mitigating COVID-19 related psychosocial risks and improving mental health of PM practitioners.

Will the study involve any risk or discomfort for me? If so, what will be done to rectify it?

The study may involve some minor discomfort because of questions related to work stressors, which may cause personal distress. If you do feel any discomfort you may withdraw from the study. You may also wish to contact the Beyond Blue through Hotline 1300224636, or Lifeline through 131114 or Mates in Construction on 1300642111.

How do you intend to publish or disseminate the results?

The findings of the research will be published in an industrial report, academic journals and conference proceedings.

Will the data and information that I have provided be disposed of?

Please note that minimum retention period for data collection is five years post publication. The data and information you have provided will be securely disposed of.

Can I withdraw from the study?

You can withdraw from the study without giving reason.

Can I tell other people about the study?

Yes, please tell other people about the study by providing them with this Participant Information Sheet and the Chief Investigator's contact details. They can contact the Chief Investigator to discuss their participation in the research project.

What if I require further information?

Please contact the Lead Chief Investigator, Associate Professor Xiaohua (Sean) Jin should you wish to discuss the research further before deciding whether or not to participate.

Email : xiaohua.jin@westernsydney.edu.au

What if I have a complaint?

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through Research Engagement, Development and Innovation (REDI) on Tel +61 2 4736 0229 or email humanethics@westernsydney.edu.au. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form. The information sheet is for you to keep and the consent form is retained by the researcher/s. This study has been approved by the Western Sydney University Human Research Ethics Committee. The Approval number is H14637.

What will happen with my information if I agree to it being used in projects other than this one?

Thank you for considering being a participant in a University research project. The researchers are asking that you agree to supply your information (data) for use in this project and to also agree to allow the data to potentially be used in future research projects.

This request is in line with current University and government policy that encourages the re- use of data once it has been collected. Collecting information for research can be an inconvenience or burden for participants and has significant costs associated with it. Sharing your data with other researchers gives potential for others to reflect on the data and its findings, to re-use it with new insight, and increase understanding in this research area.

You have been asked to agree to Extended consent.

Extended consent

When you agree to extended consent it means that you agree that your data, as part of a larger dataset (the information collected for this project) can be re-used in projects that are

- an extension of this project
- closely related to this project
- in the same general area of this research.

The researchers will allow this data to be used by other researchers to extend on the current study or for a similar study. To enable this re-use, your data will be held at the University in its data repository and managed under a Data Management Plan. The stored data available for re-use will not have information in it that makes you identifiable. The re-use of the data will only be allowed after an ethics committee has agreed that the new use of the data meets the requirements of ethics review.

The researchers will de-identify the participants by removing their emails during data cleaning and analysis. Additionally, the email exchanged will be converted to pdf and stored in cloudstor at Western Sydney University for data protection. To complete the data protection, the email exchanged shall be deleted from the researcher's email after storing at cloudstor at Western Sydney University. Additionally, the researchers want to keep the data for 10 years for possible re-use. After this time the data will be securely destroyed.

You are welcome to discuss these issues further with the researchers before deciding if you agree. You can also find more information about the re-use of data in research in the National Statement on Ethical Conduct in Human Research – see Sections 2.2.14 - 2.2.18.

<https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2007-updated-2018>

APPENDIX D: EXPERT FORUM

EXPERT FORUM GUIDE

Project Title

Improving the Mental Health of Project Management (PM) Practitioners in Architecture, Engineering and Construction (AEC) Sector during COVID-19 Pandemic.

Purpose of Expert Forum

The expert forum aims to identify psychosocial risks and relevant management practices that are related to workplace mental health of PM practitioners in the AEC sector during Covid-19 pandemic.

A list of psychosocial risks and a list of management practices have been identified beforehand as candidates to facilitate the process.

Important Instructions

Firstly, please read the information provided in the attached *Participant Information Sheet*. If you are happy to participate, please ensure you sign the attached *Consent Form* and return it to the researchers before your participation.

<h3>Section A: Personal Information</h3>
--

Your Name: Click or tap here to enter text.

Your Company: Click or tap here to enter text.

Your Position: Click or tap here to enter text.

Your Email: Click or tap here to enter text.

What is your highest level of educational qualification?

- High school Vocational education Diploma
 Bachelor's degree Master's degree Doctoral degree

In which sector are you currently involved?

- Architecture Engineering Construction
 Others (Please specify): Click or tap here to enter text.

How long have you been involved in PM-oriented works?

- 0- 5 years 6- 10 years 11- 15 years 16 years or above

Roughly how many projects have you worked on in the past five years?

- 1- 5 projects 6- 10 projects 11- 15 projects
 16- 20 projects 21 projects or above

Which professional bodies are you affiliated with? (Select all that are applicable)

- PMI AIPM APM AIQS AIB RICS
 None Others (Please specify): Click or tap here to enter text.

Section B: COVID-19 Related Psychosocial Risk Factors

Please specify whether the below listed factors are applicable to PM practitioners in the AEC sector during the COVID-19 period.

If you think that a factor is NOT applicable, please provide your reason.

If you think that some other factor(s) need to be added, please feel free to add them in the blank rows at the bottom of the table and provide your reason.

#	COVID-19 Related Psychosocial Risk Factors	Applicability	Reason
1	Safe project environment during COVID-19 period.	Choose an item.	Click or tap here to enter text.
2	Challenges due to working from home during COVID-19 period.	Choose an item.	Click or tap here to enter text.
3	Being overwhelmed by managing different projects during COVID-19 period.	Choose an item.	Click or tap here to enter text.
4	Employers' leadership knowledge and skills to manage PM practitioners during COVID-19 period.	Choose an item.	Click or tap here to enter text.
5	Accessibility to additional tools and equipment to manage project(s) during COVID-19.	Choose an item.	Click or tap here to enter text.
6	Disruption to project supply chain of materials during COVID-19 period.	Choose an item.	Click or tap here to enter text.
7	Social isolation when working from home during COVID-19 period.	Choose an item.	Click or tap here to enter text.
8	Ability to balance personal, family-related and work-related needs while working from home during COVID-19 period.	Choose an item.	Click or tap here to enter text.
9	Employers provided specific training on various communication tools during COVID-19 period.	Choose an item.	Click or tap here to enter text.
10	Need to adjust oneself to new work schedules due to Covid-19 period.	Choose an item.	Click or tap here to enter text.
11	Fear of catching corona virus in the project environment during COVID-19 period.	Choose an item.	Click or tap here to enter text.
12	Trouble in collaborating with project team members during COVID-19 period.	Choose an item.	Click or tap here to enter text.
13	Challenges in managing project stakeholders during COVID-19 period.	Choose an item.	Click or tap here to enter text.
14	Trouble in managing project resources due to working	Choose an item.	Click or tap here to

#	COVID-19 Related Psychosocial Risk Factors	Applicability	Reason
	from home during COVID-19 period.		enter text.
15	Fears of losing job due to the COVID-19 pandemic.	Choose an item.	Click or tap here to enter text.
16	Significant project delay due to COVID-19 pandemic.	Choose an item.	Click or tap here to enter text.
17	Trouble in managing project contracts due to variations caused by the pandemic.	Choose an item.	Click or tap here to enter text.
18	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.
19	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.
20	Click or tap here to enter text.		

Section C: COVID-19 Related Organisational Practices

Please specify whether the below listed organizational practices are applicable to PM practitioners in the AEC sector during the COVID-19 period.

If you think that a practice is NOT applicable, please provide your reason.

If you think that some other practice(s) need to be added, please feel free to add them in the blank rows at the bottom of the table and provide your reason.

#	COVID-19 Related Organizational Practices	Applicability	Reason
1	Offering support to PM practitioners who worked remotely during COVID-19 period.	Choose an item.	Click or tap here to enter text.
2	Providing flexible work schedules to promote social distancing during COVID-19 period.	Choose an item.	Click or tap here to enter text.
3	Providing training on how to detect and manage stress during COVID-19 period.	Choose an item.	Click or tap here to enter text.
4	Providing training on how to enhance the use of	Choose an item.	Click or tap here to

#	COVID-19 Related Organizational Practices	Applicability	Reason
	technologies for project delivery during COVID-19 period.		enter text.
5	Establishing a system to maintain effective communication between PM practitioners, project teams, leadership and stakeholders during COVID-19 period.	Choose an item.	Click or tap here to enter text.
6	Providing routine COVID-19 screening to PM practitioners.	Choose an item.	Click or tap here to enter text.
7	Regularly disinfecting the project workplace environment during COVID-19 period.	Choose an item.	Click or tap here to enter text.
8	Enforcing the use of personal protective equipment in the project environment during COVID-19 period.	Choose an item.	Click or tap here to enter text.
9	Providing additional childcare supports for PM practitioners during COVID-19 period.	Choose an item.	Click or tap here to enter text.
10	Providing training on how to manage and balance work and family during COVID-19 period.	Choose an item.	Click or tap here to enter text.
11	Providing unlimited access to self-care apps for mental health and psychological support (e.g Digital mental health app and or therapy) to PM practitioners during COVID-19 period.	Choose an item.	Click or tap here to enter text.
12	Hiring additional PM practitioners to distribute project workload during COVID-19 period.	Choose an item.	Click or tap here to enter text.
13	Offering specific pandemic-related leaves (e.g. vaccination leave, leave for self-isolation) for PM practitioners COVID-19 during the project delivery.	Choose an item.	Click or tap here to enter text.
14	Providing Employee Assistance Program (EAP) to help alleviate the distress associated with work-family conflict during COVID-19 period.	Choose an item.	Click or tap here to enter text.
15	Providing additional technical facilities for virtual and remote work during COVID-19 period.	Choose an item.	Click or tap here to enter text.
16	Encouraging PM practitioners to share ideas and suggestions to improve project delivery during COVID-	Choose an item.	Click or tap here to enter text.

#	COVID-19 Related Organizational Practices	Applicability	Reason
	19 period.		
17	Encouraging the adoption of agile PM methodologies to promote autonomy, social interactions and breaking down of project activities in various phase during COVID-19 period.	Choose an item.	Click or tap here to enter text.
18	Taking additional measures to manage the supply chain of materials for project delivery.	Choose an item.	Click or tap here to enter text.
19	Managing and maintaining collaboration between PM practitioners and stakeholders during COVID-19 period.	Choose an item.	Click or tap here to enter text.
20	Providing additional PM training (e.g Quality management, Budget management and Time management) during Covid-19.	Choose an item.	Click or tap here to enter text.
21	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.
22	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.
23	Click or tap here to enter text.	Choose an item.	Click or tap here to enter text.

Thank you for your time and participation in this expert forum. Really appreciate it! Your participation will assist in the understanding of mental health management of PM practitioners in the AEC sector during COVID-19.

Please feel free to leave your comments and suggestions, if any, on this research project. Thank you again and have a lovely day!

Click or tap here to enter text.

APPENDIX E: INVITATION LETTER FOR QUESTIONNAIRE

WESTERN SYDNEY
UNIVERSITY



**QUESTIONNAIRE SURVEY ON MENTAL HEALTH MANAGEMENT
OF PROJECT MANAGEMENT (PM) PRACTITIONERS IN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION (AEC)
PROJECT BASED ORGANIZATIONS**

Dear Sir/Madam,

Unprecedented changes due to COVID-19 pandemic introduces new psychosocial risks for mental health of project management in architecture, engineering and construction (AEC) projects. This research is aimed at improving mental health status of PM practitioners in AEC projects during COVID-19 pandemic in Australia by exploring psychosocial risk factors, evaluating their interventions, and establishing a psychosocial risk management framework. The research objectives will be attained through an expert forum, and industry questionnaire survey. The resultant psychosocial risk management framework is expected to improve mental health status of PM practitioners in AEC projects. Expected outcome of this project is Covid-19 mental health management framework for promotion of positive mental health among PM practitioners in AEC project based organization.

In this regard, you are invited to participate in this study being conducted by Australian researchers Assoc Prof Xiaohua Jin (Western Sydney University), Dr Robert Osei-Kyei (Western Sydney University), Prof Srinath Perera (Western Sydney University), Mr James Bawtree (PMLogic Company) and Mr Bashir Tijani (Western Sydney University) .

The online questionnaire survey will take approximately 20 minutes to complete and your participation in the survey is highly appreciated. All responses to the survey will be treated in strict confidence and solely used for academic purpose. Additionally, since the survey is completed online, your identity will remain anonymous throughout the research. We are willing to share the summary of the result to assist your company upon request.



Participant Information Sheet – Survey – General (Extended)

Project Title: *Improving the Mental Health of Project Management (PM) Practitioners in Architecture, Engineering and Construction (AEC) Sector during COVID-19 Pandemic*

Project Summary:

Unprecedented changes due to COVID-19 pandemic have introduced new psychosocial risks for mental health of project management (PM) practitioners in the architecture, engineering and construction (AEC) sector. This research is aimed at improving mental health status of PM practitioners in the Australian AEC sector during COVID-19 pandemic by evaluating psychosocial risk factors and their interventions, thereby establishing a mental health management framework. The research objectives are attained through an expert forum and industry questionnaire survey. The resultant mental health management framework is expected to help improve mental health status of PM practitioners in AEC sector.

You are invited to participate in this study, conducted by researchers including Associate Professor Xiaohua (Sean) Jin (Western Sydney University), Doctor Robert Osei-Kyei (Western Sydney University), Professor Srinath Perera (Western Sydney University), Mr James Bawtree (PMLogic) and Mr Bashir Tijani (Western Sydney University).

How is the study being paid for?

This study is sponsored by Project Governance and Controls Symposium (PGSC), Australia.

What will I be asked to do?

You will be asked to complete an online questionnaire about your own experience in your PM- oriented work during the COVID-19 pandemic. The online questionnaire survey is

anonymous.

How much of my time will I need to give?

Approximately 15 minutes.

What benefits will I, and/or the broader community, receive for participating?

Designing and implementing mental health management practices that promote positive mental health is paramount in shaping PM practitioners' social life, productivity and project performance. The psychosocial risks and management practices identified and the mental health management framework developed in this research will benefit PM practitioners, project-based organizations and the AEC sector by contributing to mitigating COVID-19 related psychosocial risks and improving mental health of PM practitioners.

Will the study involve any risk or discomfort for me? If so, what will be done to rectify it?

The study may involve some minor discomfort because of questions related to work stressors, which may cause personal distress. If you do feel any discomfort you may withdraw from the study. You may also wish to contact the Beyond Blue through Hotline 1300224636, or Lifeline through 131114 or Mates in Construction on 1300642111.

How do you intend to publish or disseminate the results?

The findings of the research will be published in an industrial report, academic journals and/or conference proceedings.

Will the data and information that I have provided be disposed of?

Please note that minimum retention period for data collection is five years post publication. The data and information you have provided will then be securely disposed of.

Can I withdraw from the study?

You can withdraw from the study without giving reason.

Can I tell other people about the study?

Yes, please tell other people about the study by providing them with this Participant Information Sheet and the Chief Investigator's contact details. They can contact the Chief Investigator to discuss their participation in the research project.

What if I require further information?

Please contact the Lead Chief Investigator, Associate Professor Xiaohua (Sean) Jin should you wish to discuss the research further before deciding whether or not to participate.

Email : xiaohua.jin@westernsydney.edu.au

What if I have a complaint?

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through Research Engagement, Development and Innovation (REDI) on Tel +61 2 4736 0229 or email humanethics@westernsydney.edu.au. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form. The information sheet is for you to keep, and the consent form is retained by the researcher/s. This study has been approved by the Western Sydney University Human Research Ethics Committee. The Approval number is H14637.

What will happen with my information if I agree to it being used in projects other than this one?

Thank you for considering being a participant in a University research project. The researchers are asking that you agree to supply your information (data) for use in this project and to also agree to allow the data to potentially be used in future research projects.

This request is in line with current University and government policy that encourages the re- use of data once it has been collected. Collecting information for research can be an inconvenience or burden for participants and has significant costs associated with it.

Sharing your data with other researchers gives potential for others to reflect on the data and its findings, to re-use it with new insight, and increase understanding in this research area.

You have been asked to agree to Extended consent.

Extended consent

When you agree to extended consent it means that you agree that your data, as part of a larger dataset (the information collected for this project) can be re-used in projects that are

- an extension of this project
- closely related to this project
- in the same general area of this research.

The researchers will allow this data to be used by other researchers to extend on the current study or for a similar study. To enable this re-use, your data will be held at the University in its data repository and managed under a Data Management Plan. The stored data available for re-use will not have information in it that makes you identifiable. The re-use of the data will only be allowed after an ethics committee has agreed that the new use of the data meets the requirements of ethics review.

The researchers will de-identify the participants by removing their emails during data cleaning and analysis. Additionally, the email exchanged will be converted to pdf and stored in cloudstor at Western Sydney University for data protection. To complete the data protection, the email exchanged shall be deleted from the researcher's email after storing at cloudstor at Western Sydney University. Additionally, the researchers want to keep the data for 10 years for possible re-use. After this time the data will be securely destroyed.

You are welcome to discuss these issues further with the researchers before deciding if you agree. You can also find more information about the re-use of data in research in the [National Statement on Ethical Conduct in Human Research](#) – see Sections 2.2.14 - 2.2.18.

<https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2007-updated-2018>

APPENDIX G: QUESTIONNAIRE SURVEY

I. Personal Information

1.1 What is your gender

- Male Female Others (Please specify) _____ Prefer not to say

1.2 What is your age in years

- 16- 5 years 26- 35 years 36- 45 years 46- 55 years 56 – 66 years

1.3 What is your highest level of educational qualification?

- High school Vocational education Diploma Bachelor's degree
 Master's degree Doctoral degree

1.4 How long have you been involved in PM-oriented works?

- 0- 5 years 6- 10 years 11- 15 years 16 years or above

1.5 How many years have you involved in project management (PM)- oriented works?

- 0- 5 years 6- 10 years 11- 15 years 16 years or above

1.6 Which project management professional bodies are you affiliated?

- PMI AIPM APM AIQS AIB RICS None
 Others (Please specify) _____

1.7 Roughly how many projects have you worked on during the pandemic?

- 1- 5 projects 6- 10 projects 11- 15 projects 16- 20 projects
 21 projects or above

1.8 Are those projects that you worked on during the pandemic mainly in public or private sector?

- Public Private Equally in both sectors

1.9 In which sector(s) of construction industry are you mainly involved during the pandemic?

- Architecture Engineering Construction
 Others (Please specify) _____

1.10 In which project sector are you currently working?

- Residential building Commercial building Urban development
 Industrial Infrastructure Mining and resources
 Petrochemical Institution Other (Please specify) _____

1.11 What is your employment status during the pandemic?

- Ongoing Limited term or contract Casual

1.12 What is your employment status during the pandemic

- Full time Part time

1.13 Which country is your employment based in during the pandemic

- Australia Other (Please specify) _____

1.14 How long have you been working in your current organization?

1- 5 years 6- 10 years 11- 15 years 16- 20 years 21 years or above

1.15 How many people are employed by your organization?

0 - 4 5 – 19 20 – 199 200 and over

1.16 What is the average annual turnover of your organization in recent years

Not applicable Less than \$50,000 \$50,000 to <\$200,000
 \$200,000 to <\$2 million \$2 million to <\$5 million \$5 million to <\$10 million
 \$10 million to <\$100 million \$100 million or more Don't know

1.17 What is your PM-oriented role in your organization during the pandemic?

Portfolio manager Programme manager Project manager Project team member Other (Please specify)

1.18 What is your KEY PM-oriented responsibilities in your organization during the pandemic?

Project Integration Management Project Scope Management Project Time Management Project Cost Management Project Quality Management Project Resources Management Project Communication Management
 Project Risk Management Project Procurement Management Project Stakeholder Management

Please answer the below questions based on your own experience during CoVID-19 period

Section B: Covid-19 related psychosocial risk factors
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Based on your experience during the COVID-19 period please specify the extent to which you agree or disagree with the following statements by ticking your responses using the following scale:

1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree

Statements	1	2	3	4	5
(1) My project environment has been safe during COVID-19 period.					
(2) I have been faced with challenges due to working from home during COVID-19 period.					
(3) I have been overwhelmed by managing different projects during COVID-19 period.					
(4) My organization lacks leadership knowledge and skills to manage PM practitioners during COVID-19 period.					
(5) I have had access to additional tools and equipment to manage my project(s) during COVID-19.					
(6) There have been disruption to supply chain of materials needed for my project(s) during COVID-19 period.					
(7) I have experienced social isolation when working from home during COVID-19 period.					
(8) During COVID-19 period, I have been able to balance personal, family-related and work-related needs while working from home.					
(9) During COVID-19 period, my organization has provided specific training on various communication tools.					
(10) I have adjusted to new work schedules due to Covid-19 period.					
(11) I have been afraid to catch corona virus in the project environment during COVID-19 period.					
(12) I have had trouble in collaborating with my project team members during COVID-19 period.					

Statements	1	2	3	4	5
(13) I have encountered challenges in managing stakeholders of my project(s) during COVID-19 period.					
(14) I have had trouble in managing project resources due to working from home during COVID-19 period.					
(15) I have had fears of losing my job due to the COVID-19 pandemic.					
(16) I have experienced significant project delay due to COVID-19.					
(17) I have experienced significant project cost overrun due to COVID-19					
(18) I have had trouble in managing project contracts due to variations caused by the pandemic during COVID-19 period					
(19) I have had to change project delivery methodologies due to COVID-19					

Section C: Organization practices related to project-oriented work

Based on the organizational practices related to PM-oriented work please specify the extent to which you agree or disagree with the following statements by ticking your responses using the following scale:

1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree

Statements	1	2	3	4	5
(1) My organization has supported PM practitioners who worked remotely during COVID-19 period.					
(2) My organization has provided flexible work schedules to promote social distancing during COVID-19 period.					
(3) My organization has provided training on how to detect and manage stress during COVID-19 period.					
(4) My organization has provided training on how to enhance the use of technologies for project delivery during COVID-19 period.					
(5) My organization has established a system to maintain effective communication between PM practitioners, project teams,					

Statements	1	2	3	4	5
leadership and stakeholders during COVID-19 period.					
(6) My organization has provided routine COVID-19 screening to PM practitioners.					
(7) My organization has regularly disinfected the project workplace environment during COVID-19 period.					
(8) My organization has enforced the use of personal protective equipment in the project environment during COVID-19 period.					
(9) My organization has provided additional childcare supports for PM practitioners during COVID-19 period.					
(10) My organization has provided training on how to manage and balance work and family during COVID-19 period.					
(11) My organization has provided unlimited access to self-care apps for mental health and psychological support (e.g Digital mental health app and or therapy) to PM practitioners during COVID-19 period.					
(12) My organization has hired additional PM practitioners to distribute project workload during COVID-19 period.					
(13) My organization has offered specific pandemic-related leaves (e.g. vaccination leave, leave for self-isolation) for PM practitioners COVID-19 during the project delivery.					
(14) My organization has provided Employee Assistance Program (EAP) to help alleviate the distress associated with work-family conflict during COVID-19 period.					
(15) My organization has provided additional technical facilities for virtual and remote work during COVID-19 period.					
(16) My organization has encouraged PM practitioners to share ideas and suggestions to improve project delivery during COVID-19 period.					
(17) My organization has encouraged the adoption of agile PM methodologies to promote autonomy, social interactions and breaking down of project activities in various phase during					

Statements	1	2	3	4	5
COVID-19 period.					
(18) During COVID-19 period, my organization has taken additional measures to manage the supply chain of materials for project delivery.					
(19) My organization has managed and maintained collaboration between PM practitioners and stakeholders during COVID-19 period.					
(20) My organization has provided additional PM training (e.g Quality management, Budget management and Time management) during Covid-19.					

Section D: Mental Well-being

,

The questions below ask you about your feelings and thoughts related to your PM-oriented work during the Covid-19 period. In each case, please indicate your response by selecting How Often you felt or thought a certain way.

1=Never; 2=Almost Never; 3=Sometimes; 4=Fairly often; 5=Very often

Statements	1	2	3	4	5
(1) During the COVID-19 period, how often have you been upset because of something in your PM-oriented work that happened unexpectedly?					
(2) During the COVID-19 period, how often have you felt that you were unable to control the important things in your PM-oriented work?					
(3) During the COVID-19 period, how often have you felt nervous and “stressed” in your PM-oriented work?					
(4) During the COVID-19 period, how often have you felt confident about your ability to handle the problems in your PM-					

oriented work?					
(5) During the COVID-19 period, how often have you felt that things in your PM-oriented work were going your way?					
(6) During the COVID-19 period, how often have you found that you could not cope with all the things that you had to do in your PM-oriented work?					
(7) During the COVID-19 period, how often have you been able to control irritations in your PM-oriented work?					
(8) During the COVID-19 period, how often have you felt that you were on top of things in your PM-oriented work?					
(9) During the COVID-19 period, how often have you been angered because of things in your PM-oriented work that were outside of your control?					
(10) During the COVID-19 period, how often have you felt difficulties in your PM-oriented work were piling up so high that you could not overcome them?					

Thank you for taking your time to complete this survey. Really appreciate it! Your participation assist in the understanding of mental health management of PM practitioners in the AEC sector during COVID-19.

Please feel free to leave your comments and suggestions, if any, on this survey and the associated research project. Thank you again and have a lovely day!