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Unintended Consequences of Productivity Improvement Strategies on Safety Behaviour of Construction Labourers; A Step toward the Integration of Safety and Productivity

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Abstract: The construction industry is facing constant pressure to improve its poor safety record and low productivity rate. A significant amount of research has been undertaken to identify the best practices to enhance productivity and safety. Nevertheless, the mainstream research in the field of construction focuses on one of these issues rather than implementing a holistic approach to resolve them. Consequently, the interactions between productivity and safety cannot be fully understood. Recent studies have demonstrated that management strategies and practices for improving labour productivity can trigger a series of unintended consequences that affect safety performance in construction projects. However, the behavioural aspects of these unintended consequences have yet to be investigated. This research addresses the gap by measuring the impacts of seven management strategies for improving labour productivity on the safety behaviour of construction labourers. A total of 191 construction labourers participated in a survey designed based on the Management Strategy Assessment Index (MSAI). The results show that the implemented management strategies for improving labour productivity have a greater impact on shaping safety compliance (SC) behaviours than safety participation (SP) behaviours of labourers. This study took a further step by breaking down the management strategies to their constitutive practices and measuring their impacts on SC and SP, and labour productivity. This paper provides further insight into the complex relationship between the productivity and safety behaviour of construction labourers. The findings can help project managers to improve labour productivity without harming their safety unintentionally.

Keywords: construction safety; safety behaviour; labour productivity; management strategies

1. Introduction

The construction industry is a labour-intensive sector, where most of its activities are highly dependent on its workforce. This situation puts labour productivity and its improvement into the spotlight for the project managers [1–3]. Project managers continuously seek different practices and strategies to improve labour productivity in their projects [4]. Focusing on productivity improvement affects working systems and triggers unintended dynamics that lead to unintended consequences such as compromised safety and increased accidents [5–7].

Prioritising productivity over safety can lead to excessive productivity pressure (PP), which has been cited as one of the underlying factors that contribute to occupational accidents [7–15]. Labourers are more likely to engage in risk-taking behaviours or override best safety practices when working under high PP [16–21]. A study by Han et al. [22] showed that the increased level of PP for accelerating schedules adversely affects safety. Therefore, managerial factors can play a significant role in the effectiveness of the interventions to prevent accidents [14,23–25]. Most fatal accidents are caused or at least influenced by upstream decisions [6,26,27]. These upstream decisions and management practices shape the working conditions on construction sites [28]. In addition, the effectiveness of safety management interventions to prevent accidents are significantly affected by upstream decisions and managerial factors [29]. Accordingly, Hare et al. [30] suggest that management practices can have a greater impact on safety than safety policies do. This demonstrates the importance of integrating safety into project management to achieve productive and safe projects.

Past studies have focused mostly on safety and labour productivity in isolation and rarely integrated them in a single study [31,32]. According to Hasle et al. [33], safety research is being conducted in isolation without any connections to the operation management research domain. In practice, many organisations still separate lines of management for safety and operation [34]. Ghodrati, Yiu and Wilkinson [6] investigated the unintended consequences of management strategies for improving labour productivity on safety performance in construction projects. However, the impacts of such strategies on the safety behaviour of construction labourers have not been thoroughly investigated. This is despite the fact that the safety behaviour of labourers is an important cause of accidents and a major indicator of safety culture in construction companies [35–37]. This research aims to investigate the impact of management strategies for improving labour productivity on the safety behaviour of construction labourers. Understanding how management practices and strategies that aim to improve labour productivity impact safety can promote the integration of safety considerations into the critical decision-making process. It utilised a quantitative method where seven prominent management strategies for improving labour productivity and their impacts on labour safety behaviour were investigated.

2. Literature Review

2.1. Safety Behaviour

Lagging indicators such as accident rate and fatalities have been used to measure safety performance [38,39]. These indicators have been widely criticised for their reactive nature and inability to provide advanced warning for accidents [40]. Therefore, leading indicators such as safety behaviours have been developed and utilised to measure safety performance more effectively [41]. Griffin and Neal [42] proposed safety compliance (SC) and safety participation (SP) as sub-dimensions of the safety behaviour. SC is defined as following rules and is the core of safety activities [42]. SP is conceptualised as behaviours that may not directly contribute to workplace safety but help develop an environment that promotes safety [43]. The nature of SP is voluntary, while SC belongs to in-role behaviour [44,45]. Several studies have recognised SC and SP as predictors of occupational accidents and injuries [46–48]. Wang et al. [49] revealed the importance of SC and SP in accident prevention in construction projects. A study by DeArmond, Smith, Wilson, Chen and Cigularov [43] demonstrated the adverse relationship between SC, SP and the number of occupational injuries.

2.2. Seven Management Strategies

The Management Strategies Assessment Index (MSAI) was developed by Ghodrati, Yiu, Wilkinson and Shahbazpour [2] to help project managers to improve labour productivity. They identified seven management strategies that are effective in improving labour productivity. In this study, we investigate the impact of these seven management strategies on shaping the safety behaviour of construction labourers. This section provides further theoretical evidence for including these seven management strategies.

2.2.1. Incentive

Incentive schemes are a powerful motivator for construction labourers to improve productivity and efficiency [50–55]. According to a study by Fagbenle et al. [56], incentive schemes are responsible for increasing up to 20 percent in labour productivity in bricklaying and concrete activities. Construction labourers are motivated to modify their working behaviour so as to be more productive if they perceive that it leads to a desirable outcome for them [55]. A careful design is critical for the success of incentive schemes [57]. To achieve an effective incentive scheme, labourers need to know the target of the scheme and how their performance will be assessed [58]. Therefore, simply distributing money among the labourers does not guarantee a desirable outcome for the company [59].

Recognition is another way, aside from monetary incentives, to inspire enthusiasm among labourers [17,50,52]. Labourers would like to be acknowledged for their efforts and performance by the management. Nesan and Holt [60] showed that construction labourers could achieve an outstanding performance in working environments when the management implemented recognition. They also found that recognition was more effective in motivating labourers when applied at a group level rather than an individual level.

2.2.2. Labour Management

Despite a variety of factors affecting labour productivity, the skill and mastery of labourers is a key driver in improving labour productivity in the construction industry [61–64]. Shortages of skilled labourers force the industry to rely on an inexperienced workforce, which reduces overall productivity and work quality [65,66]. Construction management teams attempt to tackle this issue and boost labour productivity by hiring and retaining skilled and experienced labourers. Allocating some authority to labourers and field supervisors is another way to improve labour productivity [67,68]. Most labourers would like to get appropriately involved in decisions that might affect them directly [69]. When labourers have some authority and control over their tasks, they feel that the management appreciates their experience and knowledge. Thus, it motivates labourers to be more innovative and efficient in performing their tasks.

2.2.3. Communication

The quality of information flow among parties and communication about key performance indicators have a supreme importance in improving labour productivity [4,51,53,70]. A labour productivity improvement plan cannot be successful without effective communication between parties in a construction project [71]. Effective communication between site management and labourers can eliminate the factors that stop labourers from being productive [1,51,72]. Broken communication between parties on a construction site causes other issues, such as out of sequence work assignments, reworking and a shortage of material and equipment. A sufficient level of communication motivates labourers to be more efficient and productive [73]. When labourers perceive that they can communicate the factors affecting their productivity with the management team and receive an appropriate response, they feel motivated to engage in activities and improve labour productivity.

2.2.4. Training

Effective training is critical for applying human resource management in the construction industry [52,74]. Training is a process that develops employees' work-related knowledge and skills to improve their performance and efficiency [75]. Management and supervisors significantly impact the employee training and development process [76]. According to Abdel-Wahab, Dainty, Ison, Bowen and Hazlehurst [63], a five percent increase in participation in training can lead to an approximate four percent increase in labour productivity. Well-trained labourers can deliver a high-quality job in a shorter time than average labourers can [77,78]. From the labourers' perspective, training and qualification are the main drivers of labour productivity [67]. Quality of training can assist labourers in performing their tasks efficiently with high quality. However, the shift to open-shop construction adversely affects the training of labourers. The decline in the number of union members in the construction industry creates a significant challenge to the industry as fewer labourers receive union training programmes [79,80]. The lack of a well-trained workforce pushes construction companies to hire labourers who may not be trained properly, and this situation affects labour productivity and reduces overall work quality.

2.2.5. Supervision

Labourers who receive proper supervision tend to have higher productivity [55,81]. The lack of proper supervision and experienced staff may encourage non-value-added activities such as taking unscheduled breaks or waiting for tasks to be allocated. According to Durdyev et al. [82], adequate supervision minimises the chance of rework and using wrong construction methods. Furthermore, continuous supervision enhances the coordination of resources and reduces faulty work, accidents, and associated delays to the project [83]. Therefore, appointing inexperienced supervisors who lack management skills and knowledge significantly affects the overall performance of labourers. In addition to affecting the quality of supervision, the number of supervisors on a site plays a critical role in improving labour productivity [53]. The ratio of supervisors to labourers in a project should be at the optimum level. Waiting for inspections has been recognised as one factor that adversely affects labour productivity [50,84,85].

2.2.6. Planning

According to the construction management literature, a project can be considered successful if it is completed on time and within budget, to the required quality and the satisfaction of the client [53,86,87]. Precise planning is a significant factor in fulfilling a project's objectives [3,30,88]. In a well-planned project, workflow is more predictable. A study by Liu et al. [89] showed a positive correlation between labour productivity and predictability of workflow. Increasing the predictability of workflow enables the management team to allocate a proper amount of resources to the project on time, thus improving labour productivity [90,91]. Poor planning can cause site congestion, which diminishes the achieved level of labour productivity [83,92,93]; or it can offset the effectiveness of other management strategies, such as resources scheduling [94,95]. These circumstances increase rework and out of sequence tasks in the project, which in turn reduce labour productivity.

2.2.7. Resource Scheduling

Cost and project duration are two dominant factors in a project's success [96]. It is common in the construction industry to accelerate the project schedule to complete it on time or sooner than the initial target. Increasing the on-site labour force is one of the common approaches to accelerate the project [94]. Overtime, shift work and overmanning are the three most common methods of increasing the on-site labour force in construction projects [81,94,95,97,98]. Overtime is often preferred for a short period because it improves labour productivity without the coordination and supervision issues associated with shift work and the need for an additional skilled workforce for overmanning [3,99]. However, the implementation of overtime creates further issues, including fatigue, low morale and higher cost per unit [94,100]. According to Mohammadi and Tavakolan [101], the short-term implementation of overtime will increase productivity despite its long term effect that appears as lost time and growth in the accident rate.

Shift work is an effective method to accelerate the project subject to being well-planned and implemented for a short duration [95]. The hasty implementation of shift work without proper planning can significantly negatively impact labour productivity [100,102]. Recommendations for achieving the best results include: applying overlap supervision between two shifts; assigning tasks to the second shift team at different locations; planning the second shift carefully; and, finally, performing a detailed safety evaluation to reduce the risks of working at night [94,95]. Generally, there is no superior method of schedule acceleration. The selection of the best fit method depends on the project situation, such as availability of skilled workforce, good supervision, duration of acceleration and site conditions.

3. Research Method

This study applied a quantitative method, where a survey collected data from 191 construction labourers. The survey instrument was developed based on a modified version of MSAI [2]. The following sections provide further details about the implemented research method.

3.1. Data Collection

3.1.1. Participants

The data were randomly collected from active labourers of construction projects in New Zealand. The scope of data collection covered a wide range of projects, including commercial, educational, and medium to high-density residential. These types of projects could guarantee a reasonable level of complexity in both safety and operational management [2]. The study obtained the list of construction contractors from Civil Contractor New Zealand (CCNZ). A letter of invitation was sent to the project managers with a consent form enclosed. The questionnaires were distributed among the labourers after the managers granted permission. The email recipients had an equal chance of participating in the survey voluntarily and were given assurance about the confidentiality of their answers. A total of 191 out of 893 returned back the completed forms, which shows a response rate of 21.4%.

3.1.2. Survey Instrument

The survey key measures were selected based on the modified version of MSAI [2]. The MSAI was adopted since it offers an efficient tool for measuring the effectiveness and implementation of management strategies and practices for improving labour productivity. The study avoided double-barrelled items and items with difficult vocabulary or multiple negatives to prevent misunderstandings [103,104]. As a part of the pilot study, a group of six experts reviewed the survey contents that ascertained its validity. The expert group comprised of

- two academics with extensive experience in construction management and health and safety research,
- one project manager,
- one safety manager, and
- two senior site managers with 10 to 15 years of experience.

A pilot study was also conducted among 20 construction labourers to ensure the survey was reliable and the potential participants understood the questions, and there were no ambiguous questions to them.

3.1.3. Measurement of the Management Strategies

The index was used to measure the implementation level of management strategies from the labourers' point of view. It consisted of 27 management practices under the seven management strategies listed in the previous section (Table 1). The respondents ranked the strategies and practices on a seven-point Likert scale with the verbal anchor of strongly disagree and strongly agreed at points 1 and 7, respectively. Several studies used the same scale of measurement in the past [6,103,105,106].

Table 1. Management strategies and practices based on modified MSAI.

Management Strategy	Management Practice	Acronym	Survey Item	Cronbach's α
Incentive				0.79
	Performance incentive	PI	I receive a bonus if I achieve my performance goals	
	Safety incentive	SI	I receive a bonus if I have an outstanding safety record without injury or accidents	
	Quality incentive	QI	I receive rewards if I have an outstanding quality performance	
	Recognition schemes	RS	My supervisor acknowledges good performance	
Labour management				0.84
	Allocating control over the type of tasks	ACT	I have control over the type of tasks that I am assigned	
	Allocating control over work pace	ACW	I have control over my work pace	
	Task briefing	TB	I receive a task brief and discuss it with my supervisor before commencing the task	
	Using high-skilled labourers	UHL	Labourers at this site have sufficient skills to handle their tasks	
	Using part-time workforce	UPW	There are many part-time labourers working on this job site	
Training				0.84
	Job training for labourers	JTL	I have received sufficient training to do this job	
	Safety training for labourers	STL	I believe that I have had the training I need to work safely	
	Supervisor training (Improving first-line leadership)	ST	My supervisor is well trained to supervise the job	
Communication				0.87
	Clear role and responsibilty	CRR	I know my responsibilities and roles very clearly	
	Effective crew comminication	ECC	There is effective communication among crews working on the site	
	Clear instruction	CI	I receive clear instructions from my supervisor	
Supervision and leadership				0.88

	Using experienced supervisors	UES	My supervisor has sufficient experience to supervise the job	
	Allocating authorities to supervisors	AS	My supervisor has the authority to make decisions when necessary	
	Sufficient supervision	SS	There are enough supervisors for this project	
Planning				0.73
	Sufficient front-end planning	SFP	Planning is completed before commencing each task at this job site	
	Detailed construction planning	DCP	Work plans for each task contain sufficient details, so I know what to do	
	Sequence	Seq	Different trades/crews are working in an adequate sequence, so they do not interrupt each other’s performance	
	Material	Mat	I have to wait for tools or materials *	
	Equipment	Equ	I have to stop my work because the equipment is not available *	
	Problem anticipation and mitigation plan	PAMP	I receive instructions to handle the potential problems that may occur during my work	
Resource scheduling				0.89
	Adding extra workforce	AEW	Job scheduling is realistic, so I have sufficient time to complete my work without pressure	
	Realistic scheduling (allocating sufficient time to each task)	RS	I am allowed to work overtime to complete my job if it is necessary	
	Overtime work	OtW	If the work is behind schedule, management adds extra labourers to cover the delay	

Note: * Reversed item.

3.1.4. Labour Productivity Measurement

The labourers rated their perception about their productivity level in their current project from 1 (significantly low) to 7 (extremely high). This approach was adopted from [2,107]. According to Donchev and Ujhelyi [108], systematic biases can be considered as the main limitation of subjective measurements. Despite the limitation of this approach, it was the preferred choice in this study because the participants were from different trades, which would leave out the possibility of using other methods such as man–hour per square meter. Furthermore, a study on the advantages and disadvantages of subjective measurements by Jahedi and Méndez [109] found that “subjective measure of specific and well-defined concepts are correlated with facts they intended to quantify”. The study justified the implementation of subjective measurements in other research areas, such as labour productivity. Wall et al. [110] found that subjective and objective measures of company productivity were positively correlated, and therefore, they could validate the findings of the subjective measurement. Finally, as a group, construction labourers have a good sense of their productivity level [107].

3.1.5. Safety Behaviour Measurement

In recent years, safety behaviour has been investigated as a multi-dimensional concept in the occupational health and safety literature [43]. This study measured safety behaviour via two short scales (SC and SP) adopted from DeArmond, Smith, Wilson, Chen and Cigularov [43]. Safety behaviour items were rated on a seven-point Likert scale with verbal anchors of never and very frequent at points 1 and 7, respectively.

3.2. Data Analysis

Before the data analysis process, the responses were screened against a systematic response pattern and more than 5% unanswered items [103]. As a result of the data screening, four of the completed questionnaires were removed from the data analysis out of 191. The rest of the completed questionnaires, with less than 5% missing data and no indication of systematic response patterns, remained in the data analysis. All missing data were imputed with a median of near points in each case [103].

As presented in Table 1, Cronbach's alpha was used to measure the reliability of the results obtained from the seven-point Likert Scale [111]. The value of the Cronbach's alpha ($\alpha > 0.7$) demonstrated the reliability acceptability of the data. Data were analysed by Multiple Regression Analysis (MRA) procedures [111]. MRA can be implemented for prediction and explanation purposes [111,112]. In this study, MRA was implemented to explain the nature of the relationship between the dependent and independent variables and to assess the importance of each independent variable in predicting the dependent variable. It presented a multivariate statistical technique to examine the relationship between a single dependent variable (SP and SC) and a set of independent variables (the seven management strategies). Since the study aims to explore and explain the prelateship between a set of variables, the sequential research approaches in MRA were adopted. There are two types of sequential research approaches in MRA: (1) stepwise estimation, which is the most common approach in selecting variables, and (2) forward addition and backward elimination. Several regression models can be generated by using sequential research approaches in MRA. Identifying the best model is a critical step. This study used adjusted R^2 and PRESS Statistic to determine the best model. Generally, a model with higher adjusted R^2 and PRESS Statistics fits the data and represents the general population better than other models [111].

4. Results

This study used two short scales developed by DeArmond, Smith, Wilson, Chen and Cigularov [43] to measure individual safety behaviour in the construction industry. Before analysing the relationship between the management strategies and safety behaviour, a confirmatory factor analysis (CFA) was performed to conform to the safety behaviour scale using AMOS 23. The result showed an acceptable fit indicating two factors with six indicators (x^2/df = 3.09, $p < 0.05$, CFI = 0.98, IFI = 0.98, TLI = 0.96, RMSEA = 0.10, PCLOSE > 0.05). According to Hu and Bentler [113], RMSEA up to 0.1 is in an acceptable range, and over 0.1 indicates a poor fit. Due to low factor loadings, items 3 of SC and items 1, 2 and 5 of SP were dropped in the CFA. Accordingly, the results of CFA confirmed that two factors (SP and SC) construct the safety behaviour measurement.

The relationship between the management strategies for improving labour productivity, as the independent variables, and SP and SC, as dependent variables, was investigated through a series of regression models. For each set of regression models, consequential research approaches were implemented for developing them. The variance inflation factor (VIF) was used to test the multi-collinearity between the independent variables [111]. The results showed that the multi-collinearity was not a concern. The results of the Durbin–Watson test for all generated models were between 1.91 and 2.08, which were in the satisfactory range [111]. After comparing adjusted R^2 and PRESS statistics of the generated models in each set, models were generated through the forward addition technique, which showed the best fit.

Tables 2 and 3 show the results of the additional forward regressions. A comparison between the size of R^2 in the regression models shows that management strategies for improving labour productivity play a significant role in explaining SC ($R^2 = 0.511$) but explain less of the variance in SP ($R^2 = 0.347$). Implementation of training and resource scheduling strategies showed the greatest positive influence on SC ($\beta = 0.325$) and SP ($\beta = 0.401$), respectively. According to regression models A_3 and B_2, planning and resource scheduling are the only management strategies that positively affect both SC and SP.

Table 2. Forward MRA models for SC.

Model	Independent Variables	β	R^2	Add R^2	ΔR^2
A	Training	0.623 ***	0.388	0.385	
A_1	Training	0.412 ***	0.457	0.451	0.068 ***
	Labour Management	0.336 ***			
A_2	Training	0.332 ***	0.487	0.479	0.030 **
	Labour Management	0.269 **			
	Resource Scheduling	0.219 **			
A_3	Training	0.325 ***	0.511	0.501	0.024 **
	Labour Management	0.177 *			
	Resource Scheduling	0.242 ***			
	Planning	0.176 **			

Note: Dependent variable: SC. β represents standardised coefficients. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 3. Forward MRA models for SP.

Model	Independent Variables	β	R^2	Add R^2	ΔR^2
B	Resource Scheduling	0.435 ***	0.190	0.186	
B_1	Resource Scheduling	0.436 ***	0.312	0.305	0.122 ***
	Incentive programmes	0.349 ***			
B_2	Resource Scheduling	0.401 ***	0.347	0.337	0.035 **
	Incentive programmes	0.272 ***			
	Planning	0.206 **			

Note: Dependent variable: SP. β represents standardised coefficients. ** $p < 0.01$; *** $p < 0.001$.

The regression models reveal that the management strategies for improving labour productivity also affect the safety behaviour of labourers. The management strategies with significant impacts on SC and SP were broken down to their constituent practices to provide further insight. The relationships between the practices of each management strategy, SP and SC, and labour productivity were investigated through MRA. The management practices were considered as the independent variables of the model (Table 4). Although the overall five management strategies (incentive programmes, training, planning, resource scheduling, and labour management) had a positive impact on safety behaviour, the results of the MRA at the operational level indicate that some of the practices applied, such as performance incentive (PI) ($\beta_{SP} = -142$; $\beta_{SC} = -175$) and overtime (OtW) ($\beta_{SC} = -165$), adversely affect SP and SC (Table 4).

Table 4. MRA models for management practices.

Independent Variables	Dependent Variables			Category
	SP	**SC**	**Labour Productivity**	
PI	−0.182 *	−0.215 *	0.063	Red
SI	0.328 ***	0.117	0.066	Green
QI	0.126	−0.186 *	0.157 *	Orange
RS	0.152 *	0.278 ***	0.259 **	Green
JTL	−0.015	0.109	0.552 ***	Green
STL	0.036	0.167 *	−0.293 **	Orange
ST	0.304 **	0.242 **	0.202 **	Green
SFP	0.098	0.108	0.063	
DCP	−0.301 ***	0.174 *	0.227 **	Orange
Seq	0.359 ***	0.240 ***	0.251 ***	Green
Mat	0.035	0.175 *	0.232 **	Green
Equ	0.327 ***	0.177 *	0.317 ***	Green
PAMP	0.317 ***	0.028	0.195 *	Green
AEW	−0.021	−0.012	0.086	
RS	0.347 ***	0.279 ***	0.193 **	Green
OtW	−0.072	−0.165 *	−0.241 **	Red
ACT	0.190 *	0.178 *	0.006	Green
ACW	−0.093	0.156 *	−0.216 *	Orange
TB	−0.172 *	−0.222 *	0.028	Red
UHL	−0.253 **	−0.164 *	0.196 **	Orange
UPW	0.145 *	0.138 *	0.072	Green

Note: Values represent standardised coefficients. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Red: management practices with negative impacts on both labour productivity and safety behaviour; Orange: management practices that improve either labour productivity or safety behaviour while adversely affecting another one; Green: management practices that improve labour productivity and/or safety behaviour without harming another practice.

4.1. Suggested Categorical Skim

It is evident that management practices and strategies for improving labour productivity also impact the safety behaviour of labourers (see Tables 2–4). Based on the analysis results presented in Table 4, the management practices can be grouped into three categories as follows:

4.1.1. Green Category

Management practices that improve labour productivity and/or the safety behaviour of labourers without causing harm to either of these aims are in the green category. Project managers can implement these practices to boost labour productivity, confident that their actions do not harm or compromise the safety of labourers on site. Management practices such as recognition schemes (RS), improving first-line leadership (ST), planning tasks in a proper sequence (Seq), and realistic scheduling (RS) not only improve labour productivity, but also significantly enhance safety behaviour on construction sites. Construction projects can benefit from higher labour productivity and savings resulting from lower accident rates and injuries due to the implementation of these practices by the project management team. These management practices improve the project's overall performance by simultaneously improving labour productivity and safety.

4.1.2. Orange Category

This category covers management practices that improve either labour productivity or safety performance while adversely affecting one of these. The application of management practices in this category requires extra precautions to minimise incompatibility between safety and productivity. Quality incentive (QI) is one of the management practices that positively impact labour productivity while significantly reducing the SC of the labourers. The labourers' understanding of the target of the incentive scheme is crucial [58]. Regarding the implementation of QI, labourers may assume that completing tasks on time and according to design specifications makes them eligible for the incentive. Therefore, they might ignore safety because, from their perspective, safety is not a criterion for allocating QI. The project management team needs to highlight that the occurrence of accidents due to ignoring safety procedures can significantly reduce the quality of the final product. Therefore, it is likely that labourers cannot receive the incentive if they have accidents. Another management practice in this category is safety training for labourers (STL). Safety training has a positive impact on SC. However, the result shows a significant negative relationship between STL and labour productivity. Labourers who receive safety training can identify risks and attempt to eliminate them to perform their job safely. Sometimes, labourers with a high level of safety awareness take excessive safety measures to perform a task with a low level of risk that negatively affects their productivity level. To tackle this issue, a well-trained and experienced safety team and supervisor can be beneficial as they can advise labourers on the reasonable level of safety measurements required to perform tasks with different levels of risks. This study shows a negative relationship between using high-skilled labourers (UHL) and SC and SP. It goes against the finding of previous studies, which have identified a lack of skill as the main cause of unsafe work behaviours on construction sites [8,19]. The Self-Efficacy Theory can explain these negative relationships. Skilled and experienced labourers have a stronger sense of self-efficacy. Experimental studies show that those with a strong sense of self-efficacy see more opportunities in a risky choice and take more risks [114]. Highly skilled labourers might take more risks as they believe that their competency and skill can cope with those risks and, therefore, perform the task safely. In this situation, they are most likely to ignore the safety policies and the procedure for performing that specific task. This type of labourer is overconfident about their competencies, which leads them to overlook the importance and advantages of voluntary participation in activities that increase their safety knowledge and improve the overall safety of the construction site. This finding does not suggest that management teams avoid using skilled labourers on site. Instead, it highlights the importance of monitoring the work environment closely to minimise the negative effect of self-efficacy in labourers' working behaviour. In conclusion, the management team can apply practices in the orange category, while they need to apply some adjustments and take extra precautions to eliminate the negative sides of this category.

4.1.3. Red Category

This category of management practices has no positive impacts on labour productivity, SP, and SC (see Table 4). The results of MRA show that PI negatively affects SC (β = −0.175) and SP (β = −0.142) while not significantly affecting labour productivity. The implementation of PI can lead to an excessive level of PP in working environments and thereby pushes the labourers to violate safety by taking shortcuts [13]. The findings suggest that project managers should not consider PI since it may motivate labourers to increase productivity scarifying safety procedures. Rather, the incentives should be associated with other tasks assessing their behaviour or following safety procedures. An incentive scheme that targets both safety and performance simultaneously can be more effective because it motivates labourers to increase productivity in a highly safe manner.

According to Table 4, task briefing (TB) has a negative relationship with safety behaviour by significantly reducing the level of SC and SP among construction labourers.

This indicates that safety is the missing part of TB on construction sites. TB cannot enhance labourers' safety performance if it does not cover the safety aspect of work and only emphasises the completion of the task on time. Emphasising productivity during TB may signal the labourers that productivity is the main concern of the management that will influence their perception regarding the value of safety in their current working environment.

Implementing overtime work OtW is a common approach to respond to schedule delays. Nevertheless, it was found that overtime is one of the practices that significantly reduce labour productivity and safety behaviour by adversely affecting the SC of labourers. Fatigue is an additional problem caused by working overtime and is a major contributor to workplace accidents and injuries [115]. Suppose the implementation of OtW is unavoidable due to a shortage of skilled workforce in the area. In that case, management may apply this practice as a last resort, for a short duration and with proper supervision. Managers need to closely observe the level of fatigue among labourers working overtime to minimise negative impacts on labour productivity and their safety behaviour.

5. Discussion

Due to the significance of management strategies, this paper was aimed to investigate the impact of management strategies for improving labour productivity on the safety behaviour of construction labourers. The study indicated the significance of the management strategies implemented for improving labour productivity on shaping the safety behaviour of labourers in working environments. The indicated relationships support the concept of unintended consequences suggested by [6,116]. To reduce the vulnerability of working systems and increase stability, the project management team must avoid focusing on operational management in isolation and carefully consider the impact of their decisions on safety. These findings are in line with previous studies in the United States and Canada manufacturing industry, where the management programmes and practices for improving a company's production have been proved to affect the safety of labourers [117–120]. A series of case studies in the United States revealed that failure to address safety and productivity through a holistic approach can lead to unintended consequences in certain circumstances [32].

The further analysis presented in Tables 2 and 3 underscored the importance of planning as a management strategy in shaping safety behaviours on construction sites. The importance lies in the fact that planning significantly affects SP and SC. Therefore, planning plays a critical role in enhancing project stability and achieving project success. There is a slim chance of accidents in well-planned projects because of a high level of risk awareness achieved with precise planning [30]. Inappropriate planning can cause inappropriate work conditions and increase labourers' constraints, leading to unsafe work behaviours. In addition, inappropriate planning causes a delay which increases PP on labourers to accelerate the work to meet the schedule. Several studies have discussed the negative impact of PP on work safe behaviours [8,19,121]. According to Ghasemi et al. [122], PP demotivates employees to participate in safety-related activities. The findings provide further support for the integration of safety into the planning process to achieve a safer working environment [34,123].

Resource scheduling was another management strategy that showed a significant positive impact on the two components of the safety behaviour. The relationship between resource scheduling and safety is not straightforward in the literature. Realistic scheduling not only improves labour productivity, but also positively affects SP and SC. When labourers have sufficient time, they can perform their tasks, according to construction specifications, without errors, which reduces the amount of rework in the project and improves labour productivity [22]. With realistic scheduling, labourers comply with all safety policies and procedures as they have sufficient time to complete their tasks without violating and compromising their safety. In addition, applying realistic scheduling reduces the PP level on labourers. In a work environment with a moderate level of PP, safety and productivity are aligned rather than competing for labourers' attention, which mostly works in favour of productivity because labourers generally believe that companies keep productive labourers rather than safe ones [124]. In this environment, the labourers will have time to assist others and make sure that they perform safely. They will also have time to participate in activities that improve safety on the construction site. It is important that management does not consider these activities as non-value added and as a type of slack that needs to be eliminated to achieve higher labour productivity.

6. Conclusions

This study delved into the complex relationship between safety and labour productivity in the construction industry by investigating the impacts of management strategies for improving labour productivity and the practice on the safety behaviour of labourers. The concept of unintended consequences was used to explain this complex relationship. According to this concept, in a complex and dynamic working environment such as a construction site, management strategies and practices for improving labour productivity can trigger a series of unintended consequences that affect individuals who work on the site. The findings highlight the significance of management strategies for improving labour productivity in shaping the safety behaviour of construction labourers. The "planning" and "resource scheduling" strategies were found to have significant positive impacts on both SC and SP. It has also been demonstrated that management strategies for improving labour productivity shape SC behaviours. This study helps project managers to realise the far-reaching impacts of their practices on the safety behaviour of labourers. In order to improve project stability, it is important to align safety with productivity and avoid practices that may have a detrimental effect on safety when determining strategies aimed at improving labour productivity. The current study has demonstrated that productivity and safety objectives can be accomplished simultaneously by implementing carefully designed and well-planned management practices. Such management practices improve labour productivity while promoting and encouraging SC and SP behaviours among labourers.

The study was not without limitations. First, it used a subjective approach which is based on labourers' perceptions to measure labour productivity. Future studies can focus on numerical analysis based on case studies which allows to measure the productivity of every single project where the number of safety incidents are recorded for a selected timeframe in a project. The project investigated the impact of management strategies for improving labour productivity on the safety behaviour of labourers based on a wide range of labourers' perceptions, although the survey was limited to New Zealand. Future investigations are suggested to replicate this study in different countries and compare the outcomes.

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