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PROMOTING OCCUPATIONAL SAFETY BEHAVIOURS: THE ROLE OF PSYCHOLOGICAL CAPITAL

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“Se camminassimo solo nelle giornate di sole
non raggiungeremmo mai la nostra destinazione”
Paulo Coelho

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RIASSUNTO

Nonostante i numerosi interventi e le iniziative messe in atto a partire dalla pubblicazione del Decreto Legislativo n. 81 del 2008, il problema della sicurezza sul lavoro permane, con un trend di crescita degli incidenti e degli infortuni negli ultimi anni (INAIL, 2022).

I dati dimostrano la necessità di costruire sistemi diversi di salute e sicurezza sul lavoro, analizzando tutte le risorse e le competenze disponibili, comprese quelle psicologiche, per prevenire questo fenomeno. In risposta a questa esigenza, la presente tesi si è concentrata sull'indagine del ruolo del Capitale Psicologico (PsyCap) nella promozione delle prestazioni di sicurezza e nella prevenzione dei micro-incidenti. Lo PsyCap è considerato in psicologia del lavoro un costrutto essenziale per la promozione della salute e della performance organizzativa, dato il suo impatto significativo sugli atteggiamenti e sui comportamenti dei lavoratori. Sulla base dei meccanismi teorici sottostanti, lo PsyCap potrebbe anche aiutare i lavoratori a concentrarsi sui temi della sicurezza e a motivarli ad agire per promuoverla.

Il *capitolo 1* esamina sistematicamente gli studi pubblicati sul legame tra PsyCap e i comportamenti di sicurezza al lavoro. I risultati mostrano (1) la presenza di una relazione diretta e indiretta tra PsyCap e performance di sicurezza, (2) il ruolo di mediatore di PsyCap nella relazione tra fattori organizzativi e comportamenti di sicurezza (cioè, partecipazione alla sicurezza, conformità alla sicurezza, incidenti e infortuni), e (3) il ruolo di moderatore di PsyCap nell'associazione tra richieste di lavoro (o fattori di stress) e comportamenti di sicurezza (cioè, partecipazione alla sicurezza, conformità alla sicurezza, incidenti e infortuni).

Il *capitolo 2*, di natura empirica, si concentra sul ruolo della speranza, una delle sottodimensioni dello PsyCap, nel promuovere la partecipazione alla sicurezza. Il capitolo dimostra che avere obiettivi e pianificare il raggiungimento degli stessi (speranza) aiuta i dipendenti a fornire la volontà (dedizione al lavoro) di raggiungere gli obiettivi e, di conseguenza, a comportarsi più frequentemente in termini di partecipazione alla sicurezza. Inoltre, avvalora che le risorse lavorative contribuiscono alla

relazione precedente come antecedenti di PsyCap e che l'effetto virtuoso della dedizione al lavoro nel promuovere la partecipazione alla sicurezza scompare quando il carico di lavoro è troppo elevato.

Infine, il *capitolo 3* testa longitudinalmente il ruolo antecedente di PsyCap nella promozione dei comportamenti di sicurezza e la sua relazione con le richieste e le risorse lavorative. I risultati mostrano che (1) PsyCap predice la performance di sicurezza (sia la conformità che la partecipazione) nel tempo, (2) PsyCap è antecedente della performance di sicurezza anche quando le richieste di lavoro sono elevate, e (3) le risorse lavorative promuovono indirettamente la performance di sicurezza attraverso la loro associazione con PsyCap.

In sintesi, il principale contributo della presente tesi è il riconoscimento del ruolo dello PsyCap nell'aumento delle prestazioni di sicurezza, suggerendo che il suo miglioramento è utile per la promozione della sicurezza. Esplorare il ruolo dello PsyCap nella promozione dei comportamenti di sicurezza ha contribuito in modo rilevante agli studi in questo settore, ampliando le prospettive proposte nell' Integrated Safety Model (ISM) e del Job Demands-Resources Model (JD-R) applicato alla sicurezza. Dal punto di vista pratico, i risultati suggeriscono alle organizzazioni di creare programmi che promuovano i comportamenti di sicurezza. Non solo riducendo la distanza tra conoscenza e conformità, ma anche incoraggiando l'autoefficacia, la speranza, l'ottimismo e la resilienza che possono contribuire a promuovere i comportamenti di sicurezza anche di natura partecipativa.

Parole chiave: capitale psicologico; performance di sicurezza; incidenti e infortuni sul lavoro; richieste di lavoro; risorse lavorative

ABSTRACT

Despite many interventions and initiatives have been implemented since the publication of the Legislative Decree n. 81\2008, the occupational safety problem remains, with a growing trend of accidents and injuries in recent years (INAIL, 2022). The data demonstrate the need to build different occupational health and safety systems by analysing all available resources and skills, including psychological ones, to prevent this phenomenon.

In response to this need, the present dissertation focused on investigating the role of Psychological Capital (PsyCap) in promoting safety performance and preventing micro-accidents. PsyCap is considered in occupational psychology, as an essential construct for promoting organizational health and performance, given its significant impact on workers' attitudes and behaviours. From this dissertation perspective, based on its underlying theoretical mechanisms, PsyCap can also help workers focus on safety issues and motivate them to take action for its promotion. Thus, PsyCap's role in promoting safety will be verified.

Chapter 1 systematically reviews studies on PsyCap and safety behaviours. The results of the systematic literature review show (1) the presence of a direct and indirect relationship between PsyCap and safety performance, (2) the mediator role of PsyCap in the relationship between organisational factors and safety behaviours (i.e., safety participation, safety compliance, accidents, and injuries) and (3) the moderator role of PsyCap in the association between job demands (or stressors) and safety behaviours (i.e., safety participation, safety compliance, accidents, and injuries).

Chapter 2 focuses on the role of hope, as a subdimension of PsyCap, in promoting safety participation. It verifies that having goal-directed and planning to meet goals (*hope*) helps workers provide the willingness (job dedication) to reach goals and, in turn, behave more frequently in safety participation. In addition, it shows that job resources contribute to the previous relationship as antecedents of PsyCap and that the virtuous effect of job dedication in promoting safety participation disappears when the workload is too high.

Finally, *chapter 3* longitudinally tests the antecedent role of PsyCap in promoting safety behaviours and its relationship with job demands and resources. The results show that (1) PsyCap predicts safety performance (both compliance and participation) over time, (2) PsyCap is antecedent of safety performance also when job demands are high, (3) job resources indirectly promote safety performance through their association with PsyCap.

In sum, the main contribution of the present dissertation is recognizing PsyCap's role in increasing safety performance, suggesting that its improvement could be helpful for safety promotions. Exploring the role of PsyCap in promoting safety behaviours was an essential contribution to studies in this area, expanding the perspectives proposed in the Integrated Safety Model (ISM) and the Job Demands-Resources Model (JD-R) applied to safety. From the practical point of view, organizations would be advised to create programs that promote safety behaviours, not only by reducing the distance between knowledge and compliance but also by encouraging self-efficacy, hope, optimism, and resilience which can help promote safety behaviours.

Keywords: psychological capital; safety performance; occupational accidents and injuries; job demands; job resources

1. INTRODUCTION

According to the International Labor Organization (ILO), 2.8 million people die yearly from work-related accidents or occupational diseases. About 400,000 workers are victims of fatal accidents, and 2.4 million are deaths caused by occupational diseases. Added to these events are more than 374 million workers who are victims of non-fatal injuries each year, which cause absences from work (International Labour Organization, 2019).

In Italy, throughout 2021, approximately 564 thousand work accidents were recorded. Over 480 thousand work-related accidents happened directly in the workplace, while almost 84 thousand cases occurred during the journey to or from work (Statista, 2022). In the same year, there was an upswing in traditional occupational injuries compared with 2020 and 2021, when data were impacted by the slowdown of many production activities and the massive use of agile work, resulting in a significant reduction in injuries (INAIL, 2022). Thus, the gradual resumption of activities in many sectors and the return of operating on-site resulted in an increased risk of injury, stressing the importance of paying attention to the problem.

Concerning labor sectors, the recovery in 2021 of road accidents is confirmed as the leading cause of work-related injuries. The nearly 16 thousand cases involving means of transport increased by 17.4% compared to the year before (more than two thousand more). Other sectors, such as construction, transportation, and warehousing, which in 2020 had recorded a decrease compared to 2019 (-19% and -20%, respectively), marked an increase in 2021 compared to the previous year (+16% and +24%). These categories of workers are more likely to be exposed to physical risk factors such as carrying or moving large goods, uncomfortable and taxing positions, and vibrations, according to EU-OSHA (2010). Long periods of standing and walking are significant risk factors. Other risk factors include manual handling of (heavy) loads, the work environment (e.g., a confined space, a slick floor, or the cold), awkward postures (e.g., stretched arms and bent postures), working above shoulder/head level, repetitive work, high force applications, vibration, and lifting heavy objects.

Despite considerable advances in technology and health sciences, the prevention of occupational injuries is still very much in evidence, even in the advanced market economies of the Member States of the European Union (EU). In all EU countries, workers continue to be injured, made ill, or die due to their work. The problem concerns many systems (e.g., organizations, insurance, healthcare) and stakeholders (e.g., employers, workers, unions, and healthcare professionals), and several strategies (e.g., regulations, mandatory training, policies, and practices) to reduce this alarming phenomenon were implemented.

However, today's situation is still critical. Indeed, ILO emphasized that the mere introduction of regulations by law is not effective in preventing accidents and injuries. Additional strategies are needed to increase the compliance of employers and workers with the safety measures that are prescribed by law (Ricci et al., 2016).

1.1.The theoretical models of occupational safety

From a research perspective, several studies have been conducted to understand the antecedents of safety behaviours and the causes of occupational accidents and injuries (Beus et al., 2010, 2015, 2016; Christian et al., 2009; Hofmann et al., 2017; Nahrgang et al., 2011).

The Integrated Safety Model (ISM)

Beus and colleagues (2016), through a metanalysis of 697 research articles, defined the Integrated Safety Model (ISM), as an inclusive theoretical model that integrates all previous research findings (Figure 1). Within ISM, safety issue was not approached exclusively by reference to alarming numbers of accidents and injuries. Indeed, accidents and injuries were evaluated only to indicate safety absence (Beus et al., 2016; Reason, 1990) because they do not occur in all circumstances, even if the worker does not behave appropriately. Accidents typically depend on various elements (such as hazardous behaviours and underlying organizational failures) that often coexist but do not always trigger accidents (Reason, 1990). To study occupational safety through a broader perspective and then reflect on possible interventions, Beus and Colleagues (2016) in the ISM also included *safety*

performance that can reveal the absence of safety before adverse events occur. Likewise, safety performance can monitor the virtuous behaviours of workers who take action to improve the safety of their workplace.

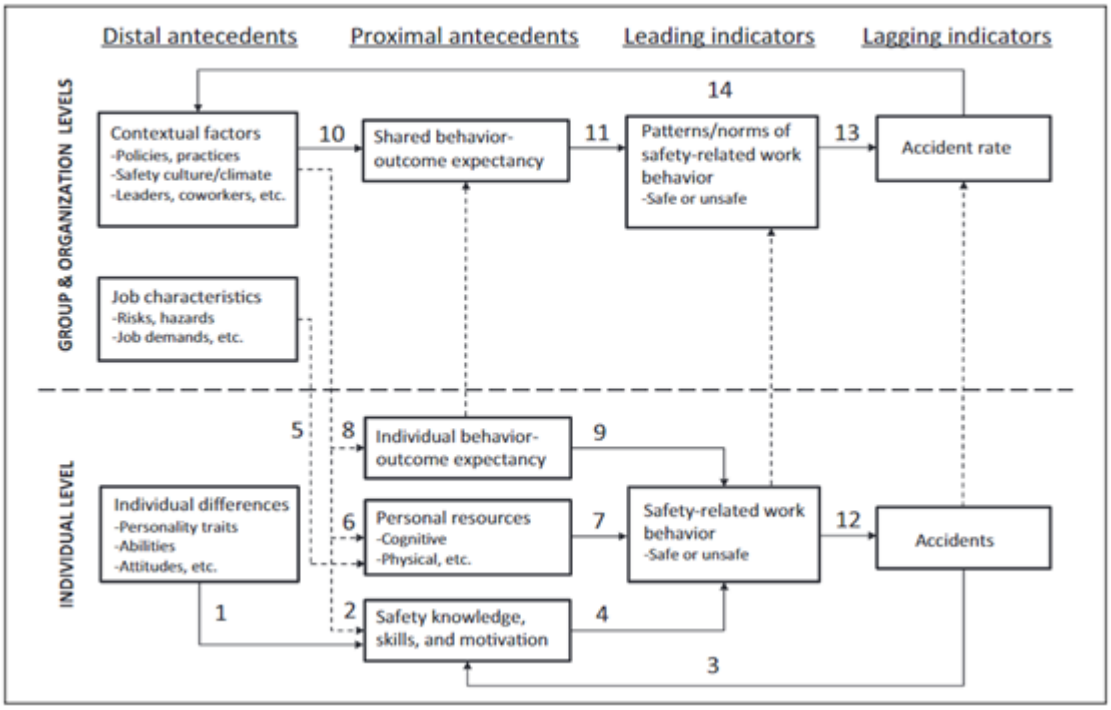
Within ISM, Safety performance and the number of accidents or injuries are distinct indicators. Safety performance is classified as a *leading indicator* of safety because it can reveal the absence of safety before actual damage is caused by accident. Instead, accidents are considered *lagging indicators* of safety because they only reflect the lack of safety after the damage has already occurred. Safety performance is thus a more *proximal indicator* of workplace safety than accidents because they are behaviours that generally precede the occurrence of accidents (Burke & Signal, 2010; Christian et al., 2009). For this reason, it is the most important indicator to be analysed to promote safety.

In the existing literature, *safety performance* is assessed by two dimensions: Safety compliance and Safety participation (Clarke, 2006; Griffin & Neal, 2000). *Safety compliance* includes involvement behaviours that would be part of a worker's role (*e.g.*, using the appropriate personal protective equipment). *Safety participation* instead involves voluntary aspects, including behaviours beyond the formal role of workers, extra-role behaviour, or organizational citizenship behaviours (*e.g.*, assisting colleagues in making sure they perform their work safely) (Clarke, 2006). Safety performance mechanisms operate through *safety knowledge* and *safety motivation* and are intended to have varied effects on task- and context-related behaviour. The first is described as the level of expertise employees have in the laws and practices required to perform their jobs safely (e.g., emergency procedures). The second shows the worker's will to exert effort to implement safety behaviour and the value connected to this behaviour.

The ISM (Figure 1) takes a multilevel perspective and differentiates between *distal* (e.g., individual differences, contextual factors) and *proximal antecedents* (e.g., safety knowledge, skills, or motivation) of safety-related behaviours and subsequent accidents across individual and group levels of analysis. The analysis of ISM shows that several interacting individual and organizational factors enable the implementation of safety performance on the one hand and fewer accidents and injuries on the other.

Figure 1

Integrated Safety Model (ISM)



Note. This figure is adapted from Beus et al., (2016) p. 355.

The Job Demands-Resources Model (JD-R)

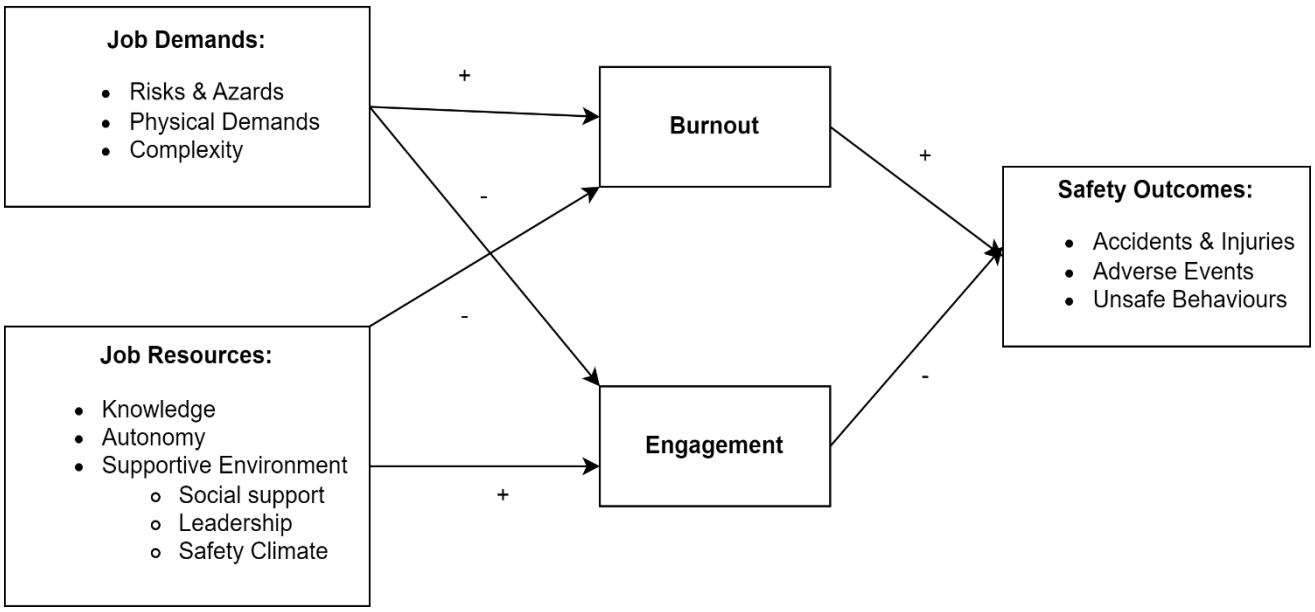
Some of the associations showed by Beus and colleagues (2016) can be explained by the Job Demands-Resources Model (JD-R) applied to safety (Figure 2). Indeed, the scholars considered that safety-related job demands (*e.g.*, work overload or risks) and job resources (*e.g.*, social support or autonomy) could influence workers' safety behaviours through their effects on the availability of personal resources, such as individuals' cognitive and physical abilities (Beus et al., 2016). In addition, the authors also assessed organizational factors (*e.g.*, safety leadership and safety climate)

as antecedents of safety behaviours through their effects on the availability of personal resources. ISM and the JD-R claim that, in contrast to how job demands deplete personal resources, job resources can both refill personal resources and mitigate the effects of job demands, increasing goal achievement (Bakker & Demerouti, 2007). There is already evidence in the literature that JD-R can also be applicable and valuable within the safety context (Derdowski & Mathisen, 2023; Hansez & Chmiel, 2010; Li et al., 2013; Nahrgang et al., 2011). For example, Nahrgang and colleagues (2011), in a meta-analysis of 203 independent samples, showed the association between job demands and resources and workplace burnout, engagement, and some adverse safety outcomes such as accidents, injuries, adverse events, and unsafe behaviours. According to their findings, job demands, including risks, hurt employees' health and cause burnout.

Additionally, job resources like expertise, autonomy, and a positive work environment encouraged individuals to engage in their work more. Job demands also hindered the progress of an employee toward engagement, but burnout was found to be lessened by job resources. Finally, the Authors found that while burnout made it harder to work safely, engagement encouraged workers to do so. According to mediation tests, the health impairment process and the motivational process suggested by the JD-R model are both mechanisms via which job demands and resources affect safety outcomes. Although ISM has the merit of systematizing knowledge about organizational and personal resources in fulfilling safety behaviours, the role of one of the most known positive attitudinal resources (i.e., Psychological Capital) cannot yet be captured. Indeed, the personal resources analyzed within the ISM refer only to factors that reflect the level of personal energy or the ability to perform a job (i.e., physical, attentive, and cognitive resources) and not to attitudinal aspects. Thus, the role of PsyCap in promoting safety remains to be investigated through studies.

Figure 2

Job demands-resources model of workplace safety.



Note. This figure is adapted from Nahrgang et al., (2011) p. *72.*

1.2. Different perspectives on the study of occupational safety: Prevention vs. promotion

Although research in occupational safety and health is extensive, most of the studies in this area have focused on safety prevention, investigating the factors leading employees to incur or not in accidents and injuries (Beus et al., 2010, 2015, 2016; Christian et al., 2009; Hofmann et al., 2017; Nahrgang et al., 2011). These studies had a negative view of the problem, focusing on the factors that led workers to get wrong, behave unsafely or act in human errors and to pinpoint the main risk variables and the approaches that will adjust them for each isolated issue. Safety is evaluated in these investigations based on its absences. The frequency and severity of adverse events (normalized for exposure) experienced over a specific time are frequently used to determine how safe an organization is (Reason, 2000). However, while a high injury rate may be seen to be a sign of poor safety performance, a low asymptotic rate does not always imply good safety performance (Reason, 2000).

The focus on this kind of practice has detrimental effects on the development of global solutions and of a positive mentality that views safety as a valuable value to be preserved rather than as an unwanted problem error (Maurice et al., 1998; Reason, 1990). It compartmentalizes interventions, ignores the

fact that problems are interconnected as their solutions, isolates intervening agencies from one another, decreases the efficiency of interventions, and endangers the development of these concepts (Maurice et al., 1998).

On the other side, this dissertation follows the *safety promotion perspective* through the analysis of the positive resources that create a safer work environment. Safety promotion is a process that aims to provide workers with the conditions and abilities that are necessary to reach and sustain an optimal level of safety (Maurice et al., 1998). This definition assumes that safety promotion is an enabling process for a community, requiring the population's active participation in defining program objectives and choosing solutions (Maurice et al., 1998).

This perspective is in line with Positive Psychology: the scientific study of human strengths and optimal functioning (Seligman & Csikszentmihalyi, 2000). Positive psychology focuses more on what is good about people rather than what is wrong with them (Luthans, 2002, p. 697). It emphasizes traits like strength, resiliency, and virtue rather than illness, disorder, incapacity, and damage (Diener, 2000; Snyder & Lopez, 2002).

In an attempt to contribute to the development of this field and to overcome this theoretical and practical shortcoming, the current dissertation focuses on the role of psychological capital (PsyCap) (Luthans, Youssef, et al., 2006; Luthans & Youssef-Morgan, 2017; Youssef-Morgan & Luthans, 2013) in the promotion of safety behaviours.

1.3. Psychological Capital: The state of the art

Researchers and practitioners have become very interested in the idea of PsyCap in recent years, and it has been connected to employee attitudes, behaviours, and performance at several levels of study (Luthans & Youssef-Morgan, 2017; Newman et al., 2014; Nolzen, 2018; Wu & Nguyen, 2019). The first researchers who studied this construct were Luthans, Youssef e Avolio (2006; 2015), who defined it as a psychological state derived from four different subdimensions: Hope, Self-efficacy, Resilience, and Optimism. More specifically,

- **H**ope (or determination) corresponds to the individual's ability to act and identify the appropriate courses of action.
- (self)-**E**fficacy represents the confidence the individual places in completing tasks successfully.
- **R**esilience consists of the ability to react positively to failures, conflicts, and changes and to be able to reconstruct a positive and meaningful life path after a traumatic event.
- **O**ptimism implies a positive vision of reality and the consequent trust that things can go well beyond personal actions: this leads people to have an external locus of control concerning adverse and internal positive events.

Combined, these four resources compose a higher-order construct based on the commonalities these four first-order constructs share (Hobfoll, 2002), which has been empirically supported (Avey et al., 2011; Luthans et al., 2007). The resulting theoretical model is also called the **H.E.R.O.** model to indicate, through the acronym, the potential of people who possess these resources.

PsyCap operates through fundamental theoretical mechanisms: agentic conation, cognitive appraisals, positive emotions, and social mechanisms (Luthans et al., 2006). Specifically, *Conation* promotes goal-directed energy, which can incite the drive and mobilize the resources required for goal pursuit and encourage a positive, as opposed to a negative, response when facing challenges. *Cognitive appraisals* should allow workers to reinterpret and reframe challenging goals, making them more enticing and deserving of time, effort, and resources. Such encouraging feedback also encourages overcoming problems head-on rather than giving up. *Positive emotions* should expand workers' thought-action repertoires, increasing creativity (Sweetman et al., 2011) and opening up more paths (Snyder, 2000). Positive emotions can also aid in the development and replenishment of previously depleted physical, social, and psychological resources (Fredrickson, 2001). Finally, the ability to establish good *social relationships* that help in times of most significant difficulty. Depending on others when one's resources are limited or missing might promote pathways to optimism and hope (Luthans et al., 2015).

The fact that PsyCap is domain-specific and typically operationalized at the work domain is another one of its fundamental characteristics. This trait suggests that a person may have a high work PsyCap but a low family or job search PsyCap. In other words, while an individual may have stronger PsyCap to achieve work goals and be resilient to setbacks at work, they may struggle to be resilient to similar personal misfortunes in another area (such as family).

PsyCap has attracted so much interest in recent years because it is a valid construct that can be measured not only in terms of the level of PsyCap but also in terms of economic impact and return on investment for PsyCap (Nolzen, 2018). In fact, as conceived by Luthans et al., (2007), PsyCap is malleable and can be developed through organizational interventions. Scholars empirically demonstrate that PsyCap varies less frequently than emotions but more frequently than personality traits, opening the possibility for developmental interventions in occupational settings. Over the years, many interventions have been developed and implemented, including using online tools (Harty et al., 2016; Luthans, Avey, et al., 2006; Luthans et al., 2008).

Many studies that have helped understand PsyCap's effects on many positive results have been conducted in the organizational field. Avey, Reichard, Luthans, and Mhatre (2011) conducted a meta-analysis on 51 samples and provided the most significant findings in this field. The findings of this meta-analysis show a significant and favorable association between PsyCap and a variety of desired employee attitudes, including job satisfaction, organizational citizenship behaviours, work engagement, well-being, and other performance metrics (self-rated, supervisor-rated, and objective). Additionally, Wu and Nguyen's latest meta-analysis (2019), which examined 105 primary papers published between 2000 and 2018, found interesting outcomes. It has been demonstrated that PsyCap influences organizational citizenship behaviours, organizational commitment, and job satisfaction.

Other studies have thorough PsyCap by emphasizing its role in the relationship between job resources or job demands and positive or negative outcomes related to the health and performance of workers concerning the JD-R Model (Grover et al., 2018). Thus, research evidence supports the contention that PsyCap plays a general role in improving the work environment because people who possess

higher levels of PsyCap relate to one another in a more considerate manner and are able to focus better on work tasks (Grover et al., 2018).

Despite all this evidence, it is not clear whether PsyCap could also predict another positive organizational outcome, such as safety performance.

1.4. Dissertation aim and scope

To contribute to this field's development and overcome this theoretical and practical shortcoming, the current dissertation focuses on the role of PsyCap in promoting safety performance and reducing micro-accident.

The objectives described above have been pursued through three studies. The purposes of the following chapters in this dissertation are briefly outlined:

Through a systematic literature review, already subject of publication in Margheritti et al., (2022), the ***first chapter*** aimed to expand the knowledge about the role of PsyCap, and its four subdimensions, in promoting safety behaviours.

Specifically, (1) identifying the presence of a relationship between PsyCap and safety behaviours and (2) investigating whether PsyCap can have an indirect effect (mediator or moderator) in the relationship between organisational factors, job demands (or stressors), and safety outcomes (i.e., safety participation, safety compliance, accidents, and injuries).

The ***second chapter***[1] focuses on a specific PsyCap's sub-dimension, or *hope*, in empirically assessing its role in the JD-R model's motivational process applied to safety (Nahrgang et al., 2011). Its interactions with job resources, job dedication, and workload are tested. The first objective (1) of this chapter was to verify whether having goal-directed and planning to meet goals (hope) helps employees provide the willingness (job dedication) to reach goals and, in turn, behave more frequently in safety participation behaviors. Secondly (2), the objective was to know whether job resources (*i.e.*, autonomy and management support) contribute to strengthening the PsyCap of

[1] This chapter represents a study conducted in collaboration with Prof. Silvia Agostinho da Silva during my visiting research period at ISCTE business school in Lisbon. It is also an article under review at *Safety Science.*

workers, prompting them to perform more safety behaviors. Finally (3), it was investigated whether (job) dedicated workers continue to perform safety participation behavior when their workload is too high.

The ***third chapter*** (divided into two studies) aims to longitudinally assess the association between PsyCap and safety behaviours, overcoming the limits shown in the previous studies.

Specifically, it was verified (1) the antecedent role of PsyCap in promoting safety performance (both compliance and participation) and preventing micro-accidents; (2) the moderating effect of job demands (*e.g.*, workload) within the previous relationship; (3) the indirect role of job resources (*i.e.*, social support, role clarity, feedback, and safety leadership) in promoting safety performance through their association with PsyCap.

Finally, a general discussion summarizes, integrates, and discusses the main results of the findings reported in this dissertation.

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CHAPTER ONE[2]

Can psychological capital promote safety behaviours? A systematic review

1. INTRODUCTION

Worldwide, at least 1.9 million workers die annually due to an occupational disease or accident at work. Moreover, 360 million nonfatal work-related injuries are recorded each year, resulting in more than four days of absence from work (ILO, 2021). For this reason, it is still relevant for both researchers and practitioners in the occupational health and safety (OHS) field to delve into the cause of these events and invest in the factors that can prevent them.

The factors affecting safety at work have been studied for a long time and summarized within the integrated safety model (ISM) (Beus et al., 2016). However, research has been limited to studying individual differences in terms of worker shortcomings, such as insufficient attention or misperception of risks (Smibert & Fleming, 2017), personality traits (Cellar et al., 2004; Hogan & Foster, 2013; Smibert & Fleming, 2017), and cognitive or physical abilities (Halbesleben, 2010; Hansez & Chmiel, 2010; Leung et al., 2012; Lusa et al., 2002; Seo et al., 2015; Wallace & Chen, 2005).

This systematic review focus on psychological capital (PsyCap) (Luthans, Youssef, et al., 2006) and its relationship with safety behaviours. We aim to emphasize positive, efficient, and productive resources about people rather than correcting what is wrong. Different meta-analyses have already reassumed the impact of PsyCap on different positive organizational outcomes such as organizational climate, performance, attitude, job satisfaction, organizational justice, and authentic leadership (Avey et al., 2011; Kong et al., 2018; Wu & Nguyen, 2019). However, it is not already clear if PsyCap has an impact on some safety behaviours as well.

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Margheritti, S., Negrini, A., & Miglioretti, M. (2022). Can psychological capital promote safety behaviours? A systematic review. *International journal of occupational safety and ergonomics*, 1-9.

1.1. Psychological capital

The construct of PsyCap has attracted much interest from researchers and practitioners in recent decades. Luthans, Youssef and Avolio (Luthans, Youssef, et al., 2006) were the first to study PsyCap and defined it as a higher-order construct derived from four different components: self-efficacy, optimism, hope, and resilience. The resources of PsyCap are each independent in their own right but also interact and may pull in the same direction (e.g., hope/optimism and hope/resilience).

Many studies on the positive impact on organizational outcomes in the organizational psychology field contribute to a better understanding of its positive effects. The most relevant results were reported in a meta-analysis carried out on 51 independent samples (Avey et al., 2011), indicating a significant and positive relationship between PsyCap and different desirable worker outcomes, such as work engagement, organizational citizenship behaviours (OCB), job satisfaction, and various performance measurements (self-rated, supervisor-rated and objective). Additionally, a recent meta-analysis carried out by Wu and Nguyen (Wu & Nguyen, 2019) who analysed 105 primary studies published between 2000 and 2018, reported positive results. Specifically, the impact of PsyCap on job satisfaction, organizational commitment, and OCB has been proven. Other studies have also shown that PsyCap is positively related to safety, such as with safety climate (Bergheim et al., 2013, 2015; Eid et al., 2012) and safety leadership (Cheung et al., 2021). In this sense, the evidence that PsyCap and its components can be related to safety in organisations is not a new topic, but in this systematic literature review, we are interested in evaluating how PsyCap can affect safety behaviours.

1.2. Study aims

This systematic literature review aims to evaluate how PsyCap, and its four subdimensions, have a relevant role in promoting safety performance (Safety compliance and Safety participation) and preventing occupational accidents and injuries. We decided to include in this review the studies that analysed the four personal resources (self-efficacy, optimism, hope, and resilience) individually and not as a PsyCap higher-order construct. Indeed, despite personal resources individually do not allow recognition of the agentic conation, cognitive assessments, positive emotions, and social mechanisms

that are recognized as the basis of PsyCap's functioning (Luthans & Youssef-Morgan, 2017); we believe it may also be useful to include these studies to grasp any differences and similarities with the functioning of PsyCap.

The general objective was broken down into two specific objectives:

(1) to identify the presence of a direct relationship between PsyCap and safety behaviours;

(2) to verify whether PsyCap can have an indirect effect (mediator or moderator) in the relationship between organizational factors, job demands (or stressors), and safety outcomes (i.e., SP, SC, accidents, and injuries).

2. METHOD

2.1. Systematic literature review

The systematic literature review was conducted following the Preferred Reporting Items for Systematic Review and Meta-Analysis Checklist (PRISMA) (Liberati et al., 2009). A search of the Scopus, PsycINFO, and Web of Science databases was carried out in February 2020 and updated in July 2021. Search terms were chosen based on the participant, interventions, comparisons, outcomes (PICO) framework. The search strategy focused on the field of work. For this reason, the terms' work', 'job', and 'safety at work' were included and combined with different terms related to PsyCap and safety behaviours. Considering that this study aims to evaluate how PsyCap and its four subdimensions play a role in promoting safety performance (SC and SP) and preventing occupational accidents and injuries, the keywords used for the search inside the title, abstract or keywords were 'Psychological capital OR PsyCap OR hope OR optimism OR self-efficacy OR resilience' AND 'safety compliance' OR 'safety participation' OR 'safety performance' OR 'safety behavior*' OR 'safety behaviour*' OR 'safety at work' OR accident* OR injur*' AND 'work* OR job' without putting any limitation on the 'year' of publication. The search strategy was not limited by research design or methodology; in fact, all types of papers, including these topics, were considered.

2.2. Eligibility criteria and study selection

The research and selection of the publications followed different steps. First, following three inclusion criteria (i.e., empirical studies published in English and a peer-reviewed journal), a first selection was made. Second, duplicates were removed. Third, by reading the title and abstract, documents were excluded following these criteria: a) the type of publication 'an essay, book review, letter, editorial, opinion, journalistic or antidotal article' (Parris & Peachey, 2013); b) if PsyCap or its four subdimensions were not studied as an antecedent or mediating and moderating variables; c) if the studies were carried out using an engineering perspective (Hollnagel, 2014); d) if the dimension of optimism was studied only in terms of 'optimistic bias' (Caponecchia, 2010; Caponecchia & Sheils, 2011; Dalziel & Job, 1997; Spitzenstetter, 2006) studies about Safety behaviours observed outside the workplace. Fourth, full-text articles were screened for eligibility following the same criteria.

Finally, for the reliability and validity of the process (described in section 2.3), two independent research scholars were asked to repeat the selection process of 300 papers (using Rayyan Systems Inc.). Excluding five articles evaluated as of doubtful utility by one of the two researchers, a 3.7% discrepancy was obtained.

2.3.Methodological quality assessment

The methodological quality of the included studies was assessed using the Hagger, Koch, Chatzisarantis, and Orbell quality criteria (Hagger et al., 2017). This tool allows the assessment of the methodological quality of both cross-sectional and longitudinal studies. The tool consists of sixteen criteria. A score of 1 was assigned for each criterion met, and a score of zero 0 was assigned for each criterion not met or when insufficient information was provided. Tertile division of scores on the quality checklist resulted in studies above the upper tertile classified as high quality and studies below the lower tertile classified as low quality. In agreement with the criteria described by the authors (Hagger et al., 2017), studies scoring an average of ≥ 6 were classified as high quality, and studies scoring an average score of < 6 were classified as low quality. No study scored < 6; therefore, no

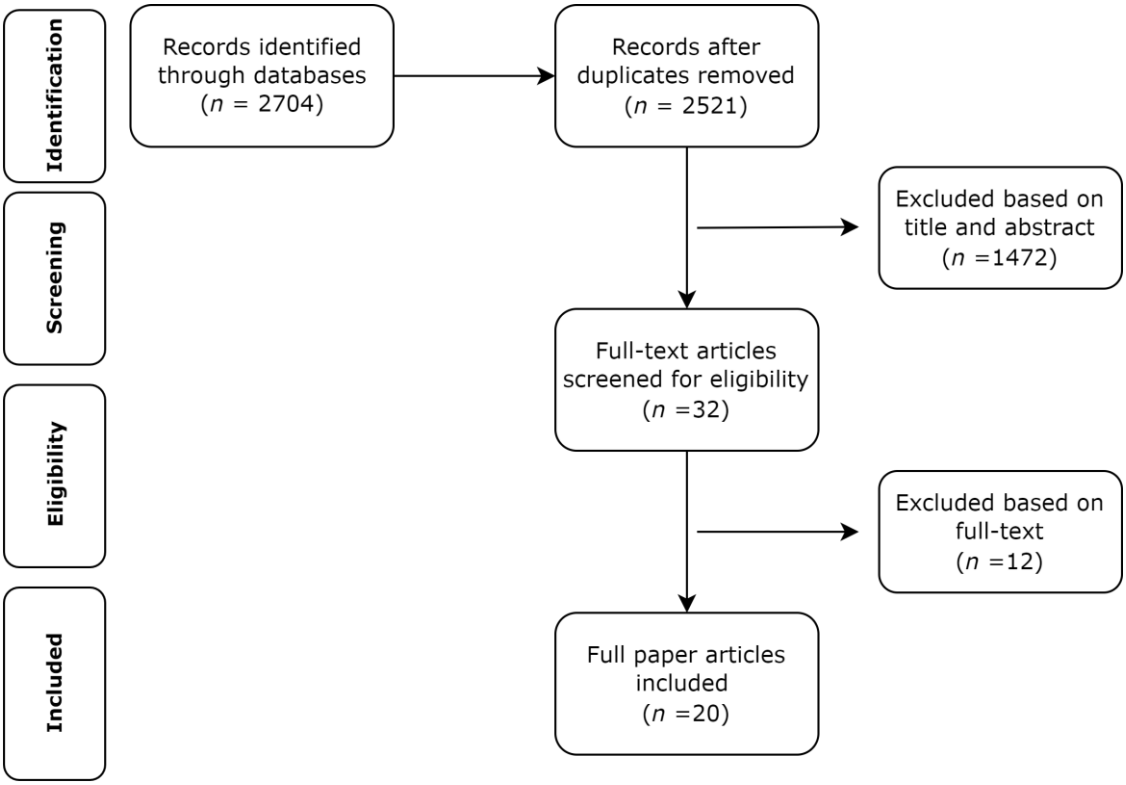
study was excluded from the sample (individual scores assigned to each study can be requested to the author).

3. RESULTS

3.1. Final selection of articles

Figure 1 represents the flow diagram for the systematic reviews and meta-analysis (Moher et al., 2009). Following the four screening steps (described in section 2.2.), 20 articles were selected. The first step allowed the extraction of 2704 articles, which became 2521 after removing duplicates. Of these 2521, only 20 met all the inclusion criteria. All 20 selected articles were assessed using the Hagger et al. (2017) criteria (Hagger et al., 2017). Having all obtained scores ≥ 6, they were all judged to be good enough and included in this review. Most studies achieved a positive rating for criteria related to the definition of the research question or objective, the definition and validity of independent variables, and the validity of dependent variables. Most of these were negatively rated for dimensions such as ethical approval, sample size, and statistical power analysis. Some of the criteria were only screened for longitudinal studies (e.g., follow-up measures and loss to follow-up).

Figure 1 PRISMA flow diagram of study selection



Note. n = number of records

3.2.Overview of the included studies

The results emerging from the systematic literature review are presented below. Following a subdivision into sections, we distinguish the role played by the constructs of interest. The publications in which other personal resources have been studied are presented in each of the sections outlined.

3.2.1. Psychological capital as an antecedent of safety performance

Various studies have highlighted the relationship between PsyCap and its subdimensions and safety performance inside organisations (see Table 1). Starting from the most recent results, Wu, and colleagues (2021) showed that a positive relationship exists between team PsyCap (part of team human capital) and the team safety performance (Wu et al., 2021). The same positive association is supported by the results of Yuen, Bai and Wang (2020). The authors demonstrated that seafarers with high levels of PsyCap exhibit safety behaviour because they believe that accidents can be prevented. In addition, Stratman and Youssef-Morgan (2019), found that PsyCap determined the reduction of unsafe behaviours by instilling in workers the hope, efficacy, resilience, and optimism necessary to contrast cynicism, which in turn is related to unsafe behaviours. In this longitudinal study, the authors carry out an intervention to increase workers' PsyCap by obtaining a significant reduction in cynicism, considered a determining variable in implementing unsafe behaviours (Stratman & Youssef-Morgan, 2019). An additional relevant study for understanding the role of PsyCap was conducted by He, Jia, McCabe, Chen and Sun (2019). The authors tested and verified the association between subdimensions of PsyCap and safety performance and the mediating role of communication competences (e.g., speak clearly) between these variables. Results showed that only three dimensions of PsyCap are directly related to safety performance outcomes. Self-efficacy significantly and positively affected the two subdimensions of safety performance (i.e., safety compliance and safety participation). Resilience was significantly and positively related to safety participation. Optimism was negatively associated only with safety participation (He et al., 2019). The same relationship was investigated by Wang and Colleagues (2018) in a cross-sectional study conducted among construction workers in China, although the results were partially discordant. Indeed, their empirical results revealed that workers' PsyCap and its four components had a direct and positive influence on safety compliance and safety participation. In addition, the findings reported in the study by Wang, Wang and Xia (2018) are in line with these results. Indeed, in their cross-sectional study, the authors reported a positive association between PsyCap (and its four sub-dimensions) with both safety compliance and participation. Furthermore, the author showed that the four sub-dimensions of

PsyCap were strongly related to safety compliance than those on Safety participation. Another cross-sectional study was conducted by Brunetto et al. (2016) among a group of nurses. The authors analysed the relationship between PsyCap, the support provided by managers (Leader–Member Exchange) added to specific safety interventions (managerial safety priorities and safety training satisfaction), and safety performance. The results showed that the positive support of a manager and PsyCap accounted for just under a fifth (19.2%) of the variance in in-role safety performance (Brunetto et al., 2016). The cited studies also report an indirect relationship between PsyCap and safety performance, specifically through safety citizenship behaviours (Wu et al., 2021), communication competence (He et al., 2019), safety motivation (Wang, Wang, & Wang, 2018), and safety training satisfaction (Brunetto et al., 2016).

Results stemmed from this literature review showed that little research has been carried out about the role of Self-Efficacy (as single dimension) in determining safety performance over the period spanning the last fifteen years. Moreover, the results are partially discordant. Indeed, Akanni, Ajila, Omisile and Ndubuze (2021) showed that the self-efficacy of bank workers was positively correlated to Safety behaviours. In addition, Chen and Chen (2014) found that self-efficacy directly affected pilot safety performance in a cross-sectional study among a sample of Taiwanese commercial pilots. Pilots with higher self-efficacy levels were more motivated to perform safely (both in terms of safety participation and safety compliance) (Chen & Chen, 2014). In contrast, Salanova and colleagues (2012) showed that high levels of self-efficacy in high-risk environments were directly associated with low safety performance levels. For this reason, the authors observed 'overconfidence' in some risky work environments due to negative results as occupational accidents.

Table 1

Content extraction table - PsyCap and Safety Performance

Reference	IV	DV	Moderating (MO) Mediating (ME) variable	Population of interest (*n* =sample)	Type of study
Akanni et al, (2021)	• Self-efficacy	• SBs	//	Bank workers in Nigeria (*n* =155)	C
Wu et al, (2021)	• Human Capital (team capability capital, team psychological capital, and team social capital)	• Safety Performance (safety compliance and safety participation)	• Safety Citizenship behaviours (ME)	Engineering project teams in China (*n* =291)	C
Yuen et al, (2020)	• PsyCap	• SBs	• Burnout (ME)	Seafarers in Singapore (*n* =202)	C
Stratman et al, (2019)	• PsyCap	• Unsafe behaviours	• Cynicism (ME)	Workers from a variety of work settings in western Nebraska (*n* =130)	L
He et al, (2019)	• PsyCap[a]	• Safety performance (safety compliance and safety participation)	• Communication competence (ME)	Construction workers in China (*n* =655)	C
Wang et al, (2018)	• PsyCap[a]	• Safety performance (safety compliance and participation)	• Safety motivation (ME)	Construction workers in China (*n* =352)	C
1^ Study Wang et al, (2018)	• Safety-related stress • PsyCap[a]	• Safety performance (safety compliance and participation)	• PsyCap (MO)	Construction workers in China (*n* =359)	C
1^ Study Brunetto et al, (2016)	• PsyCap • Managerial support • Specific safety interventions	• In role safety performance	• Safety training satisfaction (ME) • PsyCap (ME)	Nurses working in six Australian hospitals (*n* =242)	C

Reference	IV	DV	Moderating (MO) Mediating (ME) variable	Population of interest (*n* =sample)	Type of study
Chen et al, (2014)	• Self-efficacy • Perceptions of Safety management system practices	• Safety Performance (safety compliance and safety participation)		Commercial pilot (*n* =239)	C
Salanova et al, (2012)	• Self-efficacy	• Safety performance (safety compliance)	//	(3rd study) Spanish Construction workers (*n* =228)	C
PSYCPSYCAP AS MEDIATOR					
Akanni et al, (2021)	• Psychosocial safety climate	• SBs	• Self-efficacy (ME)	Bank workers in Nigeria (*n* =155)	C
Cavazotte et al, (2021)	• Authentic Leadership (Morality and Selflessness)	• Safety Performance	• Psychological Capital (ME) • Organisational citizenship (ME)	Employees from company that operates in production, distribution, and sales of fuels in Brazil (*n* =307)	C
He et al, (2021)	• Leader-member exchange (LMX) • Safety climate	• Safety performance	• PsyCap (ME) • Safety climate (ME)	Construction workers in China (*n* =536)	C
Ye et al, (2020)	• Perceived management commitment	• Safety performance (safety compliance and participation)	• PsyCap (ME)	Frontline workers in China's coal mines (*n* =400)	C
2^ Study Brunetto et al, (2016)	• Managerial support • Specific safety interventions	• In role safety performance	• Safety training satisfaction (ME) • PsyCap (ME)	Nurses working in six Australian hospitals (*n* =242)	C
Chughtai (2015) [55]	• Ethical leadership	• Safety performance (safety compliance and safety participation)	• Self-efficacy (ME)	Doctors from large public sector hospital located in Pakistan (*n* =179)	C
PSYCAP AS MODERATOR					
Kim et al, (2019)	• Transformational leadership • Job strain	• Safety performance (safety compliance and participation)	• Self-efficacy (ME)	South Korean workers of different sectors (*n* =997)	C

Reference	IV	DV	Moderating (MO) Mediating (ME) variable	Population of interest (*n* =sample)	Type of study
2^ Study Wang et al, (2018)	• Safety-related stress	• Safety performance (safety compliance and participation)	• PsyCap (ME)	Construction workers in China (*n* =359)	C

Notes. [a]The PsyCap's sub-dimensions individually were also analysed.

n = sample

IV = independent variables

DV =dependent variables

ME = Mediator

MO =Moderator

SBs= Safety behaviours

SC = Safety compliance; SP = Safety participation

L= longitudinal; C= Cross-sectional

3.2.3. The mediating role of PsyCap between organisational factors and safety performance

The evidence that PsyCap has a real and significant impact on implementing safety behaviours was also demonstrated by other studies showing its role as a mediator (see Table 1). The studies presented below considered PsyCap's resources both independently and in terms of its multidimensional construct. The most recent contribution was from Cavazotte, Mansur and Moreno (2021), who showed that employee's PsyCap mediates the effect of authentic leader morality and selflessness on frontline safety performance. In line with this evidence are the results described by He, McCabe and Jia (2021) in which PsyCap mediated the relationship between Leader-Member Exchange and safety performance and safety climate and safety performance. Also, Akanni, Ajila, Omisile and Ndubuze (Akanni et al., 2021) showed the mediating role of self-efficacy in the relationship between the psychosocial safety climate and safety behaviour at work, demonstrating that self-efficacy enhances employee's compliance and participation. In line with these results are the findings proposed by Ye and colleagues (2020), who found that all four components of PsyCap explained the association between perceived management commitment and safety performance. Specifically, the authors observed that resilience was the primary mediator in the relationship between perceived management commitment and safety compliance. Hope was the primary mediator in explaining its relationship with safety participation (Ye et al., 2020). In addition, Brunetto and colleagues (2016), among a group of nurses, found that PsyCap completely mediated the impact of managerial support on in-role safety performance. Although Leader-Member Exchange is not directly related to in-role performance, it is positively associated with PsyCap, which strongly correlates with in-role safety performance. Finally, Chughtai's (2015) cross-sectional research in the Pakistani public health sector, showed that self-efficacy (as a single dimension) was a total mediator of the relationship between ethical leadership and safety performance.

3.2.4. The moderating role of PsyCap between job demands and safety performance

Additionally, in Table 1, the studies that report the moderating role of PsyCap are summarized. By conducting a moderated mediation model analysis, Kim and colleagues (Kim & Jung, 2019) found that job strain mediates the association between transformational leadership and safety behaviours. Moreover, they found that self-efficacy moderated the relationships between job strain and workers' safety behaviours. In addition, Wang and colleagues (2018) showed that PsyCap and its subdimensions positively influenced safety compliance and participation of construction workers, moderating the safety-related stressors' effects on safety participation. They demonstrated the role of PsyCap in reducing the negative impact of safety-related stress on safety behaviour among construction workers.

3.2.5. The role of psychological capital in accidents and injuries

Few studies have analysed the direct or indirect association between PsyCap and some safety outcomes, such as accidents or injuries at work. All the studies have considered personal resources independently, not in reference to the multidimensional construct of PsyCap (see Table 2). Following a descending chronological order, the first study selected for this review was carried out by Trinh, Feng and Mohamed (2019), who analysed resilience through the construct of resilient safety culture operationalized by three dimensions: psychological, behavioral and contextual. Their findings showed that the global score of resilient safety culture and its dimensions were significantly related to the decreasing of accident rate of a sample of project managers. Regarding psychological resilience specifically, the authors found that it had a weaker relationship with accident prevention under higher contextual resilience and behavioral resilience levels (Trinh et al., 2019). Always studying resilience, Lanz and Bruk-Lee (2017) found that psychological resilience moderates the indirect effects of interpersonal conflict and workload on job outcomes, including injuries. The authors carried out a longitudinal study among nurses employed in the US. Regarding conflict, they found that the mediating role of job-related negative affectivity on job outcomes was higher for nurses who had low

resilience and lower for highly resilient nurses. Finally, Chen, McCabe and Hyatt (2017) studied the relationship between psychological resilience, interpersonal conflicts at work, and safety outcomes in the construction industry. They found a significant negative correlation with conflicts at work, which in turn could decrease the frequency of physical safety outcomes.

Studying optimism instead, Mamo and colleagues (2014) hypothesized that drivers' beliefs in their ability to drive safely in a work vehicle would be positively related to their safety performance while driving. Contrary to what was expected, their results did not confirm this relationship and contrast with previous research. Partially different results come from the research conducted by Leung and colleagues (2010). The authors showed that occupational injuries were positively predicted by emotional stress and that optimism, defined as the ability to maintain a positive view of personal situations, turned out to be negatively correlated with emotional stress (Leung et al., 2010). For this reason, optimism can be considered a resource able to reduce poor safety behaviours.

Table 2

Content extraction table - PsyCap and Safety-related outcomes

Author/ Year	IV	DV	Moderating (MO) Mediating (ME) variable	Population of interest (*N*=sample)	Type of study
Trinh et al, (2019)	• Resilient safety culture (psychological Resilience, behavioural Resilience, and contextual Resilience)	• Safety outcomes (Accident rate)		Construction project managers from Vietnam (*N*=78)	C
Lanz et al, (2017)	• Workload • Interpersonal conflict	• Job outcomes (turnover intentions) • OHS outcomes (burnout and injuries)	• Resilience (MO) • Job-Related Negative Affect (ME)	Nurses working across medical units in the US (*N*=97)	L
Chen et al, (2017)	• Interpersonal conflicts at work	• Safety outcomes (physical injuries, such as an eye injury and unsafe events, such as struck against something fixed)	• Resilience (ME)	Construction workers in Canada (*N*=837)	C
Mamo et al, (2014)	• Self-efficacy	• Driving behaviours (traffic injury and death)		Work-related drivers in Addis Ababa, Ethiopia (*N*=213)	C
Leung, et al, (2010)	• Optimism • Job stress • Emotional stress	• Safety Outcomes (Injury incident)		Workers in the construction industry in Hong Kong. (*N*=142)	C

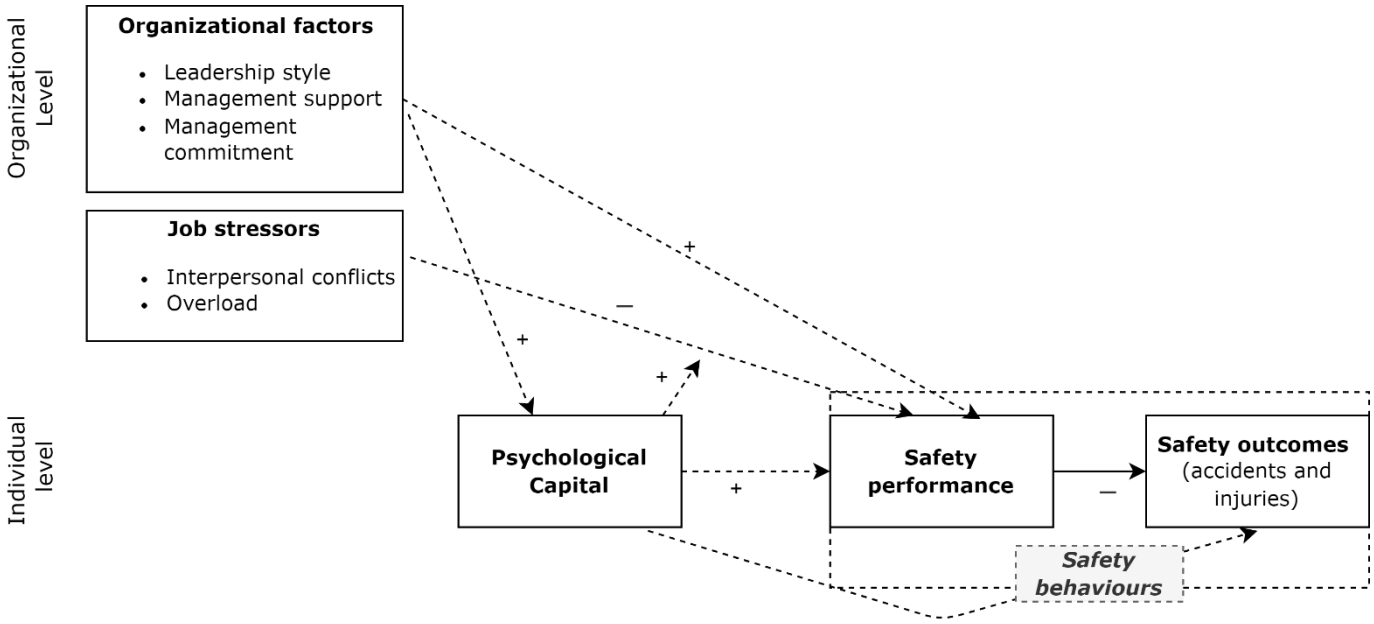
Note. L= longitudinal; C= Cross-sectional

4. DISCUSSION

Starting from ISM (Beus et al., 2016), this systematic literature review aimed to summarize available evidence regarding how PsyCap determines safety behaviours (*i.e.*, safety performance and prevention of occupational accidents and injuries) in the workplace. The supposed relationships between identified variables have been summarized in Figure 2.

Figure 2

Relationship between the studied variables – Adapted from ISM (Beus et al., 2016)



Notes. The variables included in the boxes are those analysed in the studies included within the systematic literature review.
+ indicates positive relationship between variables.
- indicates negative relationship between variables.

First, the findings suggest that PsyCap has the potential to influence the safety behaviours of different categories of workers directly and positively. The results of this review are based on studies conducted in different work sectors (*e.g.*, banks, constructions, hospitals) suggesting that PsyCap, as personal resource, is effective in promoting safety behaviours regardless of the sector, the activity and the type of risks workers are exposed to. Beyond the studies included in the review, other authors (Avey et al., 2011; Luthans & Youssef-Morgan, 2017) showed that PsyCap is more effective at promoting positive organisational outcomes within service sectors than in the industrial ones.

Furthermore, PsyCap has an indirect, positive effect on safety behaviours by reducing cynicism (Stratman & Youssef-Morgan, 2019), and by increasing safety citizenship behaviours (Wu et al., 2021), communication competence (He et al., 2019), safety motivation (Wang, Wang, & Wang, 2018), and safety training satisfaction (Brunetto et al., 2016). In addition, PsyCap or its subdimensions emerged as a mediator in the relationship between some organisational resources (*e.g.,* ethical or authentic leadership and supportiveness or attentiveness to safety management issues) and safety behaviours. Based on those results, it was possible to recognize how personal, as PsyCap, and organisational resources contribute together to the promotion of safety behaviours. Indeed, safety behaviours can be observed in organisations where both organizational and personal resources are in place and supported to obtain compliance with safety standards and protocols. Personal resources not only interact with organisational resources but also with individual differences in facilitating the transition between leadership qualities and safety behaviours. One example would be cultural differences related to the country in which PsyCap has been studied. For instance, Luthans et al., (Luthans & Youssef-Morgan, 2017) in their review reported that in the United States as opposed to other countries, PsyCap seems to have a greater impact on its outcomes.

Other studies, included in this review, demonstrated the moderating role of PsyCap in the relationship between job demands or stressors and safety-related outcomes (Kim & Jung, 2019; Lanz & Bruk-Lee, 2017; Wang, Wang, & Xia, 2018). Taking up the ISM (Beus et al., 2016), the relationship between job demands, personal resources, and safety performance could be read in moderation. This result means that the relationship between high-stress job demands, and unfavourable safety behaviours can be reduced through high levels of PsyCap. When people have certain types of personal resources, the latter, through a 'buffer' effect, mitigates the negative impact of stressors on unsafe behaviours. The buffer effect occurs because resources lead people to perceive the situation as less stressful and influence their reactions. For this reason, personal resources contribute to the explanation of different safety behaviours.

Finally, a few selected studies (Chen et al., 2017; Lanz & Bruk-Lee, 2017; Leung et al., 2010; Mamo et al., 2014; Trinh et al., 2019) considered the measurement of accidents and occupational injuries as an outcome variable. Furthermore, it was difficult to identify a representative relationship pattern and more investigation into deep needs. In agreement with previous studies (e.g., Beus et al., 2016; Christian et al., 2009), we consider that safety performance is a more proximal indicator of workplace safety and more directly linked to antecedents such as personal resources (and thus PsyCap). Safety performance includes behaviors directly related to people's choices and decisions that generally precede the occurrence of accidents or injuries (e.g., not using personal protective equipment). Differently, accidents and injuries reflect the absence of safety after the damage has already occurred and are more linked to safety performance. Fewer accidents and occupational injuries should result directly from better safety performance (Beus et al., 2016; Christian et al., 2009; Nahrgang et al., 2011).

In conclusion, some of the studies included (Akanni et al., 2021; Chen & Chen, 2014; Leung et al., 2010; Salanova et al., 2012) consider the four resources that compose PsyCap individually, without referring to the higher-order construct. In this case, the patterns of association with safety behaviours seem to be the same, although in some circumstances, they present their 'dark side'.

4.1. The dark side of Self-efficacy and Optimism

Although the role of the personal resources of PsyCap seems to be supported from a theoretical point of view, there is no consensus over the research results. Some studies highlight the 'dark side' of self-efficacy (Salanova et al., 2012) and optimism (He et al., 2019). A possible explanation could be related to the complexity of the relationship between resources and performance, following different patterns. The relationship between the personal resource and safety outcomes would seem to be attributable to inverted U. High levels of resources lead to greater performance but only within certain levels, beyond which we instead obtain a lower performance. Workers who feel able to respond to their job's challenges and believe in having the right skills at a technical and professional level to

anticipate and avoid safety-related problems may have incurred overconfidence. In an 'overconfidence situation', they might have overestimated their skills and competencies, resulting in unsafe behaviours. In the same way, workers who positively view their future and their events could act following safety rules and protocols. Nevertheless, they could also underestimate the risk of incurring injuries or accidents and perform worse, resulting in a phenomenon called optimistic bias (Caponecchia, 2010; Caponecchia & Sheils, 2011; Dalziel & Job, 1997). This evidence makes it seem necessary to consider the level and presence of workers' personal resources, deeming both low and very high-level worrying.

Starting from all these suggestions, it would be exciting to understand whether even PsyCap, as a unitary construct, presents the same complex relation with safety behaviours. In the positive case, it would appear clear that it is necessary to consider the presence or absence of resources in the workers and their level, considering as alarming a deficient level as a very high level and the specific context in which the workers find themselves.

5. LIMITATIONS AND FUTURE RESEARCH

From a methodological perspective, the review's main limitation derives from the non-inclusion of all the types of contributions related to the topic. Indeed, the choice was to include only peer-reviewed papers to guarantee a high quality of evidence and reported findings (Aburumman et al., 2019). Despite this, the criterion could exclude potentially valuable studies and best practices from organisations, industry reports, or unpublished literature. It would be interesting to compare these results with other types of works, for example, doctoral theses or conference papers, to be sure not to incur 'publication bias'. It is also possible to insert articles that are not currently in English. All these materials could provide a more complete and articulated vision for the theme, thanks to the possible inclusion of studies with different or nonsignificant relationship patterns. In addition, almost all the studies included are cross-sectional and come from Eastern countries. When studying the association between PsyCap and safety behaviours, the results seem to be positive and promising in all countries.

To further understand how positivity might emerge and be used across cultures, future safety research must consider these cultural specificities as control variables or nuances to be accounted for and as intriguing and worthwhile border conditions. In particular, future longitudinal research could broaden the geographical perspective and carry out this research within Western contexts. It will be interesting to propose them within other contexts and verify whether culture or legislative aspects could be discriminants.

These studies would also be helpful in understanding if the results of these studies are generalizable. From a theoretical point of view, this review provided insight into the direct and indirect relationship between PsyCap and safety concepts, such as safety performance in organizations. However, safety behaviours are complex and multifactorial events that other variables could influence. Thus, other individuals (e.g., gender and personality) and organisational variables, such as organisational safety culture (Noor Arzahan et al., 2022), should be included in future longitudinal studies to understand their contribution to safety behaviours better using PsyCap.

Finally, future studies considering the measurement of accidents and occupational injuries as outcome variables are needed to identify relationship patterns with Psychological Capital.

6. PRACTICAL IMPLICATIONS

Improving workplace safety will be more efficient, considering the worker's PsyCap, its development, and monitoring. As part of acquiescence requirements, safety training is often mandatory. However, when safety training is only negatively oriented, compliance-based, or implemented due to accidents and injuries (Rosner & Markowitz, 2016), it can have a limited influence on worker motivation. As a result, workers will very rarely behave safely in a proactive, agentic, and intentional way. Human resource management and safety professionals can easily integrate PsyCap development into routine safety training events. Indeed, several training interventions have been designed to significantly increase PsyCap (Luthans, Avey, et al., 2006; Luthans & Youssef-Morgan, 2017). Others can still be

developed ad hoc based on the work context's characteristics. This type of intervention can also be conducted online without losing effectiveness (Luthans et al., 2008).

7. CONCLUSION

This review highlighted, for the first time, the role of PsyCap in promoting safety behaviours in organisations and preventing accidents and injuries. The extracted results suggest that, in most cases, when workers feel resourceful, they are more confident and engaged, and in turn, they are more focused on safety issues. Moreover, the resources belonging to PsyCap seem to have a role in the relationship between some organisational dimensions (mostly related to leadership and management) and safety behaviours. Finally, adequate levels of PsyCap could allow workers to cope better with high stress levels associated with job demands. Accordingly, they could better manage the safety requirements and take more significant actions to ensure proper compliance.

At the same time, too high levels of personal resources may lead the worker to underestimate the perceived risk of incurring accidents and injuries. For this reason, it seems necessary to consider the presence or absence of workers' personal resources and their level, assessing a deficient level as well as a very high level as alarming.

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CHAPTER TWO

The role of *hope* within the motivational process of the Job Demands-Resources Model applied to safety

1. INTRODUCTION

Nowadays, promoting a safer work environment is one of the organization's most significant challenges. In fact, despite the several interventions made, occupational accident and injury numbers continue to be high (International Labour Organization, 2021). The ILO calculates around 340 million occupational accidents and 160 million victims of work-related illnesses annually (World Statistic, 2022).

Although research in occupational safety and health is extensive (Beus et al., 2010, 2015, 2016; Christian et al., 2009; Hofmann et al., 2017; Nahrgang et al., 2011), most of the studies in this area have focused on safety prevention, investigating the human shortcomings and errors leading employees to incur in accidents and injuries. On the other side, personal and organizational resources' role in promoting safety behaviours (e.g., safety participation behaviours) has long been ignored.

However, some scholars suggest that the absence of adverse safety outcomes (such as accidents and injuries) does not provide evidence of the presence of safety within organizations (Beus et al., 2016; Reason, 1990). Accidents and injuries can only be evaluated to indicate the absence of workplace safety (Beus et al., 2016). In fact, not in all circumstances do accidents or injuries occur, even if the worker does not behave appropriately. Accidents typically depend on various elements (such as dangerous behaviors and underlying organizational deficiencies) that frequently coexist but do not always trigger accidents (Reason, 1990).

Therefore, through a safety promotion-oriented perspective, this study focuses on safety participation, defined as proactive and voluntary behaviors that are not mandated by the worker's role and that have an equal impact on workplace safety (e.g., attending safety meetings or assisting colleagues in hazardous conditions) (Griffin and Neal, 2000). The idea behind the present investigation is that the

presence of safety participation gives a direct signal of the presence of safety in organizations and, at the same time, reduces the probability of adverse outcomes (e.g., accidents and injuries).

Previous studies showed that some organizational antecedents could determine safety participation, such as supervisory and co-worker safety support, leadership style, or safety climate (Cudney et al., 2017; Griffin & Hu, 2013; Heng, 2021; Saedi et al., 2020; Syed-Yahya et al., 2022). The research has not addressed investigating the role that personal attitudinal resources (such as PsyCap; Luthans et al., 2006; Luthans & Youssef-Morgan, 2017) play in promoting safety participation behaviors.

Building on the findings of Chapter 1, which provides a general overview of the role PsyCap plays in promoting safe behaviors, the role of one of these specific sub-dimensions, Hope, will be explored in this research.

Even though hope has a lot of face validity and intuitive appeal, little research has studied its role in organizations. Even fewer studies have been concerned with investigating its association with safety behaviours (see chapter 1). Although it is outside the authors' intent to consider Psychological Capital as simply the sum of its component resources, but considering it as a superordinate and unitary construct (as defined by Luthans et al., 2006; 2017), the analytical study of how each of its sub-dimensions promotes safety behaviors remains a significant research interest. Indeed, in the authors' opinion, exploring the specific role of hope is attractive to provide a more in-depth picture of the role that all four PsyCap resources (Luthans et al., 2006; Luthans & Youssef-Morgan, 2017) play in promoting safety behaviors.

The relationship between hope and safety participation will also be investigated through its interaction with job resources (i.e., autonomy and management support), job dedication, and job demands (Nahrgang et al., 2011).

2. THEORETICAL BACKGROUND

2.1. Hope: definition and antecedents

Snyder and colleagues (1991, p. 287) defined hope as a "positive motivational state that is based on an interactively derived sense of successful (a) agency (goal-directed energy) and (b) pathways (planning to meet goals)." As a psychological construct, hope is made up of three fundamental conceptual foundations: agency, paths, and objectives. The will to achieve the intended or desired consequence might be thought of as the agency component of hope (Snyder, 2000, 2002; Snyder et al., 1996). As a result, hope entails the ability or motivation to achieve a goal. Furthermore, hope includes paths consisting of identifying goals and subgoals and different routes to reach these goals. Hopeful employees use contingency planning to anticipate hurdles to reaching goals or subgoals and develop numerous paths to achieving the desired outcome (Snyder, 2000). In other words, hope can be considered the will to succeed and the ability to recognize, clarify, and pursue a path to success (Snyder, 2000).

To the best of the authors' knowledge, most studies that focused on the variables that may be antecedents of hope are within psychological capital's (PsyCap) framework, or higher order construct made by the interaction of four personal resources: hope, efficacy, resilience, and optimism (Luthans et al., 2006; Luthans & Youssef-Morgan, 2017). Avey's (2014) literature review results underlined that there are at least four categories of PsyCap antecedents: individual differences (e.g., cognitive dispositions), supervision (e.g., leadership style), job characteristics (e.g., task complexity), and demographics (e.g., age, tenure, and gender).

The importance of deepening this topic is twofold. First, most studies have centered on analyzing its outcomes, while comprehending the antecedent is still superficial (Avey, 2014; Avey et al., 2011). Second, knowing what variables lead to higher or lower levels of hope is extremely useful for its development. A basic tenet of hope is its dynamic nature and malleability (Snyder et al., 1996), also considered a part of PsyCap (Luthans et al., 2007, 2008; Luthans & Youssef-Morgan, 2017). Therefore, our goal is to deepen this topic and test whether some job resources (*i.e.,* autonomy and management support) could be antecedents of hope. Accordingly to Morgeson and Humphrey (2006),

autonomy is a widely studied task characteristic that has a central place in motivational work design approaches (Campion, 1988; Hackman & Oldham, 1976). It refers to how (work methods) and when (work schedules) the work itself is accomplished and to the worker participation in the decision-making process. Referring to the UK's Health & Safety Executive (HSE) Management Standards Indicator Tool (Toderi & Balducci, 2015), management support refers to the encouragement, sponsorship, and resources the line management provides. For instance, the immediate supervisor can support his/her employees by providing adequate information and answering specific individual concerns. Thus, in this study, it is hypothesized that employees with sufficient job resources would feel efficacious, more capable of setting realistic goals for themselves and achieving them, and optimistic about their abilities and energy to reach them. This hypothesis is in line with previous research investigating the role of personal resources within the JD-R model framework (Xanthopoulou et al., 2007). Indeed, Xanthopoulou and colleagues (2007) showed that job resources (*i.e.*, autonomy, social support, supervisory coaching, and opportunities for professional development) were directly and positively associated with personal resources (i.e., self-efficacy, organizational-based self-esteem, and optimism). Considering that hope, as a part of PsyCap, could be viewed as a personal resource in the JD-R model (Grover et al., 2018) and that two of the three personal resources investigated by Xanthopoulou and colleagues (2007) are subdimensions of PsyCap, we hypothesize that:

H1: Job resources are associated with hope.

H1a: Autonomy is positively associated with hope.

H1b: Management support is positively associated with hope.

2.2. The relationship between hope and job dedication

Previous studies have been concerned with analyzing the effect hope, and PsyCap in general, can have in terms of positive organizational outcomes such as productivity, attitudes, behaviors, health, positive relationships and wellbeing, and work engagement (Avey et al., 2011; Luthans & Youssef-

Morgan, 2017; Newman et al., 2014). According to Schaufeli and Bakker (2004), work engagement is an active, positive work-related state that is characterized by vigor, dedication, and absorption. Its second subdimension, namely job dedication, is chosen in this investigation to understand better the motivational process of JD-R applied to safety. Job dedication is defined as being strongly involved in one's work and experiencing a sense of significance, enthusiasm, inspiration, pride, and challenge (Schaufeli & Bakker, 2011). From this perspective, it could be the most strictly related to hope. Specifically, hope, expressed by the persistent pursuit of goals and the proactive identification of pathways, may provide the willingness (dedication) to reach goals (Sweetman and Luthans, 2010). The selection of this component was also derived from a recent metanalysis by Mazzetti et al., (2021), where dedication is shown to be one of the most representative subdimensions of work engagement. The metanalysis indicates that it is positively associated with several personal resources (*i.e.*, self-efficacy, hope, optimism, and proactivity).

Whereas previous studies have extensively investigated the role of personal resources (e.g., self-efficacy, self-esteem, and optimism) in the prediction of work engagement within the JD-R framework (Bakker & Demerouti, 2017; Bakker & Sanz-Vergel, 2013; Mazzetti et al., 2021; Xanthopoulou et al., 2007, 2013), research on hope and work engagement has been limited. Despite this issue, each of the four PsyCap components has been shown to be conceptually related to work engagement (Sweetman & Luthans, 2010). Thus, the actual predictive role of hope remains to be tested. Therefore, we hypothesize that:

H2: Hope is positively associated with job dedication.

2.3.The relationship between hope and safety participation

Even though hope has a lot of face validity and intuitive appeal, little research has investigated its impact in the safety field. Some studies showed the association between hope and positive organizational outcomes, such as success, financial performance, employee retention, and job satisfaction (Peterson & Luthans, 2003), desirable work attitudes, such as job satisfaction and

organizational commitment (Larson & Luthans, 2006), and work happiness (Youssef & Luthans, 2007). Despite these promising results, only a few studies were conducted to investigate the role of hope in promoting safety. For example, two studies carried out with different samples of employees by Bergheim et al., (2013;2015) showed that the hope dimension was the only PsyCap dimension significantly related to safety climate. Specifically, air traffic controllers showed that the ability to redirect efforts to reach their objectives (*i.e.,* hope) impacts the safety climate. Employees. Other noteworthy results are summarized in the Chapter 1 literature review, indicating that hope, as a sub-dimension of PsyCap, is directly and indirectly associated with safety performance. Specifically, PsyCap is shown to be (1) positively associated with safety compliance and safety participation, (2) a mediator within the relationship between organizational factors and safety performance, and (3) a moderator in the relationship between some job stressors and safety performance. Despite these fascinating results, only three of the twenty studies included in Chapter 1 investigated the specific role of hope. One of these studies was conducted by Ye et al., (2020), who showed that hope was highly and positively associated with safety participation in a sample of 400 frontline workers in China's coal mines. Also Wang et al., (2018) found the same promising results among Chinese construction workers. Instead, He et al (2019) observed that hope was not directly related to safety behaviors (compliance and participation) but indirectly related to safety participation by communication competencies.

Considering that hope is associated with several positive organizational outcomes, it was hypothesized that it could also be associated with safety participation, fostering people to be more determined to participate in safety. We focused on this specific dimension of safety performance since the studies showed it to be more related to positive organizational resources such as safety climate (e.g., Brondino et al., 2012; Christian et al., 2009; Clarke, 2006) and high-quality leader-member exchange relationships (Hofmann et al., 2003). Indeed, employees must comply with safety rules and protocols because they are mandatory (*i.e.,* safety compliance), but they can choose to participate in

safety without any constraint. Because of the voluntary nature of participation and the motivational desire of employees to act safely, it could be more associated with personal resources (i.e., hope).

H3: Hope is positively associated with safety participation.

2.4.The Job-Demands Resources Model applied to safety: The role of hope

There is already evidence in the literature that JD-R can also be applicable and valuable within the safety context (Derdowski & Mathisen, 2023; Hansez & Chmiel, 2010; Li et al., 2013).

Nevertheless, the role that hope may play in this model remains to be investigated through studies. Indeed, only a few recent studies investigated its role (see Chapter 1).

The indirect relationship between job resources, work engagement, safety outcomes, and the indirect relationship between job resources, hope, and safety performance have already been tested (Margheritti et al., 2022; Nahrgang et al., 2011). Thus, the originality of the present study is the investigation of their interaction in promoting safety participation, placing this relationship within the motivational process of the JD-R model applied to safety. More specifically, it was hypothesized that having high-quality job resources help employees to be hopeful (*i.e.*, express persistent pursuit of goals and the proactive identification of pathways), be more dedicated at work, and behave more safely. Considering that hope and job dedication were independently judged mediators in the relationship between job resources and safety performance by previous studies, we hypothesized that they could also interact and act together, leading employees to participate in safety. For these reasons, we hypothesized the following:

H4: Hope and job dedication are serial mediators in the relationship between job resources and safety participation.

H4a: Hope and job dedication are serial mediators in the relationship between autonomy and safety participation.

H4b: Hope and job dedication are serial mediators in the relationship between management support and safety participation.

2.5. The Job-Demands Resources Model applied to safety: the role of workload

Generally, relationships between workload and workplace outcomes are expected to be negative. As workload increases to the point of overload, detrimental effects on psychological and physical health, as well as performance and effort, should be observed (Mansfield, 2018). Scholars have shown that excessive workloads stress employees and contribute to burnout, negatively impacting their work engagement (Llorens et al., 2007). A high workload could also increase the likelihood of employees enacting risky safety behaviors (Ghezzi et al., 2020), has a detrimental effect on safety performance (Bunner et al., 2018), and increase fatigue associated with the increased risk of incidents (Derdowski & Mathisen, 2023; Yuan et al., 2014). All these results indicate that workload has a direct and adverse effect on safety performance; thus, the higher the workload, the lower the likelihood that employees will perform safely.

At the same time, other studies on this field point out that job demands could also be challenging and opportunities to learn, achieve and show competence, leading works to behave better, viewing demands as opportunities for mastery, personal advancement, or future rewards (Bakker & Demerouti, 2017).

In this research, we are interested in deepening this topic, focusing on the role of workload within the relationship between job dedication and safety participation. We are interested in understanding whether workload also plays a role within the model's portion closest to outcomes. Specifically, this investigation seeks to understand whether workload moderates the relationship between job dedication and safety participation. We hypothesized that employees use all their energy to cope with the workload and do not behave safely when the workload is too high. This idea is supported by Hobfoll's (2002;2018) Conservation of Resources Theory (COR). Hobfoll (2002;2018) argued that constant exposure to sustained high job demands could exacerbate their impact on adverse organizational outcomes. Accumulated job demands increase the likelihood that all available energy resources on a given day will be exhausted, making it unlikely to have more to devote to other types of behavior. In our case, the workload should diminish the strength of the positive association between

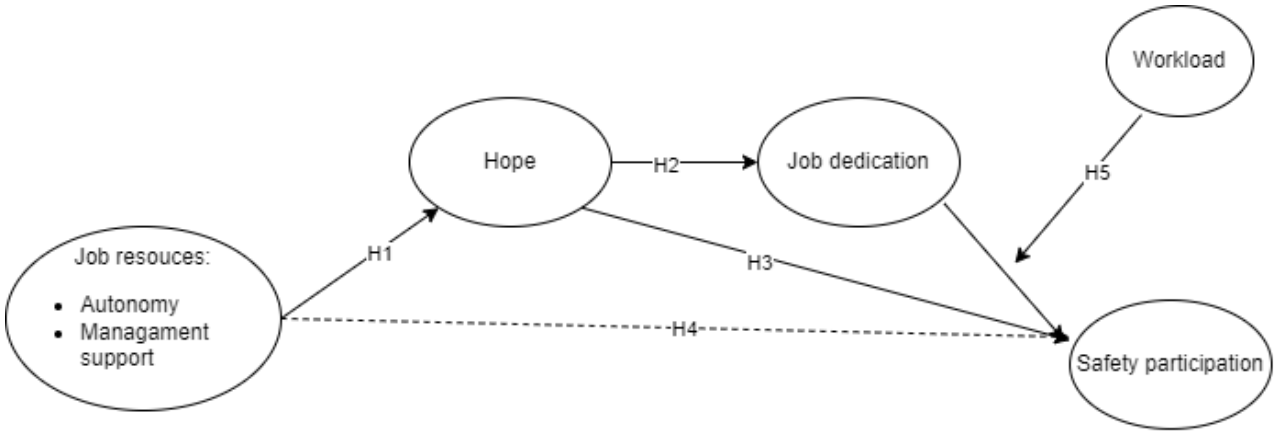
job dedication and safety participation, making the presence of job dedication insufficient for the realization of safety participation. Thus, lacking cognitive and energetic resources to devote to safety issues could lead to worse safety performance. We hypothesize from the previous results that the positive association between job dedication and safety participation does not remain constant across all workload levels. Specifically, we hypothesize that high levels of workload may diminish the strength of the relationship between job dedication and safety participation.

H5: Workload moderated the relationship between job dedication and safety participation.

To sum up, our conceptual model is shown in Figure 1.

Figure 1

Conceptual model



Note. H4 refers to the indirect effect between Job resources and Safety participation via Hope and Job dedication

3. METHOD

3.1. Sample

The sample was composed of 425 employees (53% female) of a multinational company focused on construction. Of these, 5% were less than 29 years old, 47.4% were 30–39 years of age, 34.1% were 40-49, and the others were older than 50 years. 88.4% of the participants had completed at least a university degree. Participants recruited worked in six European countries: Portugal (61.2%), Spain (15.6%), Germany (9.6%), Italy (8.9%), Romania (3%), and Greece (1.7%). Most employees worked

in the company's central offices (68%), mainly on a permanent contract (87%). Concerning the job role, 39.7% were team members, 18.3% were team leaders, 15.6% were managers, 13.5% were project team specialists, 10.5% were senior managers, and 2.4% were executives. The contract term was full-time for 96.7% of the employees.

3.2. Measures

Hope (3 items, α =.72), a sub-dimension of PsyCap, was measured using the relative dimension of the Psychological Capital Questionnaire (PCQ-24) developed by (Luthans et al., 2007). This is a Likert scale instrument. Sample items include "I can think of many ways to reach my current work goals".

Job resources: *Autonomy* (4 items, α =.80) was measured by the Work Design Questionnaire (WDQ; Morgeson and Humphrey, 2006). Example of item: "My job provides me with significant autonomy in making decision". *Management support* (3 items, α =.85) was assessed using the HSE indicator tool (Cousins et al., 2004). Example of item: "I can rely on my line manager to help me out with a work problem" (Supervisor support, 3 items).

The *job demand* (4 items, α =.85) was selected from the HSE indicator tool (Cousins et al., 2004) to measure issues such as workload and work patterns (e.g., "I have to work very fast"). Respondents answered eight items on a scale ranging from 1 "*never or strongly disagree*" to 5 "*often or strongly agree*", with lower scores indicating higher job demands.

Job dedication (3 items, α =.87) was assessed through the relative dimension of the short version of the Utrecht Work Engagement Scale (UWES-9; Schaufeli et al., 2006). Example of item: "I am proud of the work that I do". The response scale ranged from 1 "*never*" to 5 "*always*".

Safety participation (4 items, α =.81) was assessed using the safety performance scale developed by Griffin and Neal (2000). Examples of items: "I promote the safety program within the organizations" or "I put an extra effort to improve the safety of the workplace".

Hope, management support, autonomy, and safety participation were answered on a five-point ordinal scale from 1 "*strongly disagree*" to 5 "*strongly agree*".

3.3. Data analyses

The data were processed using IBM SPSS Software 27.0 (IBM Corp., 2021). Initially, descriptive statistics were calculated to understand the characteristics of the sample. Then, correlation analyses and ANOVAS were executed to test whether there were differences in our DV (safety participation) based on the socio-demographic characteristics of the sample. Since no significant difference was found in our DV based on sample characteristics, no covariates were included in our analyses.

In addition, the survey variables' intra-class correlation (ICC) was calculated. This analysis was carried out: a) considering the presence of participants from different nations, and b) to determine whether to proceed with multilevel analyses that would allow the nested nature of the data to be considered. Since the ICCs were found to be close to zero, and thus that observations within clusters were no more similar than observations from different clusters (Dyer, Hanges and Hall, 2005), the Mixed Model was not performed further.

Following the PROCESS macro (Model 6) developed by Preacher and Hayes (2004), the Bootstrap method was used to test the hypotheses from H1a to H4b. The bootstrap is a nonparametric approach that allows the effect size to be tested without making assumptions regarding the distribution of variables, nor does it require numerically large samples. This approach proves helpful in circumventing the problem of skewness and other non-normal sample distributions (Preacher & Hayes, 2004). The PROCESS macro provides a bootstrap estimate of the indirect effect, an estimate of the standard error, and the 95% confidence interval (CI): when zero is not included in the confidence interval, the indirect effect is significantly different from zero with $p<.05$; conversely, when zero is included in the 95% confidence interval, the test on indirect effects is found to be nonsignificant, with $p>.05$ (Preacher & Hayes, 2004). In the specifics of the present research, to test the hypotheses of moderated serial mediation (H5), the model 87 of Andrew F. Hayes' macro Process

model (V. 4) was used. The macro allows multiple mediators to be included, but only one independent variable and one dependent variable at a time; therefore, as many analyses were conducted, as there were VIs for each block of hypotheses.

4. RESULTS

Table 1 shows means, standard deviations, and correlations for investigated variables.

The correlation matrix shows that DV investigated (or safety participation) is not always significantly associated with IVs. Nevertheless, according to Preacher and Hayes (2004), there may be an indirect relationship between the variables through the action of an intervening mediator. Therefore, the PROCESS macro, precisely the Bootstrap method, was used to test the mediation hypotheses.

Table 1

Correlation matrix of the studied variables

Variable	M	SD	1	2	3	4	5
1. Autonomy	3.49	.76					
2. Management support	3.95	.92	.37***				
3. Hope	3.68	.66	.45***	.37***			
4. Job dedication	3.75	.78	.42***	.36***	.56***		
5. Safety participation	3.76	.63	.03	.10	.28***	.26***	
6. Workload	3.24	.81	- .39***	-.21***	-.25***	-.25***	-.18

Note. *** $p< 0.001$, ** $p< 0.01$, *$p< 0.05$.

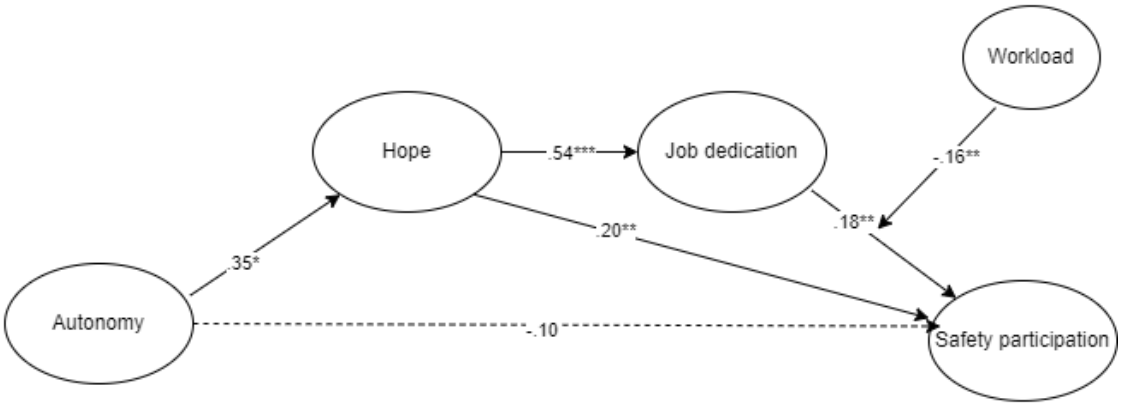
4.1. Serial Mediation Model

We used model 6 of the SPSS macro developed by Hayes (2013) to examine hypotheses H1, H2, H3, and H4. The effect of autonomy (H1a) and management support (H1b) on hope was supported. The effect of hope on job dedication (H2) and hope on safety participation (H3) was also confirmed. The main path coefficients (β) of these models are shown in Figures 2 and 3. Additionally, we found that the 95% confidence interval for the indirect effect of autonomy on safety participation through hope and job dedication (β = 0.33) did not include zero (CI [0.01;0.07]), suggesting a significant indirect

effect. Thus, we found support for H4a. Finally, H4b was supported as well (β = 0.02), indicating that hope and job dedication are also serial mediators in the relationship between the support from supervisors and safety participation (see Table 2). Also in this case, we found that the 95% confidence interval for the indirect effect did not include zero (CI [0.00; 0.05]).

Figure 2

The main effect on safety participation with autonomy as the independent variable

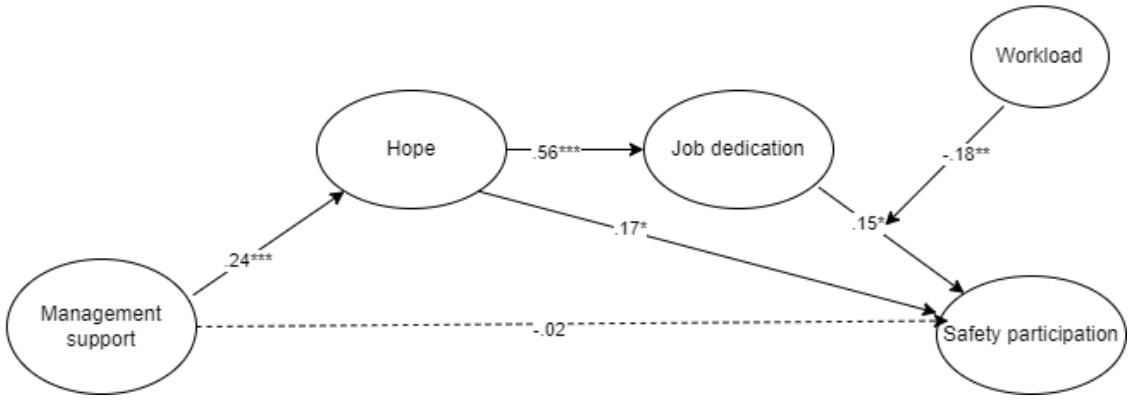


Notes. *p < 0.05, ** p < 0.01, *** p < 0.001

Dashed lines indicated not significant relationship patterns.

Figure 3

The main effect on safety participation with management support as the independent variable



Notes. *p < 0.05, ** p < 0.01, *** p < 0.001

Dashed lines indicated not significant relationship patterns.

Table 2

The indirect effect of hope and job dedication on safety participation

		Indirect effect on safety participation		Bootstrapping	
IV	Mediator\s	Point estimate	SE	Lower 95% CI	Upper 95% CI
Autonomy	Hope	.08	.03	.0160	.1495
Management support		.06	.03	.0050	.1205
Autonomy	Job dedication	.04	.02	.0058	.0913
Management support		.03	.02	.0028	.0649
	Hope and job dedication				
Autonomy (H4a)		.04	.02	.0119	.0703
Management support (H4b)		.02	.01	.0050	.0503

4.2. Moderated serial mediation model

To assess moderation effects where workload moderated the relation between job dedication and safety participation (H5), we used Model 87 of the SPSS macro developed by Hayes (2013). We found that the interaction between workload and job dedication significantly contributed to safety participation ($\beta = -.16$, $p < 0.01$). We plotted these interactions at +1/−1 SD from the workload mean (Aiken et al., 1991). As can be seen in Table 3, under low workload (−1 SD), there was a significant, positive relationship between job dedication and safety participation (see table 3). However, under a high workload (+1 SD), the relationship between job dedication and safety participation became not significant. These findings provided support for H5.

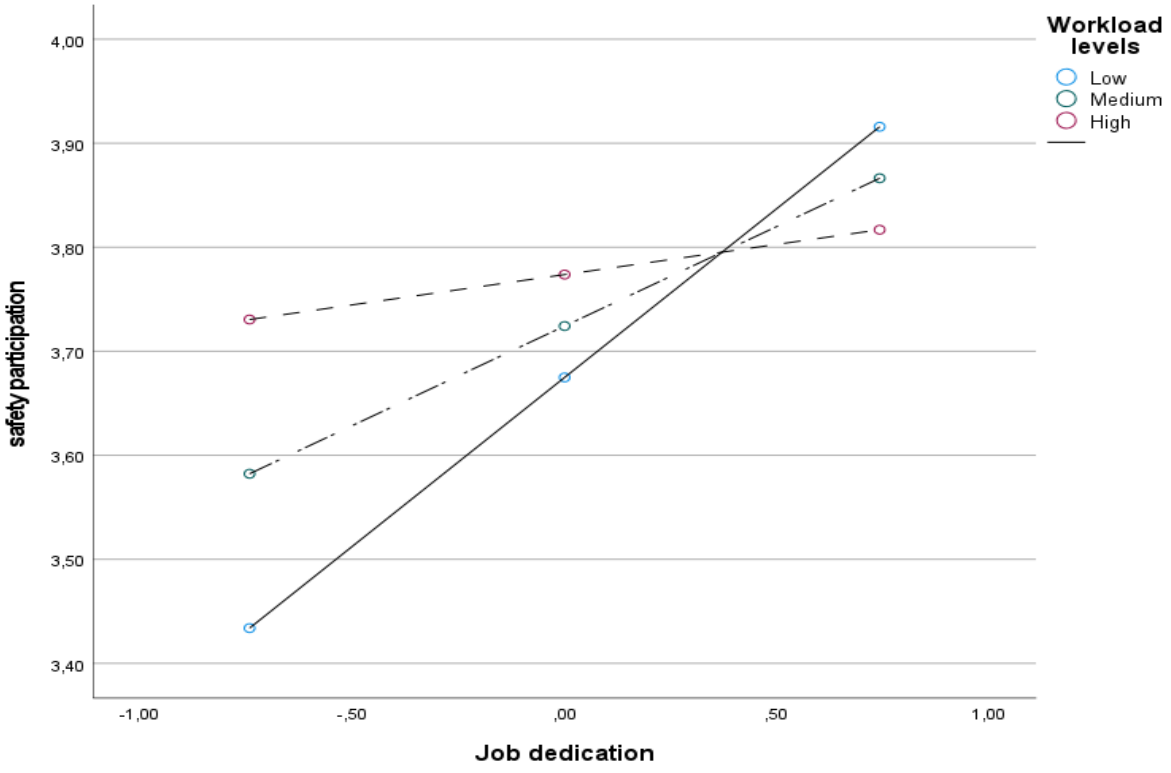
Table 3

Indirect conditional effect of job dedication on safety participation at the levels of workload

	The indirect effect on safety participation		Bootstrapping	
	Point estimate	BootSE	Lower 95 % CI	Upper 95% CI
VI autonomy				
Low workload (+1SD)	.33	.08	.1506	.4986
Medium workload	.19	.06	.0656	.3172
High workload (-1SD)	.06	.08	-.0895	.2057
VI supervisors' support				
Low workload (+1SD)	.32	.09	.1430	.5033
Medium workload	.18	.07	.0525	.3083
High workload (-1SD)	.04	.08	-.1094	.1846

Figure 4

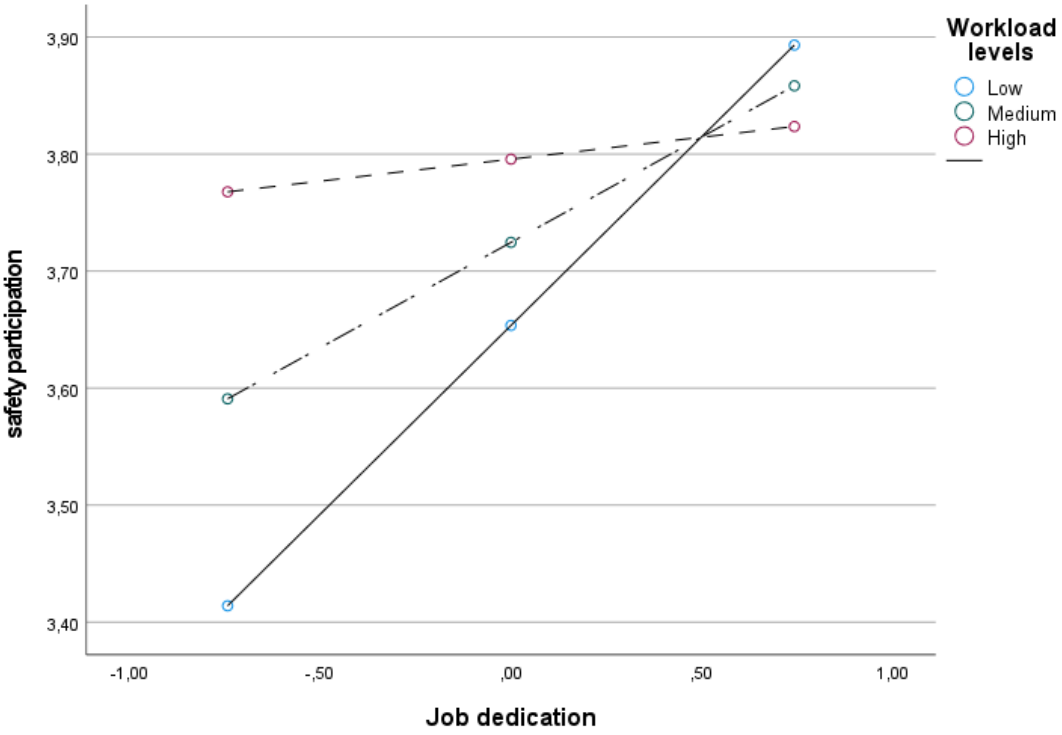
Indirect conditional effect of job dedication on safety participation at the workload levels



Note. Independent variable (IV): Autonomy

Figure 5

Indirect conditional effect of job dedication on safety participation at workload levels.



Note. Independent variable (IV): Management support

5. DISCUSSION

Within the framework of the JD-R Model applied to safety (Nahrgang et al., 2011), this study aims to assess the role of a specific personal resource (*i.e.*, hope) in promoting safety participation. The present study investigates the interaction between hope, job resources, dedication, and workload in promoting safety participation.

Our findings confirm the positive role of job resources, namely autonomy and management support in promoting hope (H1a and H1b). Specifically, having the possibility to manage tasks and timing at work makes employees hopeful, thus being able to identify goals and subgoals and different routes to those goals. The same when employees can do the same when employees can avail themselves of the support of their supervisors. Having the support of supervisors allows employees to focus on their goals, feel able to accomplish them, and experiment with alternative courses of action to achieve them. The findings align with JD-R Model (Bakker & Demerouti, 2007, 2017) and COR theory (Hobfoll, 2002; Hobfoll et al., 2018), indicating the close and mutual relationship between the job and personal resources. At the same time, these results broaden research on the antecedents of personal resources (Avey, 2014).

Regarding hope's outcomes (H2 and H3), our results suggest that job dedication and safety participation are positively associated. More hopeful employees will also feel more dedicated to work. Having goal-directed and planning to meet goals helps employees provide the willingness (dedication) to reach goals. Considering that job dedication, as part of work engagement, has been shown to be strongly associated with several positive organizational outcomes (Mazzetti et al., 2021), the development of hope should be considered an important point for organizations that want to promote health and safety. In addition, the strength of focusing on this type of personal resource is that it can be easily developed through interventions (Snyder et al., 1996).

The most important result of this investigation is that hope promotes safety participation. In fact, the study of the role of personal resources in promoting safe behavior is a new topic, still little explored within scientific research (see Chapter 1). Following Ye, Ren, Li, & Wang's (2020) study, we found

a positive association between hope and safety participation. This finding indicates that being able to think about achievable objectives, the ways to achieve them, and possibly be able to experiment with alternative courses of action leads the employee to devote himself with greater probability to safety participation behaviors. Confidence in one's abilities is also transferred within the safety framework, encouraging the worker to take action to create a work environment that is as safe as possible, going therefore beyond the simple respect of the rules linked to one's role (safety compliance). In addition, hope and job dedication (H4) can explain the association between job resources (autonomy and supervisors' support) and safety participation, indicating the serial mediation effect within this relationship. The fact that the direct impact of work resources on safety performance is not significant (Figure 2) means that the positive association occurs due to and solely due to the presence of the mediators (H4). Finally, this results in a greater likelihood that the latter will engage in voluntary and proactive safety-related behaviors.

Lastly, although work, personal, and aptitude resources seem to play a significant role in promoting safety participation, when the workload is too high, the virtuous effect of these resources disappears (H5). Workload enforces the role of organizational context, indicating that it is difficult to isolate the role of personal resources from other job characteristics. As COR theory Hobfoll (2002;2018) postulates, constantly being subjected to excessive job demands may negatively affect organizational outcomes. In fact, to be continuously exposed to one or more job demands raises the chance that all of one's energy reserves would be depleted on any given day, leaving little energy for other kinds of behavior. In our study, a high workload weakens the favorable connection between job dedication and safety participation, rendering job dedication insufficient to achieve safety participation. Therefore, poorer safety performance results from a lack of cognitive and physical resources to dedicate to safety-related concerns.

6. LIMITATIONS, IMPLICATIONS, AND FURTHER RESEARCH

The present study has some limitations. Firstly, the use of self-reported data, is criticized in the literature as it increases the likelihood of social desirability and common method bias (Howard, 1994). Future research should investigate the same phenomenon by including an analysis of objective dates related to safety behaviors (e.g., micro-accidents, accident rates, or the number of injuries) that eliminate this issue, giving more strength to our results.

The study's cross-sectional design is a second limitation, which would not allow for testing causality. Thus, in the present investigation, it is possible only claim the association between the variables. Future longitudinal studies are needed to understand the direction of the relationship between the variables considered.

To better understand the role of personal resources (such as hope) within the JD-R Model applied to safety, future research should also explore its association with other job resources (e.g., safety climate or support from colleagues), work attitudes (e.g., general work engagement or job satisfaction) and objective safety outcomes (e.g., accident rates, number of injuries and fatalities).

Despite the above limitations, the present study makes some significant theoretical and practical contributions. Firstly, it is one of the few studies, along with Nahrgang et al., (2011), to analyze the issue of promoting safety behaviors within the theoretical framework of the JD-R Model. The present research highlights how job and personal resources interact within its motivational process giving rise to better safety performance as well. This suggestion means that the model can also explain and predict these positive organizational outcomes.

Secondly, through this study, we can confirm the positive role of employees' hope in implementing safety participation behaviors. In this sense, the idea of analyzing the phenomenon of safety promotion through the lens of Positive psychology (Seligman & Csikszentmihalyi, 2000) is supported. It becomes possible not only to argue about the variables that lead employees to incur occupational accidents and injuries but also about the personal resources that, if developed and implemented, can give rise to virtuous safety behaviors. The practical implication consistent with

these results is the need for safety-training programs to focus not only on safety procedures or rules but also on improving employees' positive attitudes (e.g., hope). As part of acquiescence requirements, safety training is often mandatory. However, when safety training is only negatively oriented, compliance-based, or implemented due to accidents and injuries (Rosner & Markowitz, 2016), it can have a limited influence on worker motivation. As a result, employees will rarely behave safely in a proactive, agentic, and intentional way. Human resource management and safety professionals could integrate hope development into routine safety training events (Luthans et al., 2006; Luthans & Youssef-Morgan, 2017; Peterson & Luthans, 2003; Snyder, 2000; Youssef & Luthans, 2007), increasing their effectiveness greatly.

7. CONCLUSIONS

This international study has allowed understanding hope's role in promoting safety participation in organizations and its relationship with job resources, dedication, and workload. It represents an innovative contribution to the literature on safety participation, investigating its promotion within the motivational process of the JD-R Model. Our results suggest some new opportunities for groundbreaking research focused on occupational health and safety promotion through the lens of Positive psychology.

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CHAPTER THREE

The role of Psychological Capital, job demands, and job resources in promoting safety behaviours

1. INTRODUCTION

Despite existing legislation, nowadays accident and injury rates continue to be high in the safety-critical organizations (SCOs) for which their prevention is a major challenge.

In Italy, the Legislative Decree n. 81\2008, and its subsequent integrations regulate this issue, containing many explicit references to the human factors principles application to prevent workers' accidents, fatigue, and work-related stress. The references consider both physical (the design of workplaces, work environment, illumination, noise, and temperature levels) and cognitive (mental workload and psycho-social stress risk) factors that can have important effects on occupational health and safety (OHS).

Although many interventions and initiatives have been implemented since the publication of this law, the problem of OHS remains, with even a growing trend of accidents and injuries in recent years (INAIL, 2022). Also the frequent and constant occurrence of as micro-accidents (i.e., minor individual injuries such as getting a cut or a small burn), has been recognized as an alarming indicator of the lack of safety in organizations (Meliá & Becerril, 2009). Therefore, it is necessary to develop research and interventions able to reduce the problem.

While a richness of high-quality research reviews into workplace safety management and accident causation already exists (Beus et al., 2016; Christian et al., 2009; Derdowski & Mathisen, 2023; Margheritti et al., 2022; Nahrgang et al., 2011), it remains necessary to deepen further discussion and application of more complete and integrated models that would consider the role of cognitive challenges, emotional states, job demands and resources (Derdowski & Mathisen, 2023). To meet this end and to go beyond the culture of "blamism" that underlies many research paper on "human error", this study gives particular attention to the role of personal resources, motivations, and beliefs regarding work abilities

or feelings about the occupational future. Specifically, the focus of this research is the investigation of the role of Psychological Capital (PsyCap; Luthans, et al., 2006) in influencing safety behaviours (i.e., safety performance and micro-accidents rate).

Several studies have already linked PsyCap to several employees' positive attitudes, behaviour, and performance at different levels of analysis (Avey et al., 2011; Luthans & Youssef-Morgan, 2017; Wu & Nguyen, 2019). Nevertheless, SCOs' workers face a work environment of high risk and pressure, which might affect their psychological state, making personal resources more or less effective in promoting safety performance. Therefore, it is remarkable to confirm the positive role of PsyCap within safety-critical context.

Griffin and Neal's model (Griffin & Neal, 2000; Neal & Griffin, 2006) has been taken into account to study workers' safety performance, classified into safety compliance and participation. *Safety compliance* includes involvement behaviours that would be part of a worker's role and are mandatory for their job (e.g., to use the appropriate personal protective equipment as indicated by the site health and safety plan). *Safety participation*, instead, involves voluntary aspects, including behaviour beyond the prescribed role of workers (e.g., to promote the safety program within the organization), extra-role behaviours (to put in extra effort to improve the safety of the workplace), or organizational citizenship behaviours (e.g., assisting colleagues in making sure they perform their work safely).

To achieve the overall goal of the research, or the investigation of the role of PsyCap in influencing safety behaviours, two studies were carried out in Italy. Both took into account the Job Demands-Resources Model (JD-R Model) applied to safety (Nahrgang et al., 2011).

The following paragraphs will jointly present the theoretical background and research hypotheses, while the methods and the results will be presented separately with reference to the specific study. The discussion, conclusion, and practical implications, instead, will present the research findings in an overall and organic sense.

2. THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESES

2.1. *Psychological Capital as a predictor of safety behaviours*

PsyCap is a psychological state derived from four different resources: self-efficacy, optimism, hope, and resilience (Luthans, et al., 2006; Luthans & Youssef-Morgan, 2017; Youssef & Luthans, 2007). When combined, these four resources compose a *higher-order construct* which is based on the commonalities these four first-order constructs share (Hobfoll, 2002) and which has been empirically supported (Avey et al., 2011; Luthans & Youssef-Morgan, 2017).

Previous studies demonstrated that PsyCap positively impacts employee work engagement, organizational citizenship behaviours, job satisfaction, and performance (Avey et al., 2011; Luthans & Youssef-Morgan, 2017; Wu & Nguyen, 2019). Resourceful employees showed to be more focused on their job and motivated to perform better. In addition, PsyCap allows people to be successful because they approach situations positively, supporting their self-determination and, consequently, self-worth (Paterson et al., 2014).

Considering this positive and promising evidence, we hypothesize that PsyCap also acts positively toward another type of performance, or safety performance. The same key mechanisms through which PsyCap operates, or cognitive appraisals, conation, positive emotions, and social relationships (Luthans & Youssef-Morgan, 2017), could act, allowing employees to be focused and motivated on the safety issue.

Some recent studies have already shown that PsyCap is positively related to safety, such as with safety climate (Bergheim et al., 2013, 2015; Eid et al., 2012) or safety leadership (Cheung et al., 2021). Also in chapter 1, it was shown that PsyCap can, directly and indirectly, affect safety performance within SCOs. Nevertheless, almost all the studies included in the review are cross-sectional, and the relationship remains to be further explored through a longitudinal perspective. For this reason, this research aims to deepen the association between PsyCap and safety performance using a longitudinal study design.

In this regard, it was hypothesized that PsyCap's allow employees to be more engaged in deepening their knowledge about safety rules and procedures (i.e., *safety knowledge*). The deepening and increased knowledge of these drive them to implement safety compliance behaviours. In fact, having greater knowledge of the objective rules related to one's role helps employees comply with them. Secondly, PsyCap's higher levels allow people to be more motivated about safety (i.e., *safety motivation*) and, in turn, perform more frequent safety participation behaviours. Safety participation behaviours are, in fact, discretionary and more related to people's proactivity as well as their motivation to make a difference with respect to an issue.

Thus, within study 1, the indirect associations between PsyCap and safety performance via safety knowledge and motivation were tested.

H1: *PsyCap influences safety performance (compliance and participation) over time.*

H1a: PsyCap (T1) influences safety compliance (T3) by safety knowledge (T2).

H1b: PsyCap (T1) influences safety participation (T3) by safety motivation (T2).

The studies' results about the role of PsyCap in preventing adverse safety objective outcomes, such as micro-accidents, are still inconsistent and need to be investigated deeply (Chapter 1). According to Beus and colleagues (2016), micro-accidents could be seen as lagging indicators of safety because they only reveal a lack of safety after harm has already been done, differently from safety performance (as a leading indicator) that can signal a lack of safety before an accident causes damage. As a result, safety performance is the most direct indicator of workplace safety than micro-accidents, and the most proximal behaviour associated with personal resources (Beus et al., 2016; Christian et al., 2009). Safety performance and safety objective outcomes are, at the same time, strictly related. Indeed, through their meta-analyses, Nahrgang et al. (2011) supported the natural expectation that safety performance behaviours are associated (albeit relatively weakly) with fewer accident occurrences.

Starting from these assumptions, within study 1, it was hypothesized:

H2: PsyCap indirectly influences the occurrences of micro-accidents through safety performance.

H2a: *PsyCap (T1) indirectly influences the occurrences of micro-accidents (T3) through safety compliance* (T3).

H2b: *PsyCap (T1) indirectly influences the occurrences of micro-accidents (T3) through safety participation* (T3).

2.2. *The intervening role of job demands in the relationship between Psychological Capital and safety performance*

Previous studies showed that when workers encounter high job demands, they are also less likely to have the physical and mental energy to take action to promote a safe work environment (Chapter 2; Wallace & Chen, 2005). Within safety-critical organizations (SCOs), where reducing job demands altogether is often not possible due to the characteristics of the work to be done, it becomes essential to identify which resources can help workers manage them.

Following Hobfoll's (2002; 2018) Conservation of Resources Theory (COR), when the workload is too high, employees use all their energy to cope with it and do not behave safely. Accumulated job demands increase the likelihood that all available energy resources on a given day will be exhausted, making it unlikely to have more to devote to other types of behaviour. Thus, job demands could diminish the strength of the positive association between PsyCap and safety performance, making them insufficient for behaving safely.

From another perspective, job demands could positively promote organizational outcomes (van den Broeck et al., 2010), particularly when job demands are challenging (LePine et al., 2005). Challenging job demands deplete employees' energy and stimulate them to put effort into their job, as they yield the promise of goal achievement and need satisfaction (van den Broeck et al., 2010).

Considering studies highlighting the positive role of Psychological Capital as a key personal resource in the realization of safety behaviour (Stratman & Youssef-Morgan, 2019; Wang, Wang, & Wang, 2018; Wang, Wang, & Xia, 2018), and other positive outcomes (Avey et al., 2011; Luthans & Youssef-Morgan, 2017; Newman et al., 2014; Nolzen, 2018), we believe that the latter can be effective even in the case of high job demands. In line with this hypothesis are the results of Bakker

and Sanz-Vergel (2013), who showed that challenging job demands strengthened the effect of personal resources (i.e., self-efficacy and optimism) on personal well-being.

Since the two different perspectives mentioned above, within study 1, it was investigated whether the effect of PsyCap on safety performance stays consistent within the job demands' levels. If not, whether job demands moderate the relationship between PsyCap and safety performance, reducing the virtuous effect when it is too high or accentuating it when interpreted as challenging.

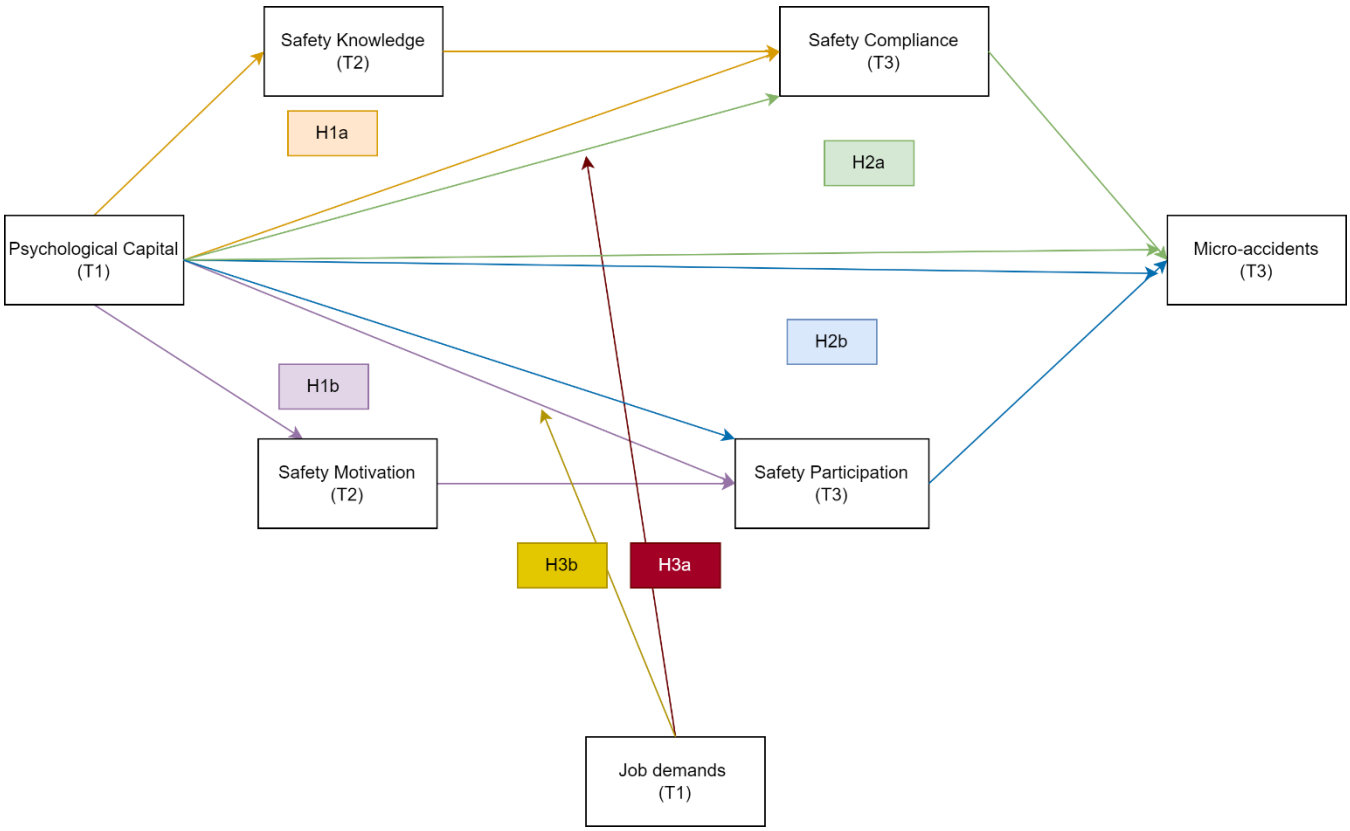
H3a: Job demands (T1) moderate the relationship between PsyCap (T1) and safety compliance (T3)

H3b: Job demands (T1) moderate the relationship between PsyCap (T1) and safety participation (T3)

All the hypotheses developed in study 1 are summarized in Figure 1.

Figure 1

The hypothesized theoretical Model (The PsyCap-Safety Model)



Note. T1 indicates data collected in the first wave, T2 and T3 indicate data collected in the second and third waves, respectively.

2.3. *The interaction between job resources and Psychological Capital in promoting safety performance*

Nahrgang and colleagues (2011), in their metanalytic analysis, found the presence of a motivational process as a mechanism through which job resources relate to safety outcomes. Analysing 203 independent samples, the authors found support for job resources such as knowledge, autonomy, and a supportive environment motivating employees and negatively relating to unsafe safety outcomes. These results confirm that the JD-R Model can also be used to explain and predict safety-related organizational outcomes.

Therefore, referring to the motivational process of the JD-R Model, within study 2 it was analysed the role of four job resources in promoting safety performance. Specifically, *social support, role clarity, feedback, and safety leadership* were considered.

Previous studies showed that increased *social support* could make it more likely to take action to improve workplace safety. Having instrumental or socioemotional support from others (e.g., through the division of tasks or empathy) may provide approval to adhere to and take part in safety improvement initiatives, as well as provide help from work pressures to allow for the implementation of these voluntary safety activities (Guo et al., 2019; Syed-Yahya et al., 2022; Tucker et al., 2008; Turner et al., 2012).

Being clear about one's duties and responsibilities (i.e., *role clarity*) also turned out to be an essential resource for implementing safety behaviours since knowing how one should behave in particular routines and emergencies is necessary. These job resources, such as social support and role clarity, have been recognized as valuable antecedents to safety behaviours, without which employees are less likely to be involved in safety performance (Griffin & Neal, 2000; Nahrgang et al., 2011).

In SCOs, supervisors play a crucial role in spreading workplace safety (Zohar, 2000, 2002). Through their feedback, workers effectively recognize the organization's safety regulations, learn how to perform their tasks safely, and develop a positive attitude toward safety (Zohar, 2002; Zohar & Luria, 2003). Supervisors can provide workers with relevant feedback to reward their safety behaviours and

substantially influence their safety knowledge and attitude toward safety (Zohar, 2002; Zohar & Luria, 2003). At the same time, a safety leadership style is a determinant in improving employees' safety performance. Leaders could utilize their influence on followers to achieve organizational safety targets under organizational and individual factors. In addition, scholars indicate that employees are more likely to provide safety when they feel that their organization encourages them and enjoy high-quality relations with their leaders (Eid et al., 2012). All this evidence confirms the role of job resources in promoting safety performance. Considering these results and the focus of this research, direct associations between job resources and safety behaviours will not be tested.

The role of PsyCap, as a personal resource has been extensively investigated within classical studies on the JDR Model (Bakker & Demerouti, 2017; Grover et al., 2018), however, its role remains to be deepened within the safety framework. Previous research showed that PsyCap reciprocally interacts with job resources, increasing engagement and motivation (Bakker & Demerouti, 2017; Chen et al., 2018; Lesener et al., 2019). Few explain whether their interaction can promote safety behaviours.

Some suggestions came from Chapter 1 of this dissertation, where the authors showed that PsyCap directly influences safety performance and interacts with job resources (such as safety leadership and management support) in influencing it.

In our opinion, PsyCap and job resources collectively contribute to promoting safety performance. Indeed, it can be observed in organizations where organizational and personal resources are in place and encouraged to comply with safety standards and protocols.

Starting with these suggestions, within study 2, it was hypothesized that PsyCap interacts with job resources in promoting safety performance (safety compliance and safety participation).

H4: PsyCap mediated the relationship between job resources and safety performance

H4a: PsyCap (T2) mediated the relationship between social support (T1) and safety performance (T3)

H4b: PsyCap (T2) mediated the relationship between role clarity (T1) and safety performance (T3)

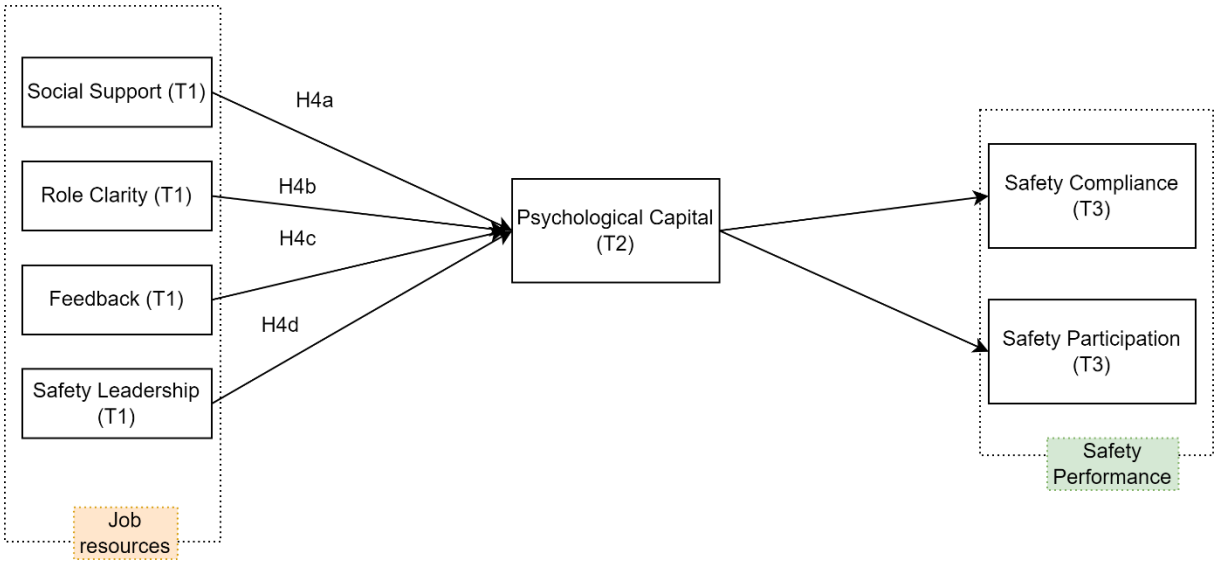
H4c: PsyCap (T2) mediated the relationship between feedback (T1) and safety performance (T3)

H4d: PsyCap (T2) mediated the relationship between safety leadership (T1) and safety performance (T3)

All the hypotheses developed in study 2 are summarized in Figure 2.

Figure 2

The hypothesized theoretical model 2 (The Job-Personal Resources Model of Safety)



Note. T1 indicates data collected in the first wave, T2 and T3 indicate data collected in the second and third waves, respectively.

STUDY 1

3. METHOD

3.1. Data collection

To test the hypotheses of the study 1 (and 2), a three-wave panel research was conducted with a time lag of 3 months between each wave. The reason for collecting data in three waves was that a minimum of three waves are necessary to test true causal effects in a mediation model (Cole & Maxwell, 2003; Maxwell & Cole, 2007). We assumed that this time interval would be adequate because researchers who have investigated similar constructs have imposed the same timing (e.g., Vogt et al., 2016). After having obtained the approval of the Research Evaluation committee, Department of Psychology, University of Milano-Bicocca (RH 2020-352), data collection started in April 2021 and closed in October 2022. This research involved workers from different Italian companies and sectors (i.e.,

automotive, manufacturing, energy, and railway). Organizations participated in the research following different data collection methods. Indeed, we first recruited participants from three organizations, presenting the research to their Human Resources (HR) manager and Health Safety and Environment managers (HSE), and got the authorization to distribute the surveys. Two of these firms' workers completed the questionnaire by pen and pencil, the others by link distributed by Qualtrics, an online platform to collect and archive data (Qualtrics). The different response process derives from the different possibility of workers accessing a professional mailbox during their working time. The others did not, and they were less accustomed to technology. We decided to accept the managers' requests of these companies, granting them the response method that would lead to the most reliable data possible. Secondly, to widen the sample, we recruited participants through one of the most important Italian trade union centers, which sent the search description and the link to access it to their subscribers that met our inclusion criteria. Specifically, to be eligible to participate, workers had to be aged 18 or more, speak, read and understand Italian, and work in an Italian organization as blue-collar or in a role that involves being in contact with safety risks (e.g., department managers or technicians who spend part of their work in production).

The research provided the compilation of three questionnaires due to its longitudinal structure. The structure of the questionnaires administered in the three measurement periods was similar, with the exception of the first one, which also contained questions about participants' sociodemographic information (*e.g.,* gender, age, education, job tenure and job role). They also provided us with an anonymous code used to match the questionnaires of the same respondent while maintaining anonymity. The code was requested also in the following two questionnaires. The average duration of a questionnaire administration (pen and pencil or online) was fifteen minutes (the first questionnaire lasted 25 minutes, the second and the third lasted 12 and 5 minutes, respectively).

3.2. Participants

A total of 331 people filled out the first questionnaire, of these 210 filled out the second and 175 filled out the third. Of the 331 initial participants, 47 stopped working (resigned, retired, or took leave) in the target organization and thus did not complete the next steps of the research. Taking only those subjects for whom it was possible to match all three questionnaires by the identification code, overall, the sample consists of 134 subjects (response rate= 40.79%). Considering that an average of 50 questionnaires could be matched for each organization, it was decided to analyse the data as a whole without referring to differences between companies. The decision was also related to respecting the privacy of the subjects who would be identifiable based on their membership in a specific company and their socio-demographic characteristics.

The sample was mainly composed of men (93.3%) with an average age of 39.8 (*SD*= 11.2). Regarding education, the 5.2% of the sample have an elementary school diploma, the 37.3% had a middle school diploma, the 54.5% completed high school and the 3% have a degree or post-degree. Most participants are blue-collar workers (88%), followed by technical office workers (7%), and production department managers (5%). Almost all of them have permanent employment contracts (94.7%) and work on average 41.6 hours per week (*SD*= 4.24). 45.5% of them declare to work in shifts. Their average job tenure is 18.3 years (*SD*=10.7).

3.3. Measures

The scales included in the three surveys (T1, T2, and T3) are described below.

- *Psychological Capital* (T1) was measured using the Italian version (Alessandri et al., 2015) of the 24-item Psychological Capital Questionnaire (PCQ-24) developed by (Luthans, Youssef, et al., 2006). Sample items include “I am confident analysing a long-term problem to find a solution” (efficacy), “There are lots of ways around any problem” (hope), “I usually manage difficulties one way or another at work” (resilience), and “I always look at the bright side of things regarding my job” (optimism). The Likert scale is from 1 (strongly disagree) to 6 (strongly agree).

- *Job demands* (T1) were assessed by the indicator questionnaire of the ISPELS-HSE model in the Italian version (Toderi & Balducci, 2015). It is made by 8 items, such as "I do not have the opportunity to take sufficient breaks" and "I have to work very hard". The Likert scale is from 1 (never) to 5 (always).
- *Safety performance* (T2 and T3) was measured by the Italian version (Toderi et al., 2016) of the safety performance scale developed by Griffin and Neal (2000). The scale consists of 16 items equally divided into four sub-dimensions: *safety knowledge* (e.g., "I know how to use safety equipment and standard work safety procedures"), *safety motivation* (e.g., "I feel that it is important to maintain safety at all times"), *safety compliance* (e.g., "I use all the necessary safety equipment to do my job") and *safety participation* (e.g., "I help my co-workers when they are working under risky or hazardous conditions"). The answer scale is from 1 (strongly disagree) to 5 (strongly agree).
- *Micro accidents* (T3**)** that occurred in the last six months are collected by a list of events proposed by Chen et al., (2017). Sample items include "I cut myself", "I got burned". Participants had to indicate how often these events occurred from 0 to 10. Following the guidance there Chen et al., (2017), responses were categorized as follows: discrete choices of "never," "once," "two to three times," "four to five times," and "more than five times" in the previous six months were created. For each of the questions, the micro-accidents were transcribed as 0, 1, 2, 4, and 5, respectively.

3.4. Data analyses

First of all, descriptive statistics were calculated to understand the characteristics of the sample and correlation analyses were executed to test the association between our variables using IBM SPSS 28.0 (IBM Corp, 2021). Secondly, a path analysis using R studio (Version 4.1.3) was performed to test the hypotheses.

Referring to hypotheses H1a and H1b, the hypothesized theoretical Model (The PsyCap-Safety Model) (Figure 1) included both the direct effect of PsyCap (T1) on safety knowledge (T2) and safety

motivation (T2) and the indirect effect of PsyCap (T1) on safety compliance (T3) and participation (T3) via safety knowledge (T2) and motivation (T2). In addition, the model (see H2a and H2b) included both the direct effect of safety compliance (T3) and participation (T3) on micro-accidents (T3) and the indirect effect of PsyCap (T1) on micro-accidents through safety performance (compliance and participation T3). Finally, in order to test the moderation effect of job demands, the model included the impact of the interaction between PsyCap (T1), and job demands (T1) on safety performance (compliance and participation T3) (see H3a and H3b). The correlation between safety compliance and participation was also included in the model because the two should influence each other from a theoretical point of view (Toderi et al., 2015).

Maximum likelihood estimates of path coefficients, R2 of endogenous variables, and chi-squares were obtained using the Lavaan package. To assess the model goodness-of-fit, we used the statistic criteria listed below: the non-significant $\chi 2$ value (this statistic suggests that if $\chi 2$ is non-significant, the model fits the data); root mean squared error of approximation (RMSEA; values smaller than 0.08 indicated an acceptable fit, values between 0.08 and 0.1 are marginal and values greater than 0.1 are poor); the comparative fit index (CFI values between 0.90 and 0.95 showed an acceptable fit); the standardized root mean square residual (SRMR; values smaller than 0.08 indicated a proper fit) (Hooper et al., 2008). If the model (M1) does not obtain sufficiently good fit indices, the modification indices will be also examined to identify the source of the misfit (e.g., a few omitted paths) (Maydeu-Olivares and Shi, 2017).

To analyse the regressions, mediations and moderations was used Lavaan package (0.6-10), through which it was possible to obtain the direct and indirect regression coefficients as well as their relative significance.

4. RESULTS

4.1. Preliminary analysis

Pearson correlation coefficients (Table 1) showed that all the safety performances' sub-dimensions (*i.e.,* knowledge, motivation, compliance, and participation) are positively associated with PsyCap, as well as micro-accidents. On the contrary, job demands do not correlate with any of the other survey variables.

Table 1

Correlation matrix of variables included in Study 1

	M	SD	1	2	3	4	5	6	7
1. PsyCap (T1)	4.45	0.62	(.88)						
2. Job demands (T1)	2.39	0.72	-0.164	(.85)					
3. Safety knowledge (T2)	4.23	0.62	0.515***	-0.005	(.81)				
4. Safety motivation (T2)	4.47	0.63	0.333***	-0.005	0.654***	(.77)			
5. Safety compliance (T3)	4.15	0.70	0.340***	-0.144	0.395***	0.407***	(.89)		
6. Safety participation (T3)	3.78	0.68	0.252**	-0.008	0.269**	0.262**	0.650***	(.70)	
7. Micro-accidents (T3)	20.1	18.4	-0.195*	0.122	0.020	0.010	-0.073	-0.109	(.88)

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2. Testing the PsyCap-Safety Model

We used the maximum-likelihood estimation method for the path analysis model because all variables in the model were normally distributed (Kline, 2011). The starting model (M1) fit was barely adequate ($\chi2$ (8) = 16.357, p = 0.038, CFI = 0.96, RMSEA = 0.09 (90% CI 0.02, 0.16), SRMR = 0.070). Thus, to improve the model, modification indices were also examined showing the presence of a direct association between PsyCap (T1) and micro-accidents (T3). Considering that this relationship is supported by previous studies (e.g., Chen, McCabe and Hyatt ,2017; Lanz and Bruk-Lee, 2017; Leung, Chan and Yuen, 2010; Mamo, Newnam and Tulu, 2014 Trinh, Feng and Mohamed, 2019; see also Chapter 1) and deserves longitudinal validation, it was added to our model. Then, the modified model (M2) was compared with the previous one (M1) by checking the increase in chi-square.

After the M1 modification indices review, the following model, (M2), showed an increase in model fit ($\chi2$ (7) = 11.526, p =0.117, CFI = 0.98, RMSEA = 0.07 (90% CI 0.00, 0.15), SRMR = 0.06.

Once checked the fit indices of the models, we compared the two models through the delta chi-squared test. The results are indicated in Table 2 and point to model 2 as the final model.

Table 2

PsyCap-Safety Model indices

Models	**χ2**	***df***	**CFI**	**RMSEA**	**SRMR**	**AIC**	**Comparison**	**Δχ2**
M1	16.357*	8	0.96	0.09 (0.02, 0.16)	0.20	1680.3		
M2	11.526	7	0.98	0.07 (0.00, 0.01)	0.06	1677.5	$M_1 - M_2$	0.02795 *

Note. * p< 0.05, ** p< 0.01 *** p< 0.001.

4.3. PsyCap as an antecedent of safety performance and micro-accidents

As reported in Figure 3, the path coefficient from PsyCap to safety compliance (β = 0.26; SE = 0.11, p = 0.013) is significant, as well as the coefficient from between PsyCap and safety knowledge (β = 0. 50; SE = 0.08, p < 0.001) and from safety knowledge to safety compliance (β = 0.23; SE = 0.10, p = 0.016). Regarding indirect effects, we found a positive and significant effect of PsyCap on safety compliance (H1a) via safety knowledge. All indirect effect coefficients and *p*-values are reported in Table 3.

On the other side, PsyCap is positively associated with safety motivation (β = 0. 35; SE = 0.08, p < 0.001) and safety participation (β = 0. 25; SE = 0.10, p = 0.012). However, safety motivation is not associated with safety participation (β = 0.03; SE = 0.09, p =0.74). We did not find a significant indirect effect on the relationship between Psychological Capital on safety participation via safety motivation (H1b).

For these reasons, H1 is only partially confirmed.

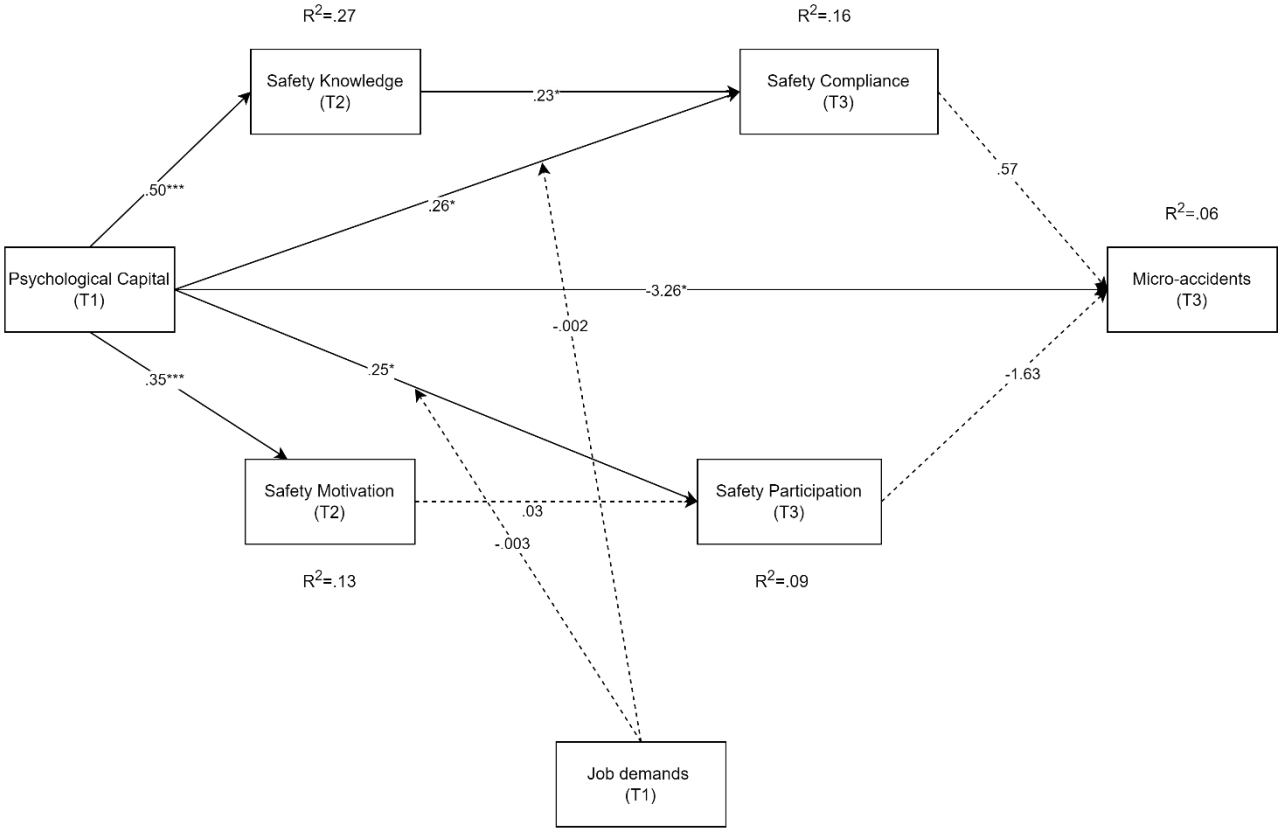
Concerning micro-accidents, we found a direct negative and significant association between PsyCap and micro-accidents (β = -3.26; SE = 1.47, p = 0.27), however, both the link with safety compliance (H2a) (β = 0.57; SE = 1.65, p =0.73) and safety participation (H2b) appear to be not significant (β =

-1.63; SE = 1.68, p = 0.33). In addition, we did not find a significant indirect effect on the relationship between Psychological Capital on micro-accidents.

Following these results, H2 is not confirmed.

Figure 3

PsyCap-Safety Model (Model 2) path coefficients (standardized)



Note. Dashed lines indicated not significant associations.

Table 3

Indirect effects of PsyCap on safety performance

Description	Estimate	SE	*p*
PsyCap ⇒ Safety knowledge ⇒ Safety compliance (H1a)	0.12	0.05	0.023
PsyCap ⇒ Safety motivation ⇒ Safety participation (H1b)	0.01	0.03	0.73

Description	Estimate	SE	*p*
PsyCap ⇒ Safety knowledge ⇒ Safety compliance ⇒Micro-accidents (H2a)	0.07	0.19	0.74
PsyCap ⇒ Safety motivation ⇒ Safety participation⇒ Micro-accidents (H2b)	-0.02	0.05	0.74

4.4. The moderating role of job demands in the relationship between PsyCap and Safety performance

A moderated path analysis was tested to investigate the extent to which the strength of the relationship between Psychological Capital and safety performance dimensions (i.e., compliance and participation), changes at different levels of job demands. The core finding was that the interaction effects between PsyCap and job demands on safety compliance (H3a) (β = -.002; SE = 0.002, p = 0.29) and from PsyCap and job demands on safety participation (H3b) (β = -.003; SE = 0.002, p = 0.08) were not statistically significant. Thus, H3 is not confirmed. This result suggested no differences in the PsyCap–Safety performance relationships for different levels of the moderator. Without the moderator effect, the direct association between PsyCap, safety compliance, and safety participation is positive and significant. Therefore, this result indicates that the association between the two variables occurs regardless of the level of job demands.

STUDY 2

5. METHOD

5.1. Data collection

The data collection procedure is the same as presented in section 3.1. Indeed, the data for both studies come from the same survey. A three-wave panel study was conducted with a time lag of 3 months between each wave. After obtaining the approval of the Research Evaluation Committee, Department of Psychology, University of Milano-Bicocca (RH 2020-352), data collection started in April 2021 and closed in October 2022. This research involved workers from different Italian companies and sectors (i.e., automotive, manufacturing, energy, and railway). Two of these firms' workers

completed the questionnaire by pen and pencil, the others by link distributed by Qualtrics. The different response process derives from the possibility of workers accessing an email box during work. Indeed, those who responded via the link had a company mailbox. The others did not, and they were less accustomed to technology. Secondly, to widen the sample, we recruited participants through one of the most important Italian Trade Union, who sent the search description and the link to access it to their subscribers that met our inclusion criteria. Specifically, to be eligible to participate, workers had to be aged 18 or more, speak, read and understand Italian, and work in an Italian organization as blue-collar or in a role that involves being in contact with safety risks (e.g., department managers or technicians who spend part of their work in production).

The research provided the compilation of three questionnaires due to its longitudinal structure. In the first one, workers answered questions about their sociodemographic information (*e.g.*, gender, age, education, job tenure, and job role). They also provided us with an anonymous code used to match the questionnaires of the same respondent while maintaining anonymity. The code was also requested in the following two questionnaires. The average duration of a questionnaire administration (pen and pencil or online) was fifteen minutes (the first questionnaire lasted 25 minutes, the second 12 minutes, and the third 5 minutes).

5.2. Participants

A total of 331 people filled out the first questionnaire, of these 197 filled out the second, and 163 filled out the third. Of the 331 initial participants, 47 stopped working (resigned, retired, or took leave) in the target organization and thus did not complete the next steps of the research. Considering only those subjects for whom it was possible to match all three questionnaires by the identification code, overall, the sample consists of 112 subjects (response rate=33.84%). Considering that an average of 50 questionnaires could be matched for each organization, it was decided to analyse the data as a whole without referring to differences between companies. The decision was also related to respecting the privacy of the subjects, who would be identifiable based on their membership in a specific company and their socio-demographic characteristics.

The sample was composed of 112 employees (92% male) with an average age of 39.6 (*SD*= 11.2). 4.5% of the sample have an elementary school diploma, the 33.9% had a middle school diploma, the 53.6% completed high school and the 8% have a degree or post-degree. Most participants are blue-collar workers (86%), followed by technical office workers (8%), and production department managers (6%). Almost all of them have permanent employment contracts (93.8%) and work on average 41.7 hours per week (*SD*= 4.28). Among participants, 41.1% of them declare to work in shifts. Their average job tenure is 17.97 years (*SD*=10.6).

5.3. Measures

The scales included in the surveys are described below.

- *Feedback* (T1) and *social support* (T1) were measured by the Italian version (Zaniboni et al., 2013) of the Work Design Questionnaire (WDQ) developed by (Morgeson & Humphrey, 2006). Examples of items are "my immediate supervisor and my colleagues give me feedback on my work performance" (feedback; 3 items) and "the people I work with take a personal interest in me" (social support; 6 items). The Likert scale is from 1 (strongly disagree) to 5 (strongly agree).
- *Role clarity* (T1) was assessed by indicator questionnaire of the ISPELS-HSE model in the Italian version (Toderi & Balducci, 2015). It is made by 5 items. Examples of them are "I am clear about what is expected of me at work" and "I know how to do my job". The Likert scale is from 1 (never) to 5 (always).
- *Safety Leadership* (T1) was assessed by the Italian version (Toderi et al., 2016) of Safety-Specific Transformational and Passive Leadership scale developed by (Kelloway et al., 2006). This instrument is made by 12 items. Sample items include "Express satisfaction when I perform my job safely", "Suggests new ways of doing our jobs more safely" and "Spends time showing me the safest way to do things at work". The Likert scale is from 1 (strongly disagree) to 5 (strongly agree).

- *Psychological Capital* (T2) was measured using the Italian version (Alessandri et al., 2015) of the 24-item Psychological Capital Questionnaire (PCQ-24) developed by (Luthans, Youssef, et al., 2006). Sample items include "I am confident analysing a long-term problem to find a solution" (efficacy), "There are lots of ways around any problem" (hope), "I usually manage difficulties one way or another at work" (resilience), and "I always look at the bright side of things regarding my job" (optimism). The Likert scale is from 1 (strongly disagree) to 6 (strongly agree).
- *Safety performance* (T3) was measured by the Italian version (Toderi et al., 2016) of the safety performance scale developed by Griffin and Neal (2000). The scale consists of 8 items equally divided into two sub-dimensions, each composed of four items: *safety compliance* (e.g., "I use all the necessary safety equipment to do my job") and *safety participation* (e.g., "I help my co-workers when they are working under risky or hazardous conditions"). The scale is from 1 (strongly disagree) to 5 (strongly agree).

5.4. Data analyses

Using IBM SPSS V.27, descriptive statistics were calculated to understand the characteristics of the sample. Then, correlation analyses were executed to test the association between our variables. In addition, to test the hypotheses, we performed a path analysis using R studio (Version 4.1.3).

Referring to hypotheses H4 (H4a, H4b, H4c, H4d), the model (M3) (figures 2 and 4) included the direct effect of job resources (T1) on PsyCap (T2) and the direct effect of PsyCap (T2) on safety compliance (T3) and participation (T3). In addition, to test mediation, indirect effects between job resources (T1) and safety performance (compliance and participation T3) via PsyCap (T2) were added. The direct effects of job resources (T1) on safety compliance (T3) and safety participation (T3) have not been hypothesized and estimated for theoretical reasons. In fact, while several studies have already tested these direct associations without considering the role of PsyCap (e.g., (Griffin & Neal, 2000; Nahrgang et al., 2011; Zohar, 2000, 2002) the present research focused on the intervening

role of PsyCap (T2) within these relationships. It was therefore decided not to re-test these direct associations but only to investigate the most parsimonious and estimable model according to the number of observations collected. Thus, only indirect associations via PsyCap were tested.

The correlation between safety compliance and participation was instead included in the model because the two should be associated from a theoretical point of view (Toderi et al., 2015).

Maximum likelihood estimates of path coefficients, R2 of endogenous variables, and chi-squares were obtained using the Lavaan package. To assess the model goodness-of-fit, we used the statistic criteria listed below: the non-significant $\chi 2$ value (this statistic suggests that if $\chi 2$ is non-significant, the model fits the data); root mean squared error of approximation (RMSEA; values smaller than 0.08 indicated an acceptable fit, values between 0.08 and 0.1 are marginal and values greater than 0.1 are poor); the comparative fit index (CFI values between 0.90 and 0.95 showed an acceptable fit); the standardized root mean square residual (SRMR; values smaller than 0.08 indicated a proper fit) (Hooper et al., 2008). To analyse the regressions and mediations was used Lavaan package (0.6-10) through which it was possible to obtain the direct and indirect regression coefficients as well as their relative significance.

6. RESULTS

6.1. Preliminary analyses

Pearson correlation coefficients (Table 4) showed a positive and significant association between social support, role clarity, and safety leadership with safety compliance and participation. In contrast, feedback did not correlate with those scales. Despite this, it was decided to test through path analysis the complete model by relying on theoretical reasons.

Table 4

Correlation matrix of variables included in Study 2.

Note. * p< 0.05, ** p< 0.01 *** p< 0.001.

6.2. Testing The Job-Personal Resources Model of Safety

	M	SD	1	2	3	4	5	6	7
1.Social support (T1)	3.57	0.82	(.76)						
2.Role Clarity (T1)	4.11	0.68	0.294***	(.76)					
3.Feedback (T1)	3.01	1.01	-0.401***	-0.176*	(.88)				
4.Safety Leadership (T1)	3.57	0.82	0.517***	0.294***	-0.356***	(.91)			
5.PsyCap (T2)	4.35	0.66	0.260**	0.426***	-0.003	0.125	(.90)		
6. Safety Compliance (T3)	4.15	0.70	0.317***	0.238**	-0.155	.0.230**	.0.453***	(.89)	
7. Safety Participation (T3)	3.78	0.67	0.209*	0.255**	-.0034	0.191*	0.419***	0.650***	(.70)

The hypothesized model (M3) fit was adequate ($\chi 2$ (8)9.998, p= 0.256, CFI = 0.984, RMSEA = 0.05(90% CI [.00; .13]), SRMR = 0.07.

Our model results (Figure 4) confirmed the direct effect of social support (β = 0.20, SE = .09, p = 0.029) and role clarity (β = 0.36, SE = .08, p < 0.001) on PsyCap but did not confirm the direct association between feedback (β = 0.10, SE = .06, p = 0.11) and safety leadership (β = 0.00, SE = .07, p = 0.99) on it.

6.3. PsyCap as a mediator between job resources and safety performance

Regarding indirect effect, our results supported only the indirect effect of social support (H4a) and role clarity (H4b) on safety compliance and participation via PsyCap (see table 5). No significant indirect effects were detected concerning feedback (H4c) and safety leadership (H4d).

Thus, Hypothesis 4 is only partially confirmed.

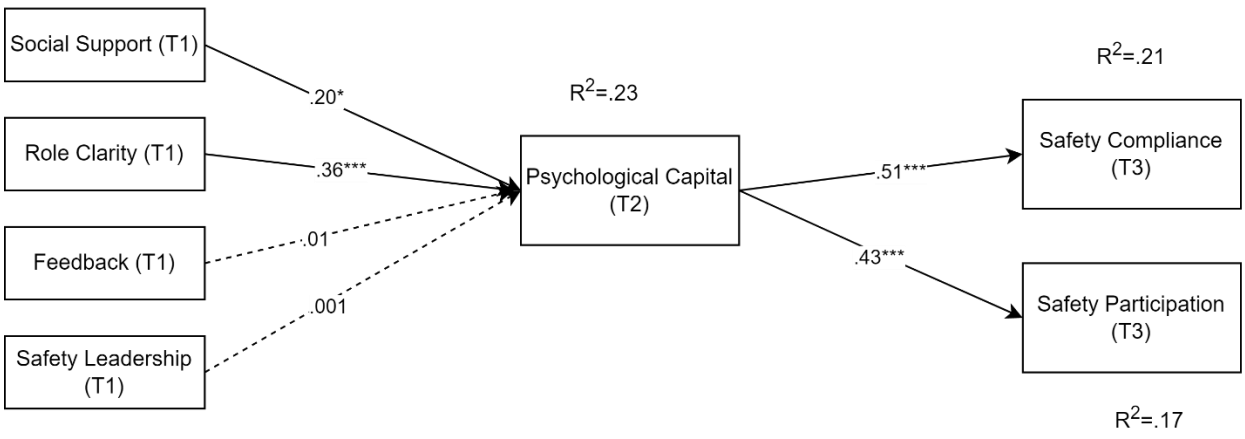
Table 5

Indirect effects of job resources on safety performance

Description	Estimate	SE	p
Social support ⇒ PsyCap ⇒ Safety Compliance (H4a)	0.10	0.05	0.043
Social support ⇒ PsyCap ⇒ Safety Participation (H4a)	0.09	0.04	0.047
Role Clarity ⇒ PsyCap ⇒ Safety Compliance (H4b)	0.18	0.05	0.001
Role Clarity ⇒ PsyCap ⇒ Safety Participation (H4b)	0.16	0.05	0.001
Feedback ⇒ PsyCap ⇒ Safety Compliance (H4c)	0.05	0.03	0.121
Feedback ⇒ PsyCap ⇒ Safety Participation (H4c)	0.04	0.03	0.126
Safety leadership ⇒ PsyCap ⇒ Safety Compliance (H4d)	0.00	0.04	0.990
Safety leadership ⇒ PsyCap ⇒ Safety Participation (H4d)	0.00	0.04	0.990

Figure 4

The Antecedents of PsyCap-Safety Model (Model 3) path coefficients (standardized)



Notes. Dashed lines indicate not significant relationships.

7. DISCUSSION

After presenting the specific methods and results of the two longitudinal studies separately, this discussion has been developed in an overall and organic sense.

The present research aimed to longitudinally investigate the role of PsyCap in promoting safety behaviours (i.e., safety performance and micro-accidents) within SCOs. In particular, the direct association between PsyCap and safety behaviours and its interaction with job demands (study 1) and resources (study 2) were explored.

Coherently with chapter 1 of this dissertation, study 1 showed that PsyCap is directly associated with safety compliance and participation. Therefore, higher levels of PsyCap allow workers to behave appropriately through their feeling about their personal resources. The same critical mechanisms through which PsyCap traditionally operates, or cognitive appraisals, conation, positive emotions, and social relationships (Luthans & Youssef-Morgan, 2017) act once more, allowing employees to be focused and motivated on the safety issue.

These results are in line with the mainstream literature indicating that PsyCap is linked with positive organizational outcomes (Avey et al., 2011; Luthans & Youssef-Morgan, 2017; Paterson et al., 2014; Wu & Nguyen, 2019), and studies focusing PsyCap within the context of occupational safety (Bergheim et al., 2013, 2015; Cheung et al., 2021; Eid et al., 2012; Margheritti et al., 2022). In addition, the present research shows that PsyCap is able to increase safety performance over time.

Regarding the indirect relationship between PsyCap and safety performance through safety knowledge and motivation, our results are only partially in line with the literature. Previous research (see metanalysis by Beus et al., 2016; Christian et al., 2009) showed that the relationship between safety climate, leadership, and personality traits directly influences safety knowledge and motivation, which directly affects safety performance. Following these suggestions, our hypothesis H1 was that the same association happened with PsyCap. We found only an indirect association between PsyCap and safety compliance via safety knowledge, confirming hypothesis H1a. PsyCap's higher levels allow workers to be more engaged in developing their understanding of safety rules and procedures that help them implement safety compliance behaviours.

Conversely, we did not find support for H1b that indicated that PsyCap motivates (safety motivation) workers about safety issues that engage them in safety participation. Our results support only the

direct association between PsyCap and safety motivation but not the link between safety motivation and safety participation. Therefore, the positive value of PsyCap remains evident in increasing worker's motivations to enact participatory safety behaviours, such as helping colleagues when they are at risk or actively advocating for participation in programs to promote safety in organizations. However, safety motivations do not always lead to safety participation behaviours.

The present chapter also investigated the indirect relationship between PsyCap and micro-accidents. For a more comprehensive analysis of the topic of organizational safety, it was essential to include within this study an evaluation of these types of events that went beyond the expression of safety attitudes. Following Beus et al., (2016), Nahrgang et al. (2011), and Christian et al. (2009), we hypothesized (H2) that PsyCap influences safety knowledge and motivation, which in turn directly influence safety compliance and participation. Then, safety performance (compliance and participation) is directly and negatively related to micro-accidents. In our opinion, higher levels of PsyCap increase safety performance as a safety-leading indicator. Safety performance should decrease the occurrence of micro-accidents precisely because of the increased realization by workers of safety behaviours, even extra-role.

Contrary to our expectations, the results did not verify the H2 hypothesis. Indeed, safety performance was not associated with a reduction in micro-accidents.

Nevertheless, our results again supported the positive role of PsyCap by identifying a direct and negative association with micro-incidents. Higher levels of PsyCap may have enabled workers to implement the appropriate strategies for reducing micro-accidents by leveraging their own coping skills and confidence in their abilities. At the same time, given the lack of direct association with safety performance, it could be that people with higher PsyCap levels simply underestimated the importance of micro-incidents, reporting fewer of them than they experienced. An optimistic view of past events may, in fact, have caused them to remember fewer of them or to evaluate some events as not to be declared having been handled with ease and without any negative impact on their work activity. This interpretation must be considered because micro-accidents were collected by self-

reported measures and were not objective. Thus, as with all self-reported measures, it is possible to incur several biases, such as recall bias (Althubaiti, 2016). In this sense, the results should be read critically.

Following the JD-R model applied to safety (Nahrgang et al., 2011) and COR theory (Hobfoll, 2002), the role of job demands within the virtuous relationship between PsyCap and safety performance was investigated. Its moderating role was tested (H3), without finding support in the data; therefore, the PsyCap-safety relationship remains consistent with all levels of job demands. This result indicates that regardless of whether workers must respond to high workloads, having high levels of PsyCap helps them focus on safety issues and thus perform safely. PsyCap turns out to be a positive resource that can help workers perceive that they are able to handle work stressors (Margheritti et al., 2022). This standpoint is very impactful within all those organizational settings where it is almost impossible to reduce workloads. Indeed, it suggests the presence of resources that can be developed to help workers in managing their workloads.

Finally, study 2 demonstrated that PsyCap could be considered a personal resource to be included within the JD-R Model applied to safety, interacting with job resources in predicting safety performance.

As hypothesized (H4a), having instrumental or socioemotional support (i.e., *social support*) from others increase PsyCap, that in turn helps people to be involved in voluntary safety initiatives (safety participation), as well as manage work pressures and comply with safety mandatory rules (safety compliance). Also, high levels of role clarity (H4b) are associated with safety performance through increased PsyCap. Having precise tasks, duties, and responsibilities help workers to behave safely, enabling them to have more confidence in their abilities (self-efficacy), to be optimistic about the development of the future (optimism), determined to achieve goals (hope), and able to react to mistakes (resilience).

In contrast, feedback (H4c) and safety leadership (H4d) were not indirectly associated with safety performance via PsyCap. Concerning these resources that are more linked to supervisors' behaviours,

it may be that these do not always affect personal resources (such as PsyCap) but directly impact positive safety performance as shown by Griffin & Neal, 2000; Nahrgang et al., 2011; Zohar, 2000, 2002; Zohar & Luria, 2003. However, in accordance with our hypotheses, Eid et al., (2012) suggested that PsyCap could be a critical intervening mechanism between leadership behaviour and safety outcomes (such as safety climate) in terms of raising worker motivation and mobilizing effort to maintain a sharp focus on safety issues, assess critical hazards and to be proactive to avoid adverse safety outcomes.

Thus, future research should explain these inconsistent results, for example, considering the interaction of other variables such as safety climate (Eid et al., 2012) or work engagement (Cheung et al., 2021) that could clarify the lack of significant relationship within our results.

8. CONCLUSION, LIMITS, AND FUTURE RESEARCH

The present research enriches the current body of knowledge by examining the impacts of PsyCap on SCO workers' safety behaviours (safety performance and micro-accidents), and the role of job demands and resources within the previous relationship.

It makes several contributions showing: (a) the antecedent role of PsyCap on workers' safety behaviours, which helps to understand the psychological mechanism of individual safety performance, (b) the non-significant role of job demands in the previous report indicating that the positive association always occurs, even when the workload is high, and (c) the mediating role of PsyCap between social support, role clarity and safety performance showing that it has a relevant role in the relationship between job resources and safety performance.

The main merit of the present research was to longitudinally test the association between PsyCap, job demands and job resources, and safety behaviours. Future studies could test the same associations by testing intervening mechanisms within the identified relationships (e.g., work engagement or safety climate).

In addition, future research could test the same relationships by involving a larger population of workers and investigating the influence of certain factors in specific SCO populations. Our sample is relatively small (with a high dropout rate) for conducting more complex analyses. The reason for such a high dropout can be related to several reasons. The first reason concerns the natural life cycle of workers within their organizations. In fact, a number (about 50) of people dropped out of the workplace during the nine months the research was conducted. In addition, the dropout rate is related to the failure to achieve cooperation (Leeuw & Lugtig, 2015). Considering that the first questionnaire was also the longest one, probably many workers were not motivated enough to participate in the second and third. To solve this problem, which is very common in longitudinal studies (Hogan et al., 2004), it might be helpful to provide economic incentives to participants (e.g., gift cards). This strategy would probably incentivize them to complete the entire search and adequately provide the required identification code so that they can be contacted again if they win.

For future studies, it is suggested that a larger population be involved and the two models be tested within one, including the role of other critical variables for the JD-R Model applied to safety.

Finally, to study the issue of occupational safety more comprehensively and objectively, it would be desirable to introduce objective indicators related to safety performance (e.g., evaluation of safety performance by co-workers or supervisors) and safety behaviours (accidents or injury rates coming from the company). Only this way is it possible to verify the real impact of PsyCap on these outcomes.

9. PRACTICAL IMPLICATIONS

The main findings of this research indicate that PsyCap can determine the increase of safety performance (safety compliance and participation), suggesting that its development could be helpful for safety behaviours promotions. Therefore, SCOs would be advised to create programs that encourage safe workplace behaviour, not only by reducing the distance between knowledge and compliance but also by encouraging efficacy, hope, optimism, and resilience which can help promote

safety behaviours. In this regard, traditional training should be supplemented with a part dedicated to developing PsyCap, with exercises applied in the context of safety.

There is rising support for the effectiveness of PsyCap development interventions (dello Russo & Stoykova, 2015; Luthans, Avey, et al., 2006; Luthans & Youssef-Morgan, 2017; Stratman & Youssef-Morgan, 2019). In addition, the development of PsyCap does not need a considerable investment of time or resources and can be reached in a few hours (Carter & Youssef-Morgan, 2022; Luthans, Avey, et al., 2006), also online (Carter & Youssef-Morgan, 2022; Luthans et al., 2008) not losing validity. With these pieces of training, employees are encouraged to stop acting unsafely and discover value in proactively and purposefully adhering to safety rules and regulations (Stratman & Youssef-Morgan, 2019). Thus, SCOs could easily integrate them, achieving great health, safety, and economic return.

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CHAPTER FOUR

General discussion

Despite the efforts carried out in the most virtuous and safety conscious organizations and at the legislative level, occupational accidents and injuries show no signs of decreasing. In Italy, throughout 2021, approximately 564 thousand work accidents were recorded. Over 480 thousand accidents happened directly in the workplace, while almost 84 thousand cases occurred during the journey to or from work (Statista, 2022). The data demonstrate the need to build different occupational health and safety systems by analyzing all available resources and skills, including psychological ones, to prevent this phenomenon.

In response to this need, the present dissertation focused on investigating the role of PsyCap (Luthans, Youssef, et al., 2006; Luthans & Youssef-Morgan, 2017) in promoting safety behaviour (i.e., safety performance) and preventing micro-accidents.

The main studies on the topic of occupational safety, summarized in the ISM (Beus et al., 2016), in the JD-R Model applied to safety (Nahrgang et al., 2011) and further meta-analysis (Beus et al., 2015; Christian et al., 2009; Clarke, 2012), did not consider PsyCap as a possible antecedent of safety behaviours. Nevertheless, PsyCap is now jointly considered, in the context of occupational psychology, as an essential construct for promoting organizational health and performance, given its significant impact on workers' attitudes and behaviours (Avey et al., 2008, 2011; Larson & Luthans, 2006; Luthans et al., 2010; Luthans & Youssef-Morgan, 2017; Sweetman et al., 2011; Sweetman & Luthans, 2010; W.-Y. Wu & Nguyen, 2019; Youssef-Morgan & Luthans, 2013). All the previous studies showed that workers with high levels of PsyCap are more likely to enact positive behaviours because they feel more able to handle the work environment and its demands (*i.e.*, self-efficacy), are optimistic about the occupational events that will occur (*i.e.*, optimism), are determined to achieve their goals (*i.e.*, hope) and resilient in the face of adverse events (*i.e.*, resilience).

From this dissertation perspective, the same mechanisms can help workers to be focused on safety issues and motivated to take action in its promotion.

4.1. EXPANDING THE INTEGRATED SAFETY MODEL (ISM)

4.1.2 The association between PsyCap and safety performance

All the results of the studies that made up this dissertation support the relationship between PsyCap and safety performance (compliance and participation).

Within the systematic literature review (chapter 1), the findings suggested that PsyCap can positively influence the safety performance of different categories of workers. Thus, resourceful employees are more able to focus on safety issues and behave safely. They are more engaged in complying with the rules related to their role (safety compliance) and more motivated to enact extra-role behaviors to construct the safest possible work environment (safety participation). Higher PsyCap levels enable employees to conduct themselves responsibly by sensing their personal resources. The same mechanisms that sustain PsyCap's conventional operation - cognitive appraisals, conation, positive emotions, and social relationships - again come into play, enabling workers to remain motivated and focused on the safety issue. Continuing the reading of the systematic literature review emerges that PsyCap has an indirect, positive effect on safety behaviours by reducing cynicism (Stratman & Youssef-Morgan, 2019) and by increasing safety citizenship behaviours (Wu et al., 2021), communication competence (He et al., 2019), safety motivation (Wang, Wang, & Wang, 2018), and safety training satisfaction (Brunetto et al., 2016). In this case, PsyCap interacts with some of the most impactful organizational characteristics to promote safety behaviours.

In accordance with these results are the findings from the cross-sectional study (chapter 2), where the specific role of one of the PsyCap sub-dimensions (i.e., hope) was investigated. The most important outcome of this investigation is that hope is able to promote safety participation. This finding indicates that being able to think about achievable objectives, the ways to achieve them, and possibly be able to experiment with alternative courses of action leads the employee to devote himself with greater probability to safety participation behaviours. Confidence in one's abilities is also transferred

within the safety framework, encouraging the worker to take action to create a work environment that is as safe as possible, going therefore beyond the simple respect of the rules linked to one's role (safety compliance).

The last studies of the dissertation (chapter 3) longitudinally supported that PsyCap is directly related to safety participation and compliance, which is consistent with earlier studies (chapters 1 and 2). In addition, the present chapter showed that PsyCap is able to increase safety performance over time. Thus, it is possible to conclude that not only are the variables associated but that PsyCap is an important predictor in the realization of worker safety performance.

Referring to the theoretical model of Griffin & Neal (2000) and Christian et al., (2009), in chapter 3, it was also tested whether Psycap is associated with the components of safety performance (i.e., compliance and participation) through their determinants or safety knowledge and motivation. This dissertation found only an indirect association between PsyCap and safety compliance via safety knowledge. Thus, PsyCap's higher levels allow employees to be more engaged in developing their understanding of safety rules and procedures that help them implement safety compliance behaviours. Conversely, there was no support for the association between PsyCap and safety participation via safety motivation. Our findings only support the direct relationship between PsyCap and safety motivation, indicating that workers' PsyCap increases their motivation about safety but does not prompt them to enact safety participation behaviours.

4.1.3 The association between PsyCap and micro-accidents

Another goal of this dissertation was to investigate the direct or indirect association between PsyCap and micro-accidents.

Within the systematic literature review (chapter 1) few selected studies (Chen et al., 2017; Lanz & Bruk-Lee, 2017; Leung et al., 2010; Mamo et al., 2014; Trinh et al., 2019) considered the measurement of accidents and occupational injuries as an outcome variable. Furthermore, it was

difficult to identify a representative relationship pattern and more investigation into deep needs. For this reason, the topic was investigated within a longitudinal study (study 3).

According to Beus and colleagues (2016), micro-accidents could be seen as lagging indicators of safety because they only reveal a lack of safety after harm has already been done, differently from safety performance (as a leading indicator) that can signal a lack of safety before an accident causes damage. Safety performance and safety objective outcomes are, at the same time, strictly related. Indeed, through their meta-analyses, Nahrgang et al. (2011) supported the natural expectation that safety performance behaviours are associated (albeit relatively weakly) with fewer accident occurrences.

Starting from previous findings, it was hypothesized that PsyCap was more related to safety performance and indirectly impacts micro-accidents, increasing the likelihood of behaving safely (i.e., safety performance). Contrary to our expectations, the results of chapter 3 do not verify the indirect association between PsyCap and micro-accident reduction via safety performance. Our findings provide another benefit of PsyCap by demonstrating a negative direct association with micro-incidents. Higher levels of PsyCap might have given employees the tools they needed to use their coping mechanisms and self-confidence to implement the right strategies for reducing micro accidents.

4.2. EXPANDING THE JOB DEMANDS-RESOURCES MODEL APPLIED TO SAFETY

This dissertation also contributes to safety literature, trying to expand the JD-R Model applied to safety (Nahrgang et al., 2011). Nahrgang et al., (2011), through their meta-analysis, provided an integrative theoretical framework that can account for the various job demands and resources and their relationship with safety outcomes (i.e., accidents, injuries, and unsafe behaviours). The current dissertation goes one step further by showing the role of PsyCap within these relationships.

4.2.1 The interaction between PsyCap and job resources in promoting safety behaviours

From the literature review (chapter 1), PsyCap or its subdimensions emerged as a mediator in the relationship between some organizational resources (e.g., ethical or authentic leadership and supportiveness or attentiveness to safety management issues) and safety behaviours. In this sense, safety behaviours can be observed in organizations where both organizational and personal resources are implemented and supported to obtain compliance with safety standards and protocols. Personal resources play determinant roles in enabling the transition between leadership qualities and safety behaviours.

Other studies also support these findings. Specifically, chapter 3 showed that having instrumental or socioemotional support (i.e., *social support*) from others increases PsyCap, that in turn helps people to be involved in voluntary safety initiatives (safety participation), as well as manage work pressures and comply with safety mandatory rules (safety compliance). Also, high levels of role clarity are associated with safety performance through increased PsyCap. Having precise tasks, duties, and responsibilities help workers to behave safely, enabling them to have more confidence in their abilities (self-efficacy), to be optimistic about the development of the future (optimism), determined to achieve goals (hope), and able to react to mistakes (resilience).

Moreover, chapter 2 supports that hope and job dedication together can explain the association between job resources (autonomy and supervisors' support) and safety participation, indicating to be serial mediators within this relationship. Thus, job resources activate employees' hope and make them feel more capable of controlling their work environment (Luthans & Youssef-Morgan, 2017; Snyder, 2002). Presumably, as a result, they are more dedicated to work, find meaning in it, and, in turn, behave safely (Youssef & Luthans, 2007). The findings also confirmed that more hopeful employees would feel more dedicated to work. Having goal-directed and planning to meet goals helps employees provide the willingness (dedication) to reach goals. Thus, hope and job dedication together are able to involve workers in safety participation.

The presence of an additional intervening variable in the relationship between job demands and safety outcomes, such as job dedication, further supports the presence of a motivational process applied to safety.

4.2.2 The interaction between PsyCap and job demands in promoting safety behaviours

The final interesting aspect emerging from the present dissertation concerns the role of job demands within the virtuous relationship between PsyCap and safety behaviours, following JD-R Model applied to safety (Nahrgang et al., 2011) and COR theory (Hobfoll, 1989; Hobfoll et al., 2018).

The systematic literature review (chapter 1) showed the moderating role of PsyCap in the relationship between job demands or stressors and safety-related outcomes (i.e., conflict and overload) (Kim & Jung, 2019; Lanz & Bruk-Lee, 2017; Wang, Wang, & Xia, 2018). This finding means that the relationship between high-stress job demands and unfavourable safety behaviours can be reduced through high levels of PsyCap. When people have certain types of personal resources, the latter mitigates the negative impact of stressors on unsafe behaviours through a "buffer" effect. The buffer effect occurs because resources make people perceive the situation as less stressful and influence their reactions. For this reason, PsyCap contributes to the explanation of different safety behaviours.

In line with these results, although from a different perspective, are the findings obtained from chapter 3. The latter longitudinally supports that the link between PsyCap and safety performance remains constant across all job demand levels. Thus, high levels of PsyCap assist workers in being motivated and focused on safety issues, which helps them execute safely regardless of whether they are dealing with an increased workload. PsyCap proves to be a helpful tool that might give users the impression that they can cope with workplace pressures.

Nevertheless, the issue of monitoring high levels of job demands remains essential and cannot be ignored. Proofs of this suggestion are the results of chapter 2, which show that although resources (i.e., hope and job dedication) play a significant role in promoting safety participation when the workload is too high, the virtuous effect of these resources disappears. Indeed, an increased workload

weakens the favorable connection between job dedication and safety participation, rendering job dedication insufficient to achieve safety participation.

4.3. METHODOLOGICAL LIMITATIONS

Although each study's limitations have been discussed in each chapter, this section will briefly summarize them.

The systematic literature review (chapter 1) did not include all the types of contributions related to PsyCap and safety behaviours. Indeed, the choice to include only peer-reviewed papers guarantees a high quality of evidence and reported findings (Aburumman et al., 2019) but excludes potentially valuable studies and best practices from organisations, industry reports, or unpublished literature. Chapter 1 also predominantly includes cross-sectional studies; therefore, the results obtained need to be read critically and verified through a more robust design. Also in chapter 2, it was adopted a cross-sectional design which did not allow us to make causal interpretations of the relationships between variables In adittion, considering the complexity of the models hypotesized in chapter 2, more sophisticated data analyses should have been conducted. For example, structural equation models or path analysis could have permitted testing all the associations between variables within the same model and provided more precise estimates. Studies of chapter 3, moreover, have a sample size relatively small with a very high drop-out rate. This aspect indicates possible problems during sampling and related data collection. In addition, chapters 2 and 3 did not include objective measures related to safety outcomes (i.e., accidents, injuries, or micro-accident rates), which were needed instead to capture the real impact of PsyCap on occupational safety. Finally, all measures included in the studies were self-report, and responses may have been subject to biases in participants (Hogan et al., 2004; Leeuw & Lugtig, 2015).

4.4. OPEN ISSUES AND SUGGESTIONS FOR FUTURE RESEARCH

The studies included in this dissertation had the merit of shedding light on a topic that has yet to be explored, namely, the role of personal resources (PsyCap or its sub-dimensions) in promoting safety

behaviours in organizations. Nevertheless, some aspects still need to be verified through future studies and investigated critically.

First, within the systematic review (chapter 1), some conflicting findings emerge regarding the direct and positive relationship between PsyCap and safety behaviours. Some studies emphasize the "dark side" of self-efficacy (Salanova et al., 2012) and optimism (He et al., 2019). Specifically, it seems that a higher level of these personal resources causes workers to behave unsafely. A possible explanation could be related to the complexity of the relationship between resources and performance, following different patterns. The relationship between the personal resource and safety outcomes seems to be attributable to an inverted U. Only up to a certain point do high resource levels result in better performance; after that point, it worsens. Workers who feel capable of meeting the job demands and possessing the expertise necessary to foresee and avoid safety-related issues may have developed overconfidence. In an "overconfidence situation," individuals might have placed too much stock in their knowledge and abilities, leading to risky conduct. Workers with a positive view of their circumstances and future actions may follow safety regulations and procedures. However, they could also overestimate the likelihood of suffering accidents or injuries and perform worse, giving rise to the optimistic bias (Caponecchia, 2010; Spitzenstetter, 2006).

This evidence makes it seem necessary to consider the level and presence of workers' personal resources, deeming both low and very high-level worrying. The results are not surprising when read in the context of PsyCap studies. In fact, even Luthans et al., (2017) suggest better investigating nonlinear relationships between PsyCap and outcomes. For example, there is evidence of "too much confidence in a good thing" in terms of overconfidence (Yeo & Neal, 2006), false hope (Polivy & Peter Herman, 2002), and unrealistic optimism (Peterson & Chang, 2003). Although the debate about these anomalies is ongoing (Luthans & Youssef-Morgan, 2017), the conflicting evidence indicates that potential nonlinear trends and boundary conditions need to be further explored, or at least taken into account in future safety research.

In line with this criticism, another aspect that should be further investigated is the direct association between PsyCap and micro-accidents identified in this dissertation (chapter 3). Indeed, workers with higher PsyCap levels may have underestimated micro-incidents' significance, reporting less of them than they encountered. A positive perspective on their past may have led them to remember fewer incidents or to assess some of them as not having been handled quickly and without detrimental impact on their work activities. Again, a high perception of personal resources may have distorted the perception of the dangerousness of certain events. Future studies should investigate the presence of this relationship through objective indicators of micro-incidents to avoid this possible bias.

To truly meet the goal of integrating the role of PsyCap within the JD-R Model applied to safety, it is necessary to proceed with further studies. In particular, investigating intervening mechanisms between job and personal resources and safety behaviours, such as work engagement. Work engagement indeed was the most attitudes variables considered within the study about JD-R Model (Bakker & Albrecht, 2018; Bakker & Demerouti, 2017; Mazzetti et al., 2021), proving to be a key attitudinal variable in linking demands, resources, and outcomes. Employees' engagement represents the extent of involvement, participation, and communication in safety-related activities (Nahrgang et al., 2011; Neal & Griffin, 2006; Saleem et al., 2022) and compliance, or the extent to which employees conform or submit to safety expectations, rules, and procedures.

Chapter 2 gives notice to this strand of studies by considering job dedication (as a dimension of work engagement) but without assessing the role of other sub-dimensions (i.e., vigor and absorption). All the dimensions investigated in terms of job resources and PsyCap should converge, making the worker more engaged (work engagement) on safety issues and thus lead to behaving safely. Either through adherence to formal rules (safety compliance) or voluntary behaviours designed to create the safest possible work environment (safety participation).

Similarly, future studies should explore the presence of a health (or safety) impairment process applied to safety. To do so requires not only considering the role of job demands and their interaction with resources in determining safety behaviours but also the presence of intervening mechanisms that

regulate these linkages. Nahrgang et al., (2011), within their meta-analysis, supported that burnout takes on this role. In workplace safety, burnout is reflected in negative employee well-being, which includes worker anxiety, health, depression, and work-related stress (Nahrgang et al., 2011). Stratman et al. (2019), moreover suggested that cynicism is precisely one dimension acting in the direction of reducing safety behaviours. The authors surmise that cynicism is exactly one of the causes of disaffection with safety issues. At the same time, however, cynicism can be reduced through PsyCap development interventions (Stratman & Youssef-Morgan, 2019).

4.5. CONCLUSION AND PRACTICAL IMPLICATIONS

The main contribution of the present dissertation is recognizing PsyCap's role in increasing safety performance (safety compliance and participation), suggesting that its improvement could be helpful for safety promotions. Exploring the role of PsyCap in promoting safety behaviours was an essential contribution to studies in this area, expanding the perspectives proposed in the ISM (Beus et al., 2016) and JD-R applied to safety (Nahrgang et al., 2011). Here, the issue of promoting safety in organizations is read through a different perspective that enhances the role of workers' resources instead of trying to reduce their shortcomings or errors.

The interest that has developed in recent years around PsyCap also stems from its malleable nature (Luthans & Youssef-Morgan, 2017). It is possible to develop it through ad hoc interventions implemented within organizations. There is rising support for the effectiveness of PsyCap development interventions (dello Russo & Stoykova, 2015; Luthans, Avey, et al., 2006; Luthans & Youssef-Morgan, 2017; Stratman & Youssef-Morgan, 2019) to improve desirable work outcomes. The development of PsyCap does not need a considerable investment of time or resources and can be reached in a few hours (Carter & Youssef-Morgan, 2022; Luthans, Avey, et al., 2006), or developed online (Carter & Youssef-Morgan, 2022; Luthans et al., 2008) not losing validity.

To the best of our knowledge, only one study (Stratman & Youssef-Morgan, 2019) has implemented interventions that can increase PsyCap'to impact safety behaviours. Thus, research and interventions on this topic remain to be developed. They could consider our significant findings as a starting point

to create programs promoting safe workplace behaviour. And it is not only by reducing the distance between knowledge and compliance, as currently done by traditional safety courses, but also by encouraging self-efficacy, hope, optimism, and resilience which can help to promote safety behaviours. In this regard, traditional training could be supplemented with a part dedicated to developing PsyCap, with exercises applied in the context of safety. The challenge for future research will be to design effective interventions that can develop PsyCap, motivate people to safety issues, and thus reduce the likelihood of the occurrence of occupational accidents and injuries.

We maintain *efficacy*, *hope* and *optimism* about the possibility of creating safer work environments by developing positive personal resources that will enable workers to be *resilient* and overcome obstacles in their path.

"There will always be rocks in the road ahead of us. They will be stumbling blocks or stepping stones; it all depends on how you use them".

Ci saranno sempre pietre sulla strada davanti a noi. Saranno ostacoli o trampolini di lancio; tutto dipende da come le usiamo.

(Friedrich Nietzsche)

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