Civil Engineering Dimension
https://ced.petra.ac.id

Influence of Prefabrication on Job Satisfaction in The Construction Industry

Chandler, L.[1] and Sunindijo, R.Y.[1]*
[1] University of New South Wales, Sydney, AUSTRALIA

DOI: https://doi.org/10.9744/ced.26.1.81-90

Article Info:
Submitted: Jan 29, 2024
Reviewed: Feb 16, 2024
Accepted: Feb 20, 2024

Keywords:
prefabrication,
job satisfaction,
job conditions,
construction industry,
work conditions.

Corresponding Author:
Sunindijo, R.Y.
University of New South Wales Sydney, AUSTRALIA
Email: r.sunindijo@unsw.edu.au

Abstract

New construction approaches, such as prefabrication, have been increasingly recognised as a strategy to boost productivity and support the industry's sustainability and growth. Advancing existing understanding on the benefits of prefabrication to promote its adoption, this research aims to assess job satisfaction and work conditions of construction practitioners involved in prefabrication and assess its impacts on their job satisfaction, represented by job demands, job support, physical work environments, and job perception. Quantitative data were collected from 37 practitioners exposed to prefabrication and 30 practitioners involved in conventional construction. The findings show that prefabrication can lead to higher job satisfaction and better work conditions than conventional construction. Compared with conventional construction, practitioners working in prefabricated projects experienced improved workload distribution, better physical surroundings, and positive job perception. This research, therefore, provides new insights into the benefits of prefabrication and its potential to promote better mental wellbeing and higher productivity.

Introduction

Despite the significance of the construction industry for socioeconomic development, the construction industry is plagued by low productivity growth, lack of profitability, and long work hours, making the industry less feasible over time [1]. Furthermore, low job satisfaction and poor work-life balance are major problems, with more than 20 per cent of workers experience negative mental health conditions [2]. Therefore, there is a need to change the way construction operates for promoting job satisfaction and increasing productivity [3].

Realising this issue, technologies and new ways of working have been proposed to reshape the nature of the Australian construction industry and transform future workforces [4]. One of these technologies and new ways of working is prefabrication, which is also referred as modular construction, design for manufacture and assembly (DfMA), and off-site construction [5]. This practice involves producing standardised components of a structure off-site followed by its assembly or placement on-site.

The benefits of prefabrication include better health and safety, reduced carbon emissions, lowered construction costs, and reduced material and water wastage [6]. Prefabrication has also been shown to accelerate projects by 20 to 50 per cent, reduce rework, and improve building quality by identifying problems in the design phase and performing work in a controlled environment [7,8].

Note : Discussion is expected before July, 1st 2024, and will be published in the "Civil Engineering Dimension", volume 26, number 2, September 2024.
ISSN : 1410-9530 print / 1979-570X online
Published by : **Petra Christian University**

This research has originated from the notion that certain specific characteristics linked with prefabrication can influence construction workers' job conditions and satisfaction. Better job conditions and higher satisfaction should then contribute to better workers' wellbeing and improved productivity. Understanding this relationship can encourage the wider use of prefabrication, which is still considerably lacking in Australia, so that the construction industry can further realise the potential benefits of this approach.

Therefore, the aim of this research is to determine the effects of prefabrication on the job satisfaction and work conditions of workers in the Australian construction industry. In order to achieve this aim, three research questions have been formulated: (1) What are the main factors that influence job satisfaction?; (2) how do workers currently perceive job satisfaction factors within conventional and prefabrication project contexts?; and (3) what effect does prefabrication have on job satisfaction and work conditions?

This research collected data from the Australian construction industry, which is one of the largest industries in Australia and employs more than nine per cent of the workforce [9]. The industry has a healthy growth rate and a significant pipeline of projects due to record government infrastructure investments [1]. However, the need to deliver construction projects under continually demanding time and cost constraints further worsens the pressure placed on practitioners to perform. Due to the labour-intensive characteristic of the industry, successful delivery of future projects relies upon sustaining a healthy and productive workforce while also attracting new ones [1]. Therefore, addressing wellbeing and work-life balance issues in this industry is urgent [10]. Despite its focus on Australia, the findings are expected to be generalisable to other contexts.

Prefabrication

In Australia, the adoption of prefabrication is slow, and it constitutes only three to five per cent of the Australian construction market [11,12]. Prefabrication can be split into two major categories: non-volumetric pre-assemblies, and three-dimensional volumetric assemblies or modular systems [13]. Many public spaces including new railway lines, police stations and healthcare facilities are now incorporating these modern assemblies with the support from the Australian Government and other initiatives. School Infrastructure New South Wales (NSW) has developed a set of guidelines to standardise school design, which enables the application of prefabrication in schools across NSW [6]. In general, prefabrication has been accepted as a potential strategy to reduce construction costs and maximise return on investment through improved design and construction processes [14].

A substantial amount of research has been conducted to explore the benefits of prefabrication, which can be categorised into economic, environmental, and social benefits [15]. The economic benefits of prefabrication include cost savings through better construction efficiency, waste reduction, reduced time on site and simplified approaches to finishes [6]. Prefabrication enables some construction activities to be conducted simultaneously, whereas conventional construction processes are generally more restricted to a linear process. For example, when utilising prefabrication, the phases of site preparation and the manufacture of certain building components can be conducted simultaneously, resulting in time reduction, in some cases, up to 40 percent when compared with conventional construction [8]. This efficiency reduces job demand requirements, resulting in better work environment for construction practitioners [16]. Detailed cost analysis to investigate the cost impacts of prefabrication in five schools in NSW revealed that prefabrication can reduce cost by 14 per cent [6].

A range of environmental benefits, including the reduction of on-site construction waste, noise, and carbon emissions, as well as higher building quality, are associated with prefabrication [17]. Cao et al. [18] compared two typical residential buildings, one was built with prefabrication and the other was conventionally constructed. The prefabricated residential building had higher levels of energy efficiency and reduced total energy for construction by 20.49 per cent. Jaillon et al. [19] studied the waste reduction potential of prefabrication and found that prefabricated buildings can reduce waste by over 50 per cent when compared with conventionally built buildings. These environmental benefits, such as less noise and air pollution, are also associated with better working conditions for workers [16].

In terms of social benefits, prefabrication can contribute to improving health and safety of workers and reduce the impact of construction activities on the surrounding community. Sunindijo et al. [5] found that prefabrication reduces construction safety risks and muscular stress injuries commonly caused by manual handling which permeates construction practices. Fagbenro et al. [16] also argued that prefabrication has the potential to improve mental health in the construction industry. The increased quality associated with prefabrication is another important social benefit, given the rising awareness of poor quality and serious defects of buildings in Australia [20].

Job Satisfaction

Locke [21, p. 1304] defined job satisfaction as "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences." Job satisfaction has been found as one of the key factors that influences the productivity of construction practitioners [22]. It is both an outcome and a critical enabler of the long-term growth of the construction industry, which is key for Australia's economic development [6]. Within the literature, determinants of job satisfaction can be categorised into work-related and non-work-related factors [22]. Work-related factors include the physical work environment, job demand, job support, and job perception, while non-work-related factors include culture, society, and demographic-related factors.

Research has revealed the major impact of work-related factors on job satisfaction. Hwang et al. [23] determined that job characteristics and the work environment are among the most significant dimensions that influence workers' satisfaction. Globally, the construction industry is characterised by its high rates of work incidents and high-pressure work environments [24]. The dynamic and unpredictable nature of construction work also exposes practitioners to high levels of psychological hazards. These inherent conditions cultivate physical and psychological demands, which cause decreased job satisfaction and poor work-life balance [25]. Construction practitioners experience a number of psychological factors that affect satisfaction, including long working hours, heavy workloads, job insecurity, time pressure, lack of control, and poor work-life balance [24].

Poor Physical Work Conditions

Physical work environments have the potential to influence the safety, health, and well-being of practitioners. Poor work conditions can lead to occupational incidents and the deterioration of health and job satisfaction [26]. In many cases, construction practitioners are subject to workplaces with excessive noise, and exposure to changing climatic conditions, chemicals, and poor ventilation [27], conditions which contribute to poor mental health and is a leading stressor in the industry [25].

Unreasonable Job Demand

Demerouti et al. [28, p 501] defined job demand as "physical, social, or organizational aspects of the job that require sustained physical or mental effort and are, therefore, associated with certain physiological and psychological costs." Typical examples of job demand include overwork, project overload, and role ambiguity. Previous Workers experience strain when exposed to a combination of high job demands and low job control, which is a common occurrence in the construction industry [25].

Long Work Hours

The need to complete projects within a given time and budget creates pressure on construction practitioners. As a result, being overwork has become an inherent feature of working in the construction industry, causing poor mental health and reduced quality of work [25]. Typically, construction professionals are required to work non-standard work schedules to meet client objectives, resulting in a negative work-life balance. These expectations can be worsened if workers need to travel long distances to the site, lengthening the workday and further impacting work-life balance.

Long work hours are also associated with a negative spill over between work and family life, which is consistently connected to poor satisfaction and negative health outcomes [29]. Furthermore, long work hours is identified as one of the most-identified stressors for construction practitioners [25]. This issue causes a significant cost burden on the construction industry because there is an inverse relationship between hours worked and productivity [10].

Project Overload

Project overload is a hazard stemming from discrepancies between job demand and a person's ability to cope. Within construction management literature, project overload is the most reported factor affecting health and satisfaction [3]. A survey in the Australian construction industry revealed that almost 50 percent of practitioners were exposed to high job demands and felt that they had to work very fast most or all of the time. Furthermore, 88 per cent of construction practitioners exposed to high job demands felt that they were expected to keep track of more than one task at a time either often or all of the time [30]. A systematic literature review by Tijani et al. [3] found that 60 per cent of papers included in the review reported project overload as a causal factor of occupational stress and low job satisfaction in construction.

Role Ambiguity

Role ambiguity refers to a person's lack of a clear understanding of their roles, work content, and purpose. Role ambiguity creates uncertainty resulting in an imbalance between resources and needs, which can heighten job dissatisfaction and poor health [24]. A total of 15 out of 38 papers analysed by Tijani et al. [3] identify role ambiguity as a factor that affects health negatively in construction.

Poor Work-Life Balance

Work and family are crucial aspects of modern life, and a balance of these two aspects is essential for a person's long-term stability. Existing literature has frequently highlighted that poor work-life balance in the construction industry is detrimental to health, safety and wellbeing [29]. Report by Culture in Construction [10] shows that 59 per cent of construction workers are not satisfied with their work-life balance due to the demand to work long hours. The industry's culture of long work hours and project-by-project nature create difficulties for construction practitioners to take time off and spend an adequate time with family, causing poor work-life balance and low job satisfaction.

Lack of Job Support

Sufficient organisational support is crucial for the well-being and satisfaction of practitioners. Job support can be defined as the respect, trust, and support gained from colleagues and supervisors [3]. Job support can also be perceived as resources in the workplace, which are integral to practitioners' job satisfaction and health [28]. Construction, unfortunately, is known for its lack of job support with inadequate communications, harassment, and bullying being previously reported and are considered as common stressors when working in the sector [25].

Demotivation

The complex and dynamic nature of construction requires highly motivated and engaged practitioners for achieving optimal performance and productivity. It is imperative that work environments enhance and maintain practitioners' motivation to increase their job satisfaction. However, due to project overload and the limited resources that construction organisations have, practitioners frequently experience burnt out and are demotivated, causing their performance and productivity to suffer [25].

Method

As highlighted earlier, in comparison to conventional construction, prefabrication has economic, social, and environmental benefits that can improve work conditions in the construction industry. Better work conditions should lead to higher job conditions and, in turn, higher productivity which is urgently needed in this industry. This relationship between prefabrication and job satisfaction, however, has not been empirically investigated. This research, therefore, hypothesised that construction practitioners involved in prefabrication projects are likely to have improved work conditions and higher levels of job satisfaction. To test this hypothesis, a quantitative methodology was adopted. The methodology is well suited for deductive reasoning in which the determinants of work satisfaction in prefabricated projects were compared with those in conventional projects. A questionnaire survey was used to collect data from construction practitioners in Australia.

The questionnaire has three sections: (1) demographic questions; (2) job satisfaction determinants; and (3) short answer questions. In the second section, respondents were asked to determine their level of agreement with various statements regarding job demands, job support, physical conditions, and job perception for a chosen project. A 5-point Likert scale, comprising (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree, was used. The key themes of job satisfaction are presented in Table 1.

Section three of the survey included three short answer questions allowing respondents to provide any additional commentary or describe any other factors affecting their work conditions and job satisfaction. These questions ensure various dimensions relevant to the research topic can be captured, analysed, and supported. The short answer questions are:

1. Can the use of prefabrication improve your overall work conditions? Please explain.
2. What would you like to see changed about your current working conditions?
3. Are there any other comments you would like to make?

Table 1. Job Satisfaction Measures

Theme	Dimension	Item
Job demands	Workload	W1. I usually work long hours due to work pressure
		W2. I have to work fast because I don't have much time
		W3. My workload is evenly distributed throughout the duration of the project
		W4. An excessive workload prevents me from doing a high-quality job.
	Emotional demand	ED1. I would describe my general wellbeing as good
		ED2. The project facilitates good work-life balance
		ED3. The project often interferes with my personal life
	Job control	JC1. I have low control over my work
		JC2. I don't have the freedom to vary my work schedule
Job support	Career development	CD1. I am satisfied with my chances for advancement on the job
	Compensation	CB1. I am satisfied with my wages
		CB2. I am satisfied with the benefits provided by my employer
	Role clarity	RC1. My project is well planned
	Job security	JS1. I am satisfied with my overall job security
		JS2. I feel my job is secure
	Support	SS1. I can count on my supervisor for support when I need it
		SS2. I can count on my co-workers for support when I need it
Physical condition	Working conditions	PC1. I am satisfied with the environmental conditions at work
		PC2. I am satisfied with the physical surroundings at work
		PC3. I am often exposed to high noise levels
		PC4. I am often exposed to high humidity levels
		PC5. I am often inconvenienced by dust
		PC6. I am often exposed to hazardous chemicals
		PC7. My job involves exposure to harsh weather conditions (sun, rain etc.)
		PC8. Weather and other environmental conditions prevent me from completing work
	Physical demands	PD1. My job involves strenuous physical movement
		PD2. My job involves repetitive physical movements
	Safety	PCS1. Some of my tasks are quite risky and complicated
		PCS2. I am concerned with the safety in the project
Job perception	Motivation	JSA1. I am satisfied with my job
		JSA2. The work I do is meaningful to me
		JSA3. I am happy to remain working in my current company.
		JSA4. When I get up in the morning, I feel like going to work
	Culture	C1. I am satisfied with the culture at my workplace

Convenience sampling was selected to facilitate fast data collection due to the time constraint of the research. At a minimum, 60 participants were targeted to take part in the survey, consisting of at least 30 construction practitioners working in prefabricated projects and 30 practitioners in conventional projects. Managers of construction organisations were invited to participate in the research. Once they agreed to support the research, they were requested to distribute the online survey to the employees within the organisations. Data triangulation was achieved by collecting data from a range of construction roles, including construction workers, apprentices, project managers and engineers. Data were also collected from a range of different organisations, including sole traders, contractors, and top tier builders.

Results and Discussion

Respondent demographic characteristics are presented in Table 2. Of the valid 67 participants, 74.6 per cent (n=50) were male and 25.4 per cent (n=17) were female. The majority of the respondents (79.1 per cent) were employed full time, 13.4 per cent were employed part time and 7.5 per cent were self-employed. Over a quarter of the participants were aged between 18 and 25 years (28 per cent), followed by 21 per cent aged between 26 and 35 years, and 15 per cent aged between 36 and 45 years. Fifteen per cent of participants were between 46 and 55 years, and 16 per cent between 56 and 65 years. The remaining four per cent were over the age of 66. These figures closely mirror Australian Government data that indicate the highest proportion of construction workers are aged 25 to 34 (28.8 per cent) and 35 to 44 years old (22.5 per cent), while 18.6 per cent of the workforce is 45-54 years old and only 3 per cent of workers are over 65 years [9].

The respondents comprised a wide range of site-based construction roles. The larger groups were engineers (28 per cent) and construction or project managers (25 per cent). Eighteen participants (27 per cent) classified themselves as other, which included apprentices, cost administrators, quantity surveyors and site-based design managers. The remaining were foreman/supervisors (4 per cent), superintendents (4 per cent), and tradespersons or operators (10 per cent). Thirty-seven respondents (55 per cent) worked in prefabricated projects, while the remaining 30 worked in conventional projects.

Table 2. Demographic Profile of the Respondents

Demographic Variables		Frequency	%
Gender	Male	50	75%
	Female	17	25%
Age	18 - 25 years	19	28%
	26 - 35 years	14	21%
	36 - 45 years	10	15%
	46 - 55 years	10	15%
	56 - 65 years	11	16%
	above 66 years	3	4%
Employment Status	Employed full time	53	79%
	Self-employed	9	13%
	Employed part time	5	7%
Years of Experience	Less than 5 years	25	37%
	5 - 10 years	11	16%
	11 - 20 years	11	16%
	21 - 30 years	6	9%
	30+ years	14	21%
Role	Construction/Project manager	17	25%
	Engineer	19	28%
	Foreman/Supervisor	3	4%
	Superintendent	3	4%
	Tradesperson/Operator	7	10%
	Other	18	27%
Construction Method	Prefabrication	37	55%
	Conventional	30	45%

Reliability

Cronbach's alpha is the most widely used objective measure of reliability. It measures the internal consistency or reliability between multiple items, ratings, or measurements. The value of Cronbach's alpha ranges between zero and one, with higher values indicating a greater internal consistency of the variables in the scale [31]. The Cronbach's alpha values for the four themes are 0.77 for job demands, 0.82 for job support, 0.92 for physical work conditions, and 0.93 for job perception. All values are greater than 0.7, indicating that the questionnaire is reliable [31].

Comparison between Conventional and Prefabricated Projects

Table 3 presents the job satisfaction survey results. In presenting the results, negatively framed questions have been reversed scored. An independent samples t-test was used to compare the levels of job satisfaction in prefabricated and conventional projects. There are 10 significant differences with *p*-values less than 0.05. Across these 10 items, respondents working in prefabricated projects indicated higher job satisfaction than those working in conventional projects. In the below discussion, [c] refers to the mean of conventional projects and [p] refers to the mean of the prefabrication group.

Job Demands

Previous research has identified the inadequacy of workload distribution and excessive workload as top factors contributing to occupational stress and dissatisfaction in the construction industry. Based on the results, prefabrication has the potential to address this issue by improving workload distribution throughout the project duration (mean [p] = 3.3 vs. mean [c] = 2.57; p-value = 0.007). This finding demonstrates the value of prefabrication in reducing intensive workload, which is a common issue in construction [15].

Despite the positive impact of prefabrication on job demands, specifically on workload distribution, it is important to recognise that job satisfaction in both groups is still relatively low. Long work hours and the pressure to complete work as quickly as possible are particular concerns that negatively affect job satisfaction. Participants provided further insight into workload issues when asked what they would like changed in their workplace. They expressed that "resourcing is a major concern" and that they would like to see "more staff to focus on the job." Another participant strongly acknowledged the need to improve distribution of workload in construction as noted in the following quotation: "I would like to see projects adequately resourced so I don't have to work the hours I do. I'd like the culture to change so I don't feel guilty for working less hours". To promote worker satisfaction, the industry, as a collective, needs to re-evaluate how work-life balance can be improved and sustained.

Table 3. Job Satisfaction in Prefabricated and Conventional Projects

Code	Item	Overall	Conventional	Prefabrication	Significance Difference
1	Job demands				
W1*	I usually work long hours due to work pressure	2.433	2.4667	2.405	0. 843
W2*	I have to work fast because I don't have much time	2.493	2.3667	2.595	0.387
W3	My workload is evenly distributed throughout the duration of the project	2.985	2.567	3.324	**0.007
W4*	An excessive workload prevents me from doing a high-quality job.	2.970	2.967	2.973	0.981
ED1	I would describe my general wellbeing as good	3.806	3.533	4.027	0.067
ED2	The project facilitates good work-life balance	3.597	3.367	3.784	0.065
ED3*	The project often interferes with my personal life.	3.239	3.300	3.189	0.717
JC1*	I have low control over my work	3.104	2.933	3.243	0.315
JC2*	I don't have the freedom to vary my work schedule.	3.269	3.200	3.324	0.689
2	Job support				
CD1	I am satisfied with my chances for advancement on the job	3.851	3.533	4.108	0.071
CB1	I am satisfied with my wages	3.866	3.367	4.270	**0.000
CB2	I am satisfied with the benefits provided by my employer	3.985	3.633	4.270	**0.022
RC1	My project is well planned.	3.284	2.800	3.677	**0.006
JS1	I am satisfied with my overall job security	4.149	4.000	4.270	0.246
JS2	I feel my job is secure	4.149	4.067	4.216	0.529
SS1	I can count on my supervisor for support when I need it	4.045	3.933	4.135	0.389
SS2	I can count on my co-workers for support when I need it	4.015	3.900	4.108	0.374
3	Physical work conditions				
PC1	I am satisfied with the environmental conditions at work	4.000	3.833	4.135	0.229
PC2	I am satisfied with the physical surroundings at work	3.866	3.566	4.108	**0.034
PC3*	I'm often exposed to high noise levels	3.403	3.000	3.730	**0.011
PC4*	I'm often exposed to high humidity levels	3.642	3.333	3.892	**0.037
PC5*	I'm often inconvenienced by dust	3.284	3.067	3.460	0.253
PC6*	I'm often exposed to hazardous chemicals	3.881	3.733	4.000	0.384
PC7*	My job involves exposure to harsh weather conditions (sun, rain etc...)	3.328	3.200	3.432	0.518
PC8*	Weather and other environmental conditions prevent me from completing work	3.403	3.233	3.541	0.358
PD1*	My job involves strenuous physical movement.	3.806	3.900	3.730	0.562
PD2*	My job involves repetitive physical movements	3.806	4.033	3.622	0.151
PCS1*	Some of my tasks are quite risky and complicated.	3.328	3.167	3.460	0.400
PCS2*	I am concerned with the safety in the project.	3.746	3.867	3.649	0.505
4	Job perception				
JSA1	I am satisfied with my job	3.970	3.600	4.270	**0.015

Code	Item	Overall	Conventional	Prefabrication	Significance Difference
JSA2	The work I do is meaningful to me	3.940	3.433	4.351	**0.007
JSA3	I am happy to remain working in my current company.	4.000	3.500	4.405	**0.007
JSA4	When I get up in the morning, I feel like going to work	3.597	3.233	3.892	0.056
C1	I am satisfied with the culture at my workplace	3.627	3.467	3.757	0.383

Notes: 1 = Strongly Disagree; 2 = Disagree; 3 = Uncertain; 4 = Agree; 5 = Strongly Agree
* = reversed scored items; ** = Significance difference at 0.05 level

Physical Conditions

Workers involved in prefabrication demonstrated greater satisfaction regarding the physical surroundings of their workplace (mean [p] = 4.11 vs. mean [c] = 3.57; p-value = 0.034). This result aligns with the finding in previous studies which acknowledges prefabrication as an effective way to minimise construction waste and improve the physical work environment [5]. This is further supported by the written response of a participant (Construction Director, Male) which stated:

> "*A 10 per cent to 15 per cent saving was made from on-site bins throughout the direction of the project. The physical surroundings of the site were evidently cleaner as a result of prefabrication. In addition to the reduction of waste, the fact that prefinished walls and ceiling panels were completed off-site means the site did not have to endure 'messy' conventional build processes including setting, sanding, services rough in, and some painting. Other items including the off-site preassembly of fans meant that the site was not subject to unnecessary packaging being left around. Cleanliness of the site and ability to erect complete prefabricated elements contributed to the project being completed with nil Lost Time Injuries.*"

The survey results also indicate workers involved in prefabrication experience reduced high noise levels (mean [c] = 3 vs. mean [p] = 3.73; p-value = 0.011). The benefits of prefabrication in reducing noise are also reflected in the following quotations: "prefabrication means less noise and more freed up space on site" and "the dusty and noisy trades aren't on site, the culture is better and its quick to get water tight conditions limiting external exposure." These findings mirror previous studies which revealed that prefabrication reduces construction noise and dust benefiting on-site workers and neighbours and increasing job satisfaction [20].

Job Support

The survey results indicate that construction projects involving prefabrication are better planned than conventional construction (mean [c] = 2.8 vs. mean [p] = 3.68; p-value = 0.006). Sunindijo et al. (2023) found that schedule and planning benefits of prefabrication is one of the top compelling drivers for the construction industry to adopt prefabrication. In conventional construction, tedious management activities are needed to procure and coordinate the various trades on site. In contrast, prefabrication transfers these tasks to a manufacturer, who completes components in a factory environment, protected from the external environmental factors. This work process simplifies on-site planning and alleviates schedule pressure. Another study by Bertram et al. [7] showed that prefabrication can cut projects schedules by 20 to 50 per cent because of the lean off-site manufacturing process. Fagbenro et al. [16] found that adding design and process standardization in prefabrication reduces variations and reworks, and improves resource planning. Incorporating prefabrication reduces clashes, unforeseen issues, and schedule changes during construction as well as enables off-site work to take place in parallel with on-site work. In turn, project planning is improved, and additional planning tasks required due to inclement weather events are minimised. A participant stated that "from a design perspective the use of prefabrication requires a lot of up-front work, but, as you move into construction the workload and planning requirements are greatly reduced."

Job Perception

The impact of job satisfaction extends beyond individuals and has far reaching implications on productivity levels and organisational profits. The results indicate workers involved in prefabrication have greater levels of overall work satisfaction. Participants were significantly more satisfied with their job (mean [c] = 3.6 vs. mean [p] = 4.27; p-value = 0.015) and perceived their work as more meaningful than workers involved in conventional construction (mean [c] = 3.43 vs. mean [p] = 4.35; p-value = 0.007). Participants strongly acknowledged the role of prefabrication in improving work satisfaction and site conditions as noted in the following quotations: "there are less people to manage on site and less quality to manage on site which makes for an easier day," and "prefabrication can improve work conditions by reducing the amount of on-site quality assurance required, being exposed to less on-site safety hazards

and risks." This result confirms that prefabrication improves work conditions because of reduced on-site coordination, reduced manual handling, less exposure to health and safety risks, and less weather dependent. All this contributes to improving the mental health of construction practitioners due to less demand for coordination and people management [5]. As a result, participants involved in prefabrication also expressed that they were happier to remain working in their current company (mean [c] = 3.5 vs. mean [p] = 4.41; p-value = 0.007), which can reduce costs associated with recruiting and training new employees.

Conclusions

Workers are an indispensable component of construction projects, with the success and productivity of construction sites largely attributed to their performance. The levels of job satisfaction experienced by workers can directly influence the success of projects and the profitability of organisations. Studying the factors affecting the job satisfaction of workers is crucial for the Australian construction industry to meet increasing project demand, while working to resolve deep-rooted challenges of declining productivity, tight deadlines, and cost overruns.

This research has confirmed that prefabrication can improve the job satisfaction and work conditions of construction professionals. Specifically, workers in prefabrication projects were significantly more satisfied than workers in conventional construction regarding their workload, physical surroundings, and job perception. The quantitative and qualitative findings highlight the value of job demands for construction professionals, particularly regarding fair workload distribution for improved job satisfaction. Despite the significant difference between workload attitudes in prefabrication and conventional constructions, the findings demonstrate workers in both groups would like to see workload distribution prioritised. Increased attention needs to be given to strategies to alleviate excessive workload across all construction projects. The inadequacy of workload distribution and excessive workload, resulting in long work hours, is a top factor contributing to poor mental health in the construction industry.

This research has strong theoretical and practical implications. Current research on the benefits of prefabrication technology is extensive but research on the effect of prefabrication on workers is still limited. This research provides crucial insight into the viability of prefabrication and advances the current understanding of work conditions and job satisfaction experienced by workers in prefabrication. The study provides a valuable reference for practitioners to update their current knowledge of job satisfaction and work conditions in the Australian context. Based on the findings, practitioners involved in both conventional and prefabrication construction can implement various management strategies to improve job demands and work conditions for the benefit of workers and organisational success. With the expected uptake of prefabrication, the findings will be useful to encourage developers and owners to promote prefabrication, owing to an increased understanding of its benefits beyond economic and environmental factors.

It is important to note that data were collected from the Australian construction industry, so comparative research is useful to find the impact of prefabrication on job satisfaction in other contexts, particularly those in developing countries. More data are also needed to investigate the influence of demographic and organisational characteristics, such as gender, occupation, age, and organisational size, on the relationship between prefabrication and job satisfaction. Tailored strategies can be developed for specific population groups once the influence of these factors is better understood. Lastly, collecting additional qualitative data using is recommended to get deeper insights into the impact of prefabrication on job satisfaction and the mechanism behind this relationship.

References

1. Infrastructure Australia, *Delivering Outcomes: A Roadmap to Improve Infrastructure Industry Productivity and Innovation*, 2022, Retrieved from https://www.infrastructureaustralia.gov.au/sites/default/files/2022-03/IA%20Delivering%20Outcomes%20March%202022%20Final_1.pdf, Accessed 13 October 2022.
2. Engineers Australia, *Building Mental Health into the Construction Industry*, 2020, Retrieved from https://www.engineersaustralia.org.au/news-and-media/2022/07/building-mental-health-construction-industry, Accessed 13 October 2022.
3. Tijani, B., Jin, X., and Osei-Kyei, R., A Systematic Review of Mental Stressors in the Construction Industry, *International Journal of Building Pathology and Adaptation*, *39*, 2021, pp. 433-460.
4. Priddis, M., Miller, G., and George, R., *Technology Impacts on the Australian Workforce*, ACS, Sydney, 2020.
5. Sunindijo, R.Y., Wang, C.C., and Haller, D., Benefits of Prefabrication on Health and Safety in the Australian Housing Sector, In: Manu, P., Shang, G., da Silva Bartolo, P.J., Francis, V., and Sawhney, A., Editors, *Handbook of Construction Safety, Health and Well-being in the Industry 4.0 Era*, Chapter 25, Routledge, 2023.
6. Schools Infrastructure NSW, *DfMA Guidelines*, Schools 2020, Retrieved from https://www.schoolinfrastructure.nsw.gov.au/what-we-do/we-build-schools/modern-construction-methods.html, Accessed 15 October 2022.

7. Bertram, N., Fuchs, S., Mischke, J., Palter, R., Strube, G., and Woetzel, J., *Modular Construction: From Projects to Products*, McKinsey & Company, 2019, Retrieved from https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/modular%20construction%20from%20projects%20to%20products%20new/modular-construction-from-projects-to-products-full-report-new.pdf, Accessed 13 October 2022.
8. Navaratnam, S., Ngo, T., Gunawardena, T., and Henderson, D., Performance Review of Prefabricated Building Systems and Future Research in Australia, *Buildings*, *9*(2), 2019, p. 38.
9. Labour Market Insights, *Construction*, Australian Government, 2022, Retrieved from https://labourmarketinsights.gov.au/industries/industry-details?industryCode=E, Accessed 25 October 2022.
10. Culture in Construction, *A Culture Standard for the Construction Industry*, 2021, Retrieved from https://cultureinconstruction.com.au/wp-content/uploads/2021/10/A-Culture-Standard-for-the-Construction-Industry_Consultation-Paper_October-2021.pdf, Accessed 25 October 2022.
11. Mordor Intelligence, *Australia Prefabricated Buildings Market - Growth, Trends, COVID-19 Impact, and Forecasts (2022 - 2027)*, 2022, Retrieved from https://www.mordorintelligence.com/industry-reports/australia-prefabricated-buildings-industry, Accessed 25 October 2022.
12. Navaratnam, S., Satheeskumar, A., Zhang, G., Nguyen, K., Venkatesan, S., and Poologanathan, K., The Challenges Confronting the Growth of Sustainable Prefabricated Building Construction in Australia: Construction Industry Views, *Journal of Building Engineering*, *48*, 103935, 2022.
13. Mostafa, S., Chileshe, N., and Abdelhamid, T., Lean and Agile Integration within Offsite Construction Using Discrete Event Simulation, *Construction Innovation*, *16*, 2016, pp. 483-525.
14. Mostafa, S., Kim, K.P., Tam, V.W.Y., and Rahnamayiezekavat, P., Exploring the Status, Benefits, Barriers and Opportunities of using BIM for Advancing Prefabrication Practice, *International Journal of Construction Management*, *20*, 2020, pp. 146-156.
15. Aghasizadeh, S., Tabadkani, A., Hajirasouli, A., and Banihashemi, S., Environmental and Economic Performance of Prefabricated Construction: A Review, *Environmental Impact Assessment Review*, *97*, 106897, 2022.
16. Fagbenro, R.K., Sunindijo, R.Y., Illankoon, C., and Frimpong, S., Influence of Prefabricated Construction on the Mental Health of Workers: Systematic Review, *European Journal of Investigation in Health, Psychology and Education*, *13*(2), 2023, pp. 345-363.
17. Lawson, R. M., Ogden Ray, G., and Bergin, R., Application of Modular Construction in High-Rise Buildings, *Journal of Architectural Engineering*, *18*(2), 2012, pp. 148-154.
18. Cao, X., Li, X., Zhu, Y., and Zhang, Z., A Comparative Study of Environmental Performance between Prefabricated and Traditional Residential Buildings in China, *Journal of Cleaner Production*, *109*, 2015, pp. 131-143.
19. Jaillon, L., Poon, C.S., and Chiang, Y.H., Quantifying the Waste Reduction Potential of using Prefabrication in Building Construction in Hong Kong, *Waste Management*, *29*, 2009, pp. 309-320.
20. Zhou, J., Li, Y., and Ren, D., Quantitative Study on External Benefits of Prefabricated Buildings: From Perspectives of Economy, Environment, and Society, *Sustainable Cities and Society*, *86*, 2022, p. 104132.
21. Locke, E.A., The Nature and Causes of Bob Satisfaction, In: M.D. Dunnette, Editor, *Handbook of Industrial and Organizational Psychology*, Rand McNally, Chicago,1976.
22. Wang, Z. and Jing, X., Job Satisfaction Among Immigrant Workers: A Review of Determinants, *Social Indicators Research*, *139*, 2018, pp. 381-401.
23. Hwang, B.G., Zhao, X., and Lim, J., Job Satisfaction of Project Managers in Green Construction Projects: Influencing Factors and Improvement Strategies, *Engineering, Construction and Architectural Management*, *27*, 2019, pp. 205-226.
24. Wu, G., Hu, Z., and Zheng, J., Role Stress, Job Burnout, and Job Performance in Construction Project Managers: The Moderating Role of Career Calling, *International Journal of Environmental Research and Public Health*, *16*, 2019, p. 2394.
25. Zhang, S., Sunindijo, R.Y., Frimpong, S., and Su, Z., Work Stressors, Coping Strategies, and Poor Mental Health in the Chinese Construction Industry, *Safety Science*, *159*, 2023, p. 106039.
26. Carvajal-Arango, D., Vásquez-Hernández, A., and Botero-Botero, L.F., Assessment of Subjective Workplace Well-being of Construction Workers: A Bottom-up Approach, *Journal of Building Engineering*, *36*, 2021, pp. 102-154.
27. Jung, M., Lim, S., and Chi, S., Impact of Work Environment and Occupational Stress on Safety Behavior of Individual Construction Workers, *International Journal of Environmental Research and Public Health*, *17*, 2020, pp. 1-21.
28. Demerouti E., Bakker A.B., Nachreiner F., and Schaufeli W.B., The Job Demands-Resources Model of Burnout, *Journal of Applied Psychology*, *86*(3), 2001, pp. 499–512.
29. Holden, S. and Sunindijo, R.Y., Technology, Long Work Hours, and Stress Worsen Work-Life Balance in the Construction Industry, *International Journal of Integrated Engineering*, *10*(2), 2018, pp. 13-18.
30. Safe Work Australia, *Work Health & Safety Perceptions: Construction Industry*, 2015, Retrieved from https://www.safeworkaustralia.gov.au/system/files/documents/1702/whs-perceptions-construction-industry.pdf, Accessed 20 October 2022.
31. Tavakol, M. and Dennick, R., Making Sense of Cronbach's Alpha, *International Journal of Medical Education*, *2*, 2011, pp. 53-55.