VNIVERSITAT DE VALÈNCIA

ORGANISING MINDFULLY: EXPANDING MINDFUL ORGANISING'S NOMOLOGICAL NETWORK THROUGH TESTING PREDICTORS AND OUTCOMES IN HIGH RISK ENVIRONMENTS

DOCTORATE IN THE PSYCHOLOGY OF HUMAN RESOURCES

DOCTORAL THESIS

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GENERAL INTRODUCTION

The numerous, constantly evolving, systems and technologies that exist today allow us to continue to develop, prosper and advance humanity to live better connected and higher-quality lives. From nuclear power plants, aviation, to information system technology, humans have created wonderous complex systems that have had beneficial effects on our quality of life. However, we continue to grapple with devastating consequences and lost lives resulting from failures of these systems and accidents within these environments. For decades, scholars and practitioners from a plethora of disciplines have attempted to understand how to better manage safety and prevent accidents in countless high-risk industries worldwide. Through the insight gained from management and research over the years, we have learned a great deal about the socio-technical factors at play for safety management. These socio-technical factors are multifaceted and various authors have created frameworks and theories to give leaders and safety management practitioners tools to better manage safety. Despite the increasing sophistication in our understanding of risk and safety management, it is estimated that workplace fatalities are on the rise, with a recent report based on statistics from the International Labour Organization estimating that 2.78 million people die every year from occupational accidents and work-related illnesses (Takala et al., 2017). We are still left with the challenge of better understanding increasingly complex systems and creating better frameworks and tools to avoid accidents and keep people and communities out of harm's way.

As our systems continue to become more and more complex, our ability to manage safety does too, because the number of interactions between the social system (workers) and the technical system (technologies) in an organization continues to rise, making it impossible to map out every interaction that could happen. This rising complexity makes organizations more and more vulnerable to unexpected events that could lead to accidents and errors. Therefore, safety management theorists have started to shift their focus away from analysing the causes of errors and accidents (as this is becoming futile with rising complexity) and towards understanding how to build resilience in organizational systems so that unexpected events do not destabilise the system (Hollnagel et al., 2015). This lead scholars to study organizations that had very high levels of resilience, to try to extrapolate lessons of how to build resilience. Nuclear power plants and air traffic control centres immediately stood out as outliers in terms of resilience and reliability, as these organizations managed to operate within an exceptionally high-risk environment, with exceptionally low accident rates (Rochlin et al., 1987). They found that these organizations did experience unexpected events and errors, but these unexpected events and errors did not destabilise them (Weick et al., 1999; Schulman, 2004). Through analyses of how these organizations managed to achieve such high resilience and reliability, they saw that these organizations designed for safety on a systems level and had a very intricate understanding of their operations with highly mapped our procedures and protocols (Schulman, 2004). Beyond that, they exhibited the social and relational infrastructure that allowed them to expertly manage unexpected events (Weick & Roberts, 1993).

When analysing this social and relational infrastructure, researchers discovered that these highly resilient organizations had specialised team dynamics characterised by mindful actions and interactions (Weick & Roberts, 1993). These mindful actions and interactions allowed teams to be able to anticipate when something was about to go wrong, and quickly contain this potential problem before it caused more serious harm (Weick et al., 1999). They called these team dynamics “mindful organising”, and since its inception, it has been studied in numerous high-risk environments and has shown to have beneficial effects on safety performance (Sutcliffe et al., 2016). Mindful organising offers a promising framework to use to help other high risk organizations better manage safety. However, its current utility in research and practice is stunted due to a lack of clear conceptualisation of the construct, a lack of adequate quantitative backing, a limited understanding of the conditions needed to support and sustain it in organizations as well as limited insight into how it affects individual behaviour and attitudes (Sutcliffe et al., 2016). In addition, research has been criticised as not being socially embedded enough and too narrow in its level of analysis (Martínez-Córcoles & Vogus, 2020).

The aim of this present thesis is to add to the current literature on “mindful organising”. The present thesis tried to explore and address some of the theoretical and methodological shortcomings through empirical research addressing the nomological network of mindful organising in high risk environments (namely nuclear power and chemical plants). We do so by first explaining the evolution of safety management theories, with special focus on high reliability organization theory (Chapter I), we then move onto a theoretical review of the concept of mindful organising (Chapter II). Chapter III describes the objectives of this thesis and the methodology used to carry out each empirical study presented within this thesis. The four studies carried out for this thesis are found in Chapters IV, V and VI. Our first empirical study validates a mindful organising measure in a nuclear power plant, distinguishing it from other important team-based safety variables and in doing so, clarifies some conceptual ambiguities in Chapter IV. We then expand our understanding of which team safety and communication conditions are needed to create and sustain mindful organising and what impact mindful organising may have on team satisfaction and turnover. We do so by testing a structural equation model in a sample of nuclear power plant workers in Chapter V. We go on to test two multilevel mediation models using workers from two separate chemical plants in chapter VI. The first model explores whether mindful organising mediated the relationship between team safety climate and individual in-role and extra-role safety behaviour. The second model looks at whether individual role breadth self-efficacy mediates the relationship between mindful organising and in-role and extra role safety behaviours. We present a general discussion of our findings in Chapter VII. Finally, we finish with the most relevant conclusions drawn from our work in Chapter VIII.

CHAPTER I:
RISK AND SAFETY MANAGEMENT THEORIES

1.1. INTRODUCTION

This chapter will present and discuss various theories and paradigms used for understanding risk and safety in organizations. To do so, we begin by delving into where and why safety is important in organizations. Next, we present three significant theories used to understand safety in organizations: normal accident theory, high reliability organization theory as well as safety-I and safety-II. Lastly, we conclude by extrapolating lessons that can be learned from these contrasting theories.

1.2. SAFETY IN ORGANIZATIONS

Safety is of primary concern for millions of organizations across the globe where the consequences of the work done pose danger to employees, the environment and sometimes even to the broader community in which these companies operate. A few examples of industries where safety is of primary importance are construction, health care, manufacturing, aviation and nuclear power. Organizations operating in these industries have a strong moral and legal responsibility to do whatever they can to ensure the safety and wellbeing of all those that could be harmed by their operations. However, managing safety is not an easy feat, especially in a time where the complexity of technological systems are rising, making it more difficult than ever to fully understand and map out all of the interactions within the socio-technical system of an organization.

The context and features of an industry or organization are key to understanding risk management, with some organizations operating in environments that pose far broader and more complex challenges for managing safety than others. It is painstakingly clear that some organizations manage risk and prevent accidents far better than others. This sometimes extends to industries, as the lessons learned from approaches used in highly reliable organizations within one industry, may become implemented and become the safety standard in other organizations operating in the same industry.

Human error has shown to be the leading cause of major accidents and events in many risky and complex industries, such as health care (Makary & Daniel, 2016), the nuclear industry (Reason, 1990), aviation (Helmreich, 2000) and the petrochemical industry (Kariuki & Lowe, 2007). Focusing on human behavioural systems from a psychological perspective as the answer to better managing risk has been regarded as somewhat futile by certain scholars. For example, Perrow's (1984) normal accident theory argues that accidents cannot be controlled as they are a normal consequence of complex systems and researchers from the discipline of engineering such as Leveson et al. (2009) argue for a system's design approach to safety as the only way to effectively reduce human error. On the other hand, the merits and value of focusing on human behavioural systems have been endorsed in other theories such as safety-I and safety-II (Hollnagel, 2014) and High Reliability Organizations (HRO) theory (Rochlin, 1993; Sutcliffe, 2011; Weick et al., 1999). These theories are discussed and contrasted in the following sections.

1.3. NORMAL ACCIDENT THEORY

Perrow (1984) analysed the system characteristics of large-scale accidents to understand how high-risk technologies and operations unravel as well as how to best manage these technologies. As an organizational sociologist, Perrow was largely interested in the system perspective in analysing large scale risky operations and their impact on society. Therefore, he analysed the details of every failure and contributing factor that caused catastrophic accidents in a variety of sectors, such as aircraft crashes, the Three Mile Island nuclear accident, ship collisions at sea, dam collapses and DNA research. The analyses made and conclusions reached transformed the way many understood high risk organizations.

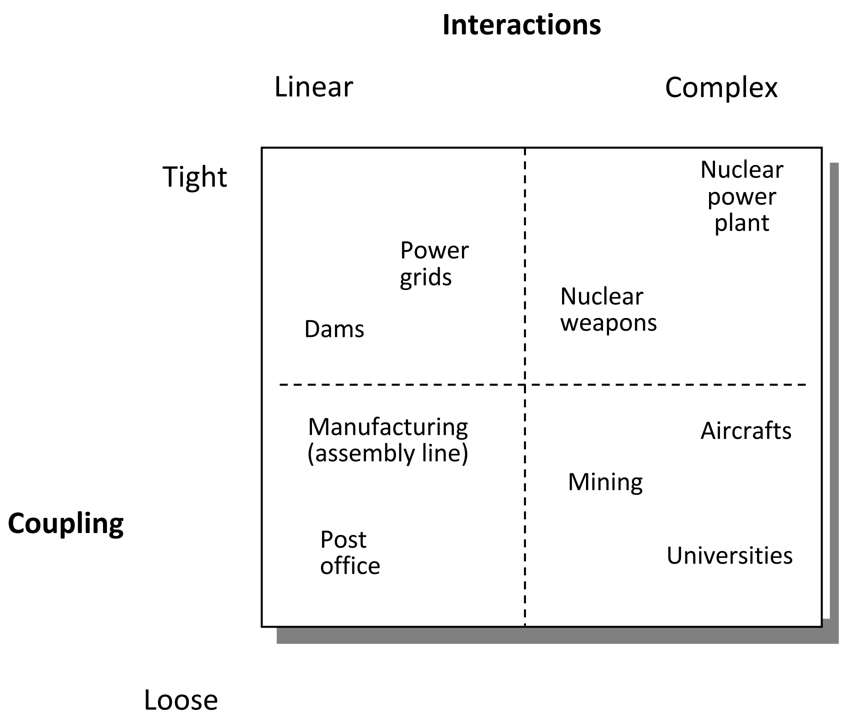
After his extensive and detailed case study research on various accidents in many different sectors, he categorized an organizational system into four levels. Level one is a small part of a system such as rudders, tubes or valves. Level two is the combination of small parts that form a unit such as a motor or an engine. Level three refers to a subsystem, which is the combination of many units such as a navigation set in an aircraft. Level four is the entire system, which sums up all the subsystems, such as an aircraft carrier. Perrow used these various levels of analysis to distinguish between incidents and accidents. An incident is when there is a failure in a small part of the system (level one) or a unit of the system (level two). An accident is when a subsystem (level three) or the whole system (level four) fails.

Perrow (1984) outlines two key interacting factors essential for understanding how organizational systems differ and how susceptible these organizations may be to accidents. These two factors are (1) coupling and (2) interactions.

In terms of the first factor, Perrow identified that an organizational system can either be tightly coupled or loosely coupled. This idea was originally proposed by Weick (1976). In Perrow's model (1984), he explains that coupling has to do with how much time or slack is tolerated between items within a system. He describes a tightly coupled system as rigid, intolerant of any delays and as having high interdependence among subsystems. This means that if there is a failure in one part of the system, it has big ramifications for other parts of the system. Tightly coupled systems are rigid and not easily malleable so back up safety features need to be designed into the system as there is no time for on-the-spot changes and intervention. Loosely coupled systems, on the other hand, refer to systems that are more flexible in their mechanisms of control and have decentralised operations. This means that when changes happen in one part of the system, it does not necessarily affect the rest of the system, meaning that there is more time allowed in responding to emergencies and more flexibility in how those working in the system can address and tackle these emergencies.

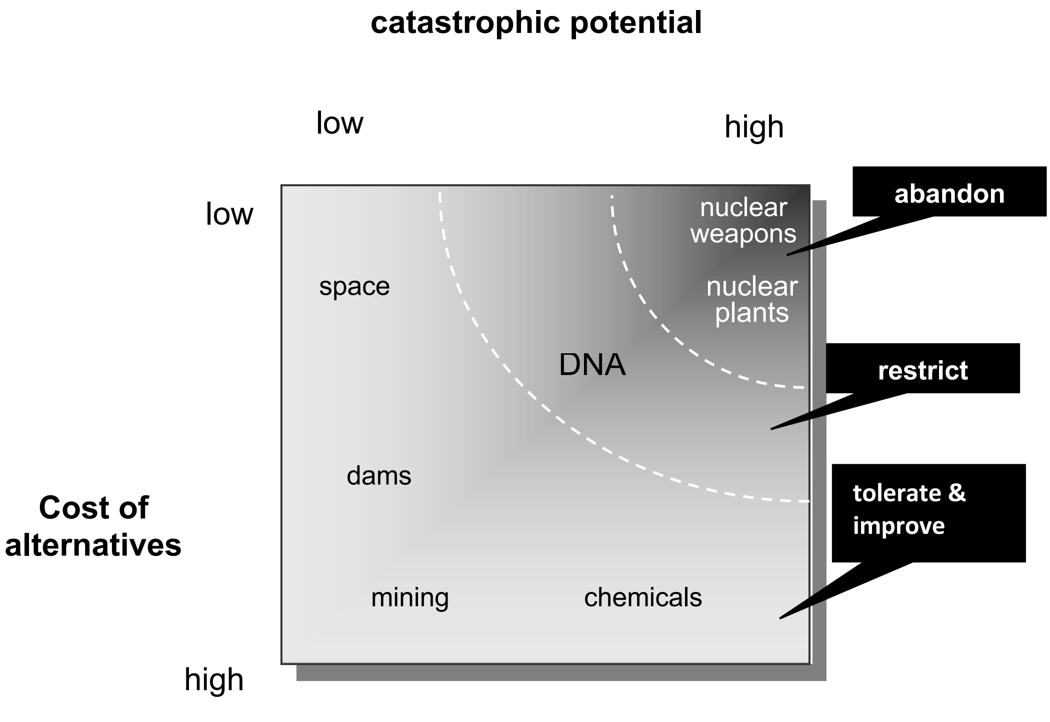
In terms of the second factor, Perrow identified that the interactions within a system could either be complex or linear. An organizational system with complex interactions means that all the various interactions happening within the system are difficult to fully conceptualise, monitor and understand. There are many feedback loops causing unforeseen and unplanned interactions. This means that complex systems inevitably experience unexpected events as it is impossible to monitor all the combinations of events that happen within the system. If an organization has linear interactions instead, it means that the parts of the system interact with one another in a sequential, straight forward and planned manner. These kinds of systems do not have a large number of feedback loops between parts of the system, which means each part of the system is easier to monitor and manage. From this, Perrow created a taxonomy to classify kinds of operations according to the type of interactions and the types of coupling, as seen in figure 1 below.

Figure 1. Perrow's (1984) taxonomy of organizational systems according to the type of coupling and interactions.



It is based on this reasoning that Perrow believes that accidents are normal and inevitable. He posits that in a system that is tightly coupled and complex, accidents cannot be avoided. This is because there are so many unforeseen interactions and failure in one part of the system has wide-ranging effects on other parts of the system. Therefore, Perrow believes that no matter how hard we try, we cannot stop these accidents from happening. After making this conclusion that all tightly coupled and complex systems will experience unforeseen and unavoidable accidents no matter what, Perrow looked at the catastrophic potential of organizations within this sphere of tightly coupled and complex interactions and mapped them out according to the cost of alternatives, as seen in figure 2 below. He then proposed recommendations about which kinds of high-risk technologies to abandon, restrict or tolerate/ improve. It is unsurprising that in his thesis, he recommends abandoning nuclear-based operations, such as nuclear weapons and power plants. Jarringly, just two years after the release of Perrow's book, the major Chernobyl nuclear power plant disaster happened.

Figure 2. Graph showing Perrow's (1984) recommendations about how to deal with certain high-risk systems based on their catastrophic potential and cost of alternatives.



Normal accident theory at first appears to give us a useful framework to think about complex systems and how accidents may occur in these systems. Perrow (1984) was one of the first to shed light on the fact that complex systems entail considerable unforeseeable interactions which can inevitably lead to failures and accidents. However, his framework has been criticised as oversimplifying the design of a system by not taking into account the various types of complexity (structural, dynamic, interactive etc.) and the various types of coupling (coupling according to time, structure, information, data etc.). This leads to the boundary conditions identified and comparisons between "types of systems" to be misguided, vague or inaccurate (Leveson et al., 2009). The lack of an adequate definition of system parameters also leads to inappropriate comparisons and unlikely conclusions. This is seen in the actual rates of accidents in the technologies and systems identified. The most at-risk systems for "normal accidents" identified are systems that historically have the lowest accident rates of all industries (such as the nuclear power sector and aviation). Mining and manufacturing, on the other hand, have some of the highest accident rates and are placed in the "tolerate and improve" category as they appear to be less susceptible to accidents given that they are loosely coupled.

Perrow also continuously attempts to absolve human error as the main cause of accidents in his analyses of system accidents, however, the majority of the patterns in situations of system accidents that he identifies are human errors (Leveson et al., 2009). He also goes on to pessimistically argue that people and organizations can never be capable of understanding and managing these complex technologies and therefore should abandon complex technologies that could lead to catastrophe if something goes wrong. This advice has not had much weight on a policy level, as we have seen that people have not been prepared to give up nuclear energy despite the potential safety hazards. This is largely because there are still energy shortages worldwide and nuclear power is a major source of satisfying energy demand. In addition, nuclear power has some environmental advantages as it does not emit carbon dioxide, which means it has a limited impact on the current climate change crisis. There is also still an abundant supply of uranium, which is needed for nuclear power generation. Nevertheless, aside from the continuation of nuclear power plants, we have just seen a dramatic rise in other complex system technologies entering the market since Perrow came out with his theory, which have major risks inherent in them.

Despite some shortsighted analyses and conclusions, normal accident theory was a useful starting framework for understanding the dynamics within an organizational system and how these may cause unexpected situations leading to uncontrollable accidents. However, it does not leave leaders and researchers of high-risk environments with much to work with in terms of better managing safety.

1.4. HIGH RELIABILITY ORGANIZATION THEORY

High-reliability organizations are organizations that have been identified as hardly ever having “unwanted, unanticipated, and unexplainable variance in their performance” (Hollnagel, 1993, p. 51). The concept of high-reliability organizations and the HRO paradigm was created by a team of researchers at the University of California, Berkeley (Rochlin et al., 1987). These authors wanted to understand why some organizations had exceptionally high safety standards and never seemed to fail. They identified nuclear power plants and air traffic control as two industries that managed to ensure safety despite continuously being exposed to high risk. Within this section, we will present definitions used by various authors to understand high reliability organizations. We will then discuss the various models created to summarise the defining features that make HROs so effective. We then end this section by discussing the main criticisms of this theory.

1.4.1 Definition of high reliability organizations

Since the concept of HROs was discovered, there have been two major approaches to defining these kinds of organizations. The first approach focuses on what HROs achieve (the outcome of their operations). In fact, the original HRO research defined “high reliability” as the ability to maintain error free performance for long periods of time, in the face of consistent and numerous risks (Roberts, 1990; Roberts, 1993; Rochlin et al., 1987). Researchers then started to define HROs by looking at the statistics of failures over a period of time. Some authors (e.g. Hopkins, 2007) have criticised this approach as it does not sufficiently distinguish remarkable organizations that manage to ensure safety against all odds, with less remarkable organizations that merely manage to operate consistently without failure. Rochlin (1993) then argued that what distinguishes high reliability organizations from other types of organizations, is not necessarily only their accident rate, but rather the innate way in which they effectively manage risky technologies. Rochlin’s (1993) newer definition suggests that perhaps a more meaningful way of defining HROs is by focusing on the processes these organizations use to successfully manage risky technologies. This second approach, of looking at the processes that allow HROs to successfully manage risky technologies has been the focal point of this research and theory going forward.

1.4.2. HRO models

Over the years, there have been various iterations of models that aim to capture the defining features or processes of HROs. Early research by Roberts and Rousseau (1989) argued that the following features distinguished HROs from other organizations:

- Following Perrow's (1984) work, these authors argue that HROs operate in environments with high levels of interconnectedness between the components of the organization and high levels of complexity with various components and systems that are unpredictable and technologically sophisticated.
- These organizations have clearly defined responsibilities and roles within a clear hierarchical structure.
- There is redundancy designed into both human behaviour (people make continuous important decisions and supervise operations) and technology (multiple protection barriers and back-up systems that will take over if there is a failure of a single mechanism).
- Strict adherence to procedures by all workers is expected at all times with clear expectations and high levels of accountability.
- These organizations operate under time pressure where in the moment actions are needed in order to adequately manage the operation.

Roberts and Rousseau (1989) posited that in order for an organization to be considered an HRO, it had to have all of these features.

Building on this, other notable HRO processes identified by the team of original researchers at University of Berkeley, California (e.g. La Porte and Consolini, 1998; Roberts, 1990, 1993; Roberts and Bea, 2001; Rochlin, 1993) are:

- HROs function in social and political environments that are unforgiving resulting in large pressure from internal and external stakeholders to achieve reliable performance above other competing demands such as efficiency.

- The technologies in HROs are risky creating constant possibilities for error.
- The scale of the possible consequences of error is so large that it does not allow for learning through experimentation.
- HROs use a complex system to serve and manage a complex external environment.
- Decisions are made through hierarchical order during routine events, but deferred to those with the best expertise regardless of rank during emergency events.
- There is a climate for ongoing learning and workers are continuously trained to increase their technical skillset and boost interpersonal trust.
- There are many different channels to communicate safety-critical information to others to ensure quick access of essential information and pooling of expertise during emergencies.

Further research on the organizational culture of a highly reliable Los Angeles nuclear submarine by Bierly and Spender (1995) confirmed the findings of the researchers at Berkely University. These authors found that the nuclear submarine had a culture that was characterised by:

- Continuous exhaustive training capturing all potential unwanted scenarios,
- a strong presence of risk and incident reporting with ongoing accident and landslide analysis to have an operational state of the organization,
- rich, two-way communication between leaders and employees, and
- decision making that is both centralised and decentralised.

The various features described in the models above give some insight into system level design features as well as the social and people-related processes that are said to help organizations operating in high-risk environments achieve high levels of reliability.

Another well-known perspective on HRO theory is the work on high-reliability principles by Karl Weick and Kathy Sutcliffe and later Tim Vogus (e.g. Weick et al., 1999; Weick and Sutcliffe, 2001; 2007; 2015; Vogus & Sutcliffe, 2007; Sutcliffe, 2011; Sutcliffe et al., 2016). Weick and Colleagues built on the idea that effective HRO's are successful due to their uncanny ability to manage the unexpected through competing approaches: anticipation and containment.

First, workers in HROs organise themselves to always be *anticipating* everything that could threaten the stability and safety of the system to the best of their ability (Weick et al., 1999). Previous research echoes this idea as studies explain how HROs are committed to anticipating everything that could go wrong through their organizational practices and procedures. Case studies show that HROs are committed to designing for safety, by creating highly standardised working procedures, rules, routines and contingency plans to best guide organizational behaviour to avoid mishaps, errors and accidents (Hirschhorn, 1999). They create these plans and protocols after mapping out the events or conditions that may lead to occurrences that they do not want to happen (Schulman, 2004). However, case studies of various HROs also show that those operating within these systems know that adherence to rules based on what worked in the past cannot always prevent incidents as even detailed procedures cannot control and cover what they have not yet anticipated (Hirschhorn, 1999). Therefore, they organise themselves in a way that mapped out procedures can be carried out with flexibility, improvisation and adaption during novel and unexpected events by a highly trained workforce (Sutcliffe, 2011). They also manage fluctuations of performance and human interaction to identify unforeseen circumstances that could destabilise the system as they occur (Weick et al., 1999; Schulman, 2004).

Second, HROs organise for *containment,* in that they are committed to resilient action to quickly manage, and bounce back, from the unavoidable fluctuations that occur in their work. According to Sutcliffe (2011):

> "*Resilience involves three abilities: (1) the ability to absorb strain and preserve functioning in spite of the presence of adversity (e.g., rapid change, ineffective leadership, performance and production pressures, increasing demands from stakeholders); (2) an ability to recover or bounce back from untoward events – as the team, unit, system becomes better able to absorb a surprise and stretch rather than collapse; and (3) an ability to learn and grow from previous episodes."* (pp. 136-137).

High reliability organizations are always trying to build their resilience capabilities (Weick et al., 1999; Hollnagel et al., 2006) to ensure that they are consistently stable, as instability could lead to catastrophic consequences. This does not mean that HROs do not experience errors, it is just that errors are always controlled and do not destabilise the system (Sutcliffe, 2011). Resilience is created through learning from errors, training and simulations as well as having a wide range of responses to use in a flexible manner (Weick & Sutcliffe, 2007).

Investigations into social and behavioural factors that underpin effective anticipation and containment by Weick and Roberts (1993) and Weick et al. (1999) uncovered that workers in effective HRO displayed highly attentive patterns of interrelating. They called this “heedful interrelating”. This attentive pattern of interrelating came from each member of the team carefully making decisions or performing a certain action with the full awareness that they are operating in a system created by connected actions between them and their team members. They then carefully fit their actions into this reciprocal system with others. This attentive pattern of interrelating allowed for teams to better understand the complexity they faced which resulted in fewer errors. The capability for each team member to exhibit such mindful awareness of their actions and how they fit into the broader system allowed for more effective responses to these unexpected events (events not controlled for in procedures). According to these authors, this ability to engage in an attentive pattern of interrelating led to more sophisticated collective reasoning and sense-making which leads to a larger range of responses and actions at the team’s disposal to successfully deal with anything they were faced with. In environments such as this, successfully handling unexpected events stems more from active interpretation rooted in a capability to act and less from decision making (Weick & Roberts, 1993). Weick and Roberts (1993) called this capability a kind of “collective mind” (later called “mindful organising”) following theories on organizations as mental entities capable of collective thought (Sandelands & Stablein, 1987). Mindful organising is defined as the collective capability that allows teams to detect intricate details about possible problematic issues and act swiftly in response to such details (Weick et al., 1999). This follows Langer’s (1989) definition of mindfulness where she highlights that the action or new perspective that arises from a mindful state (or act of noticing) is just as important as achieving that mindful state or state of awareness in the first place.

There are five practices and attitudes that appear to underpin and reinforce “heedful interrelating” or “mindful organising” (Suctliffe, 2011). They are: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise (Weick et al., 1999; Weick & Sutcliffe, 2007). These five processes of mindful organising are enacted on a team level and present a promising behavioural framework to understand how collective efforts can be used to manage unexpected events. Advancing our understanding of mindful organising in high-risk environments will be the focus of this dissertation. The concept of mindful organising and its characteristic process will be dealt with in detail in the next chapter.

1.4.3. Criticisms of the HRO paradigm

Critics of HRO theory, such as Leveson et al. (2009), believe that researchers within this paradigm fall into the same traps as Perrow’s (1984) normal accident theory. They argue that HRO researchers oversimplify the causes of accidents and are too quick to find similarities between completely different types of systems. These critics also find fault in the interchangeable use of “reliability” and “safety” within this theory, when the definition of each of these terms is completely different. Reliability means that a part of a system or a system as a whole fulfils the requirements of what it was supposed to fulfil. Safety implies that there were no failures or unacceptable losses. The truth is that often perfectly reliable components of a system interact to create accidents in complex systems. According to Sutcliffe (2011), HRO researchers themselves have since acknowledged that the terminology used is unfortunate, but it was needed at the time to be used as an all-encompassing description of systems with dynamic responses, activities and properties that are constantly attempting to enhance their reliability to either prevent or quickly recover from errors. It has also been acknowledged by the HRO community that pursuing and achieving both reliability and safety is elusive (Schulman, 2007). Therefore, it is more useful to think of the concept of high reliability as a dynamic process of organising rather than one of being an HRO because achieving reliability is a continuous, ongoing accomplishment" (Sutcliffe, 2011). It has also been made clear that "HROs"' are not distinguished based an error and accident rates, but rather on how effectively these organizations can manage exceptionally risky technology very effectively through intensive effort and control (Weick et al., 1999).

These critics from the engineering field (e.g. Dekker, 2004; Leveson, 2004; Rasmussen, 1997) also argue that the best way to understand and manage safety is through thorough system design and focusing on "decentralised human action and interaction" is futile. These authors argue for simpler, more a full proof safety management by mapping out a system and designing for better safety and fewer risks. This is done by finding boundary conditions and leverage points within an organizational system to find the best conditions of safety to ensure that we design for safer responses and adjustments to safety. It is a top-down approach that requires a full understanding of a safety system and the boundary conditions and leverage points available. However, research shows that there are limits to logical prevention of safety hazards (Hirschhorn, 1993; Schulman, 2004; Weick et al., 1999). Procedures can never fully cover all the various situations or conditions that shape peoples work (Sutcliffe, 2011)

1.5. SAFETY-I AND SAFETY-II

Another prominent theory which is rising in popularity is that of Safety-I and Safety-II. This theory, much like the HRO paradigm looks at positive deviance in risk management. Researchers such as Hollnagel (2014) have argued that every other science will analyse a certain phenomenon to try to understand it better. However, in safety science, researchers tend to analyse accidents and system failures to try to understand the phenomenon of safety, when accidents represent the absence of safety. He believes that if we want to study safety and truly understand how to lower accident rates, we need to research the billions of cases where there are perfect conditions of safety and nothing goes wrong, and from this, we should extrapolate lessons about how to create safer workplaces. Hollnagel believes that there are not enough frameworks and models that show us how to comprehend the billions of cases where safety is high, and nothing goes wrong. He therefore distinguishes between two approaches to thinking about safety: safety-I and safety-II. In the Safety-I approach, safety is defined as a situation where as few things as possible went wrong. In safety-II, safety is defined as a situation where as many things as possible go right. He believes that in order to reduce accidents and mishaps we must dedicate more time to analyse and understand why things usually go right and less time to analyse why things occasionally go wrong, although this is also important.

Hollnagel (1993; 2014; 2018) believes in looking at safety from a systems perspective through applying "resilience engineering". He argues that it is problematic to think of safety in a linear way, where we believe that there is a cause and consequence of something going wrong, so we search for the cause to mitigate the consequence. Many researchers within high risk environments do this, they look at certain consequences (major accidents) and try to find all the things that went wrong to try to change them. The problem with this, according to Hollnagel, is that desirable and undesirable consequences both result from the same thing in complex systems (the adjustments we make in our everyday work). When things go wrong, we must not try to understand the cause of the failure, but we should rather try to understand how things have normally gone right. In other words, to explain the failure of a part of a system, we need to know how it usually works. This approach entails analyzing the work people normally do and the adjustments in performance that people usually make to identify potential weak points across the whole system. This way we can achieve safety more easily as we identify and change the boundary conditions through which work adjustments are made to make these adjustments more favourable.

As figure 3 below illustrates, statistically, the probability of something going wrong in high-risk systems is often exceptionally low (around a 1 in 10 000 chance), this is illustrated by the red portion of the graph. However, the probability of operations going well and nothing failing is very high (around 9999 in 10 000 chance), this is illustrated by the green portion of the graph. Hollnagel et al. (2015) make a strong case for the fact that we need to fully analyse and understand the many times where accidents and failures do not occur to inform safety practice and management. Rather than spending all our time, resources and effort basing safety strategy on trying to find (often arbitrary causes) of safety failures.

Figure 3. Graph illustrating the imbalance between things that go right and things that go wrong (Hollnagel et al, 2015)

Hollnagel et al. (2015) recognise that it is tempting to find a single well-defined problem in the safety-I approach and find solutions to fixing this problem, but it will never be as effective as a safety-II approach. It is important to note that Hollnagel does not argue for abandoning all safety-I efforts, as accident analysis is essential for learning and will always be important for identifying risk. However, the safety-II has gained great traction and many scholars believe this theory is more robust and effective than traditional methods of approaching safety (e.g. Dieckmann et al., 2017; Patriarca et al., 2018; Wears & Sutcliffe, 2019).

Hollnagel's understanding of safety recognises that systems cannot simply be decomposed to find causes of possible failure, as this bimodal understanding of systems is shortsighted and dangerous in today's complex organizations and institutions. He argues that work needs to be viewed as variable and flexible. From a human behaviour perspective, this theory suggests a better way of understanding complex systems is by analyzing the intricacies of work actually done instead of work as imagined. "Work as done" is often characterised by situations where (1) people adapt and rearrange their environment to reach their goals, (2) people avoid harmful things, (3) people know that others in their work environment are also adapting and avoiding harm like they are. All three of these processes are done unconsciously, without actively thinking about it. He criticises how a safety-I approach (looking for a system or human causes of failure) does not consider the how and why human performance regularly is successful in attaining safety through people adjusting their behaviour to their circumstances. He argues that in a world of increasingly complex and uncertain systems and technology, focusing on the human behavioural adjustments that make systems work become crucial for managing risk and safety. Therefore, Hollnagel argues that we should develop more performance models to understand how human performance "goes right" despite the complexity, goal conflict and uncertainty in work situations. He highlights that these models are lacking in traditional safety management. Safety-I does not fully articulate how to prepare for unforeseen and unexpected circumstances that happen consistently in organizations and societies that require quick, real-time responses from people on the ground in order to adapt and contain these situations. For this reason, individual variability in performance is needed, to adapt their behaviours to the "unplanned event" and achieving safety.

Unexpected events stemming from interactions that were not possible to foresee and/or properly manage are only going to be more and more prevalent as we create more complexity through our increasingly sophisticated technologies and world. What is needed when these unexpected events disrupt the system is in the moment responses that can only really be made by human initiative and action (Hollnagel et al., 2015; Sutcliffe, 2011). This human initiative and action are best equipped when it is organised and emergent, helping the system in which it operates to quickly anticipate when things are about to go wrong, and then act quickly to recover damage (Weick & Sutcliffe, 2007). The revolutionary idea behind Holnagels argument, that many engineers may disagree with, is that most of the time people are not the problem when it comes to safety management, but rather, they are the solution.

This is where high reliability organization theory, and especially Weick and colleagues mindful organizing model (Weick et al., 1999; Weick & Suctliffe, 2007) has some interesting points of reference in terms of the behavioural and organizational elements that are important for managing safety.

1.6. CONCLUSIONS

All models and theories of organizational systems are limited and do not take into account various ambiguities and cannot begin to define every factor influencing operations. However, using the insight gained from a psychological behavioural systems perspective is still of major value to scholars and organizational leaders as these theories can give us resources and blueprints to enhance safety management to the best of our ability. Using the engineering systems perspective, which entails building detailed operating procedures based on boundary conditions and systems analysis, is an essential prerequisite for designing for safety as it creates operating discipline (Sutcliffe, 2011). It should not be ignored, and it should be the first point of analysis with creating safer systems. However, as many engineers agree, complex systems entail hundreds of unforeseen interactions that result in unexpected events which can disrupt the system at any moment (Hollnagel et al., 2015, Leveson et al., 2009). Moreover, over-reliance on operating procedures and treating individuals and teams as mostly passive agents in the system creates blind adherence to safety processes, which lessens people's ability to respond effectively to surprises (Weick et al., 1999). Therefore, it is crucial for sociologists and psychologists to help inform safety management paradigms by illustrating the conditions under which human behaviour is able to successfully manage and contain unexpected events, which is the biggest threat to complex systems.

CHAPTER II: MINDFUL ORGANISING: A CONCEPTUAL REVIEW

2.1. INTRODUCTION

The following chapter presents the team level capability found to underpin the success of high reliability organizations: mindful organising. We begin this chapter by first discussing the broader definition of mindful organising and discuss the five processes of mindful organising. We will then position mindful organising within other concepts of mindfulness. Thereafter, we will discuss the state of the literature on mindful organising, the utility of this research and its shortcomings. Lastly, we will conclude by briefly discussing future research needed to increase the impact of mindful organising in research and practice.

2.2. DEFINING MINDFUL ORGANISING

2.2.1. Initial conceptualisation

The concept of mindful organising emerged from Weick and Roberts (1993) and Weick et al.'s (1999) research into how high reliability organizations (HROs) managed to achieve almost error-free performance under such trying conditions. From this, these authors observed that HROs had a different social and relational infrastructure to other kinds of organizations. Weick and Roberts (1993) discovered that teams in effective HROs engaged in "heedful interrelating". This "heedful interrelating" meant that teams were highly attentive in their actions and interactions with one another. Further research into these highly attentive actions and interactions showed that it allowed teams to have an expanded understanding of the system in which they operated (Weick et al., 1999). This expanded understanding of the system was also linked to a wider range of possible responses to novel or unexpected situations (Weick et al., 1999; Weick & Sutcliffe, 2007). This meant teams were able to manage the unexpected and contain errors far more effectively than teams operating in other high-risk environments (Weick & Sutcliffe, 2007). They called this team phenomenon mindful organising.

Mindful organising was then defined as "the collective capability to detect discriminatory detail about emerging issues and act swiftly to respond to such details" (Weick et al., 1999, p. X). The detection of discriminatory detail about emerging issues allowed teams on the front line to *anticipate* potential errors, anomalies or unexpected events (Wick & Sutcliffe, 2007). The ability to act swiftly in responding to these errors, anomalies or unexpected events allowed these teams to recover from, or *contain,* these possibly problematic events (Weick & Sutcliffe, 2007). These definitions appear to conceptualise mindful organising as a two-factor variable, with the ability to anticipate errors, anomalies and unexpected events as the first factor and the ability to act swiftly to contain these events as the second factor. However, the analysis into this collective capability through case study analyses of effective HROs showed that mindful organising was enacted by five interrelated practices and attitudes (Weick et al., 1999). They are: (1) *a preoccupation with error, (*2) *a reluctance to simplify interpretations*, (3) *a sensitivity to operations*, (4) *a commitment to resilience* and *(5) deference to expertise.* It appeared that the first three processes underpinned a team's capability for anticipation and the last two processes underpinned a team's capability for containment and recovery (Weick & Sutcliffe, 2007).

2.2.2. The five processes of mindful organising

Most theoretical and empirical articles outlining the five processes of mindful organising offer short definitions of each dimension, with little conceptual coherence among the various explanations of these processes. The most detailed description of the five processes of mindful organising comes from the three editions of the management book "Managing the unexpected" written by the original authors of this concept Weick and Sutcliffe (2001; 2007; 2015). However, even in these accounts of the five processes of mindful organising, there are some conceptual ambiguities and there appear to be overlapping ideas between the five constructs. Through analyzing the current literature on mindful organising from theoretical articles (LaPorte & Consolini, 10991; Sutcliffe, 2011; Reb & Choi, 2014; Vogus, 2011; Vogus & Sutcliffe, 2012), case studies (Schulman, 1993; Weick et al., 1999; Weick & Roberts, 1993), empirical studies (Hoy et al., 2006; Mu & Butler, 2009; Ray et al., 2011; Vogus & Sutcliffe, 2007) to the management books on mindful organising by Weick and Sutcliffe (2001; 2007; 2015), we have attempted to clarify the definitions and theoretical models of each of the five processes of mindful organising (Renecle & Gracia, in preparation). These concepts are explained below.

Teams that engage in mindful organising are **preoccupied with errors.** This means that teams are always concerned about potential or actual errors. After an extensive review of theoretical and conceptual accounts of preoccupation with error, it appears as if this process of mindful organising is manifested through four main behavioural indicators in a team. The team:

1. is always aware of the high potential for errors or unexpected events in their work environment,
2. spends time and effort trying to anticipate everything that could go wrong,
3. places continuous importance on detecting and reporting errors, and
4. takes any error or near-error very seriously as it could indicate larger problems.

A preoccupation with error is an essential practice for anticipating potential threats and unexpected events within a system. The four behavioural indicators encompass both attitudes and actions/practices. The first indicator of preoccupation with error describes an attitude, where team members remain cautious and attentive at all times that something could potentially go wrong in their work since they are operating in a dangerous high-risk environment (Schulman, 1993). The second indicator describes a practice, where teams work hard to anticipate and specify what could go wrong as well as identify the mistakes they do not want to make (Weick & Sutcliffe, 2007). The third indicator also refers to practices, where teams will make sure to identify and report errors of all size (Rochlin, 1993; Westrum, 1992). The fourth indicator is an attitude, where teams will always treat small deviations and mistakes seriously, as it could potentially mean a bigger problem elsewhere in the system (LaPorte & Consolini, 1991).

Mindful organising also requires teams to be **reluctant to simplify interpretations.** This means that the group tries to actively avoid simple analyses of complex phenomena as it could lead to incorrect conclusions. Our review of the concept of reluctance to simply interpretations showed that it encompassed the following four behavioural indicators. The team:

1. will refrain from making assumptions or drawing conclusions too quickly when interpreting and diagnosing what is happening in their environment,
2. pays attention to new evidence or information that a situation has changed rather than relying on old explanations when making sense of something new or unexpected at work,
3. will encourage rich exchanges of points of view to be able to have a more complete picture of what is happening in their work environment, and

4. encourages a questioning attitude and ongoing scepticism when interpreting what is happening in their environment.

This component of mindful organising helps teams to gain as much information about what is going on in their work, before creating labels or conclusions about an unexpected event or error (Weick & Sutcliffe, 2007). This safeguards teams, to a certain extent, from coming to incorrect conclusions about the causes or consequences of errors or unexpected events. The four behavioural indicators within this process of mindful organising encompass practices and attitudes to do with communication and sense-making within the team. The first indicator has to do with resisting possible assumptions made by others by challenging one another when an assumption is made too quickly or a deep analysis of the situation has not yet taken place (Schulman, 1993). The second indicator describes the practice of paying attention to any new cues that something has changed when trying to understand a novel situation (Weick & Sutcliffe, 2007). It also entails discussing the unique aspects of a situation before relying on past explanations of this situation. In fact, according to Weick & Sutcliffe (2007) when teams recognise familiarity in a new situation that could signify something they have already experienced and controlled before, this is a sense of concern rather than comfort for them. This has to do with the fact that superficial similarities between the past and present may mask the more fundamental differences in the information that could ultimately lead to a catastrophe (Weick & Sutcliffe, 2015). The third indicator describes the practice of teams getting together and gathering various points of view of what is happening at work by encouraging different explanations of what is happening among themselves (Weick & Sutcliffe, 2007). The fourth indicator has to do with ensuring team members remain sceptical and continuously ask questions to try to diagnose and better understand novel situations at work (Rochlin, 1993).

Teams that organise mindfully are also **sensitive to operations.** This means that teams and leaders remain aware of the reality of what is happening in operations at any given moment. After consulting the current literature on mindful organising, it appears as if sensitivity to operations is manifested by three core behavioural indicators. In showing sensitivity to operations, teams will:

1. be constantly aware of the details of current operations and the big picture status of their work, and
2. constantly communicate and update management on the intricacies of current operations.

Sensitivity to operations is also sustained from management actions, where managers:

1. are in touch with the reality of operations happening on the front-line

Sensitivity to operations allows for teams to remain aware of the important intricacies of operations within the system, especially those that affect their work (Weick et al., 1999). The connectedness of the team with others in the system coupled with an awareness of what is happening elsewhere in the system, allows team members and leaders to quickly detect and communicate any important information as it happens (Weick & Sutcliffe, 2007). The three indicators of sensitivity to operations have to do with team communication practices and entail contact and communication with leaders and managers. The first indicator has to do with gathering and synthesizing information about operations happening beyond the teams work, that is important for the team's work (Rochlin, 1997). This is often accomplished through various practices such as frequent operations meetings, wide dissemination of operational measures of performance and continuous face-to-face interactions (Weick & Sutcliffe, 2007). The second indicator has to do with team members sharing possible anomalies or strange events with managers and leaders. It entails teams informing leaders of the procedures and policies that do not reflect the realities of operations. This has similarities with the concept of "work as done" versus "work as imagined" discussed by Hollnagel (2014) as workers will constantly update management on the realities of how work is actually done. The last indicator has to do with management accessibility and contact with teams. Teams that are sensitive to operations have leaders that are accessible when important issues develop, have close and continuous contact with the team and are quick to adapt procedures to reflect the reality of what is happening in operations (Weick & Sutcliffe, 2007).

Teams that engage in mindful organising are **committed to resilience.** Resilience means being able to bounce back from adverse events and continue to operate normally. Our extensive review of the mindful organising literature shows that teams that are committed to resilience both prepare for resilience and act resiliently.

1. Preparing for resilience means teams will develop their ability to be resilient through different practices. Some important practices to prepare for resilience are training, simulations and learning from errors.
2. Teams also act resiliently when faced with unexpected events and errors. This is seen in teams being able to quickly recover and maintain the stability of the system through flexibly using a wide range of responses.

Commitment to resilience has to do with essential actions and practices that help teams in recovering from mishaps, errors or unwanted surprises (Weick et al., 1999). The first indicator (preparing for resilience) encompasses practices that are carried out to expand team members knowledge, skills and capabilities to better deal with unexpected events so that they are better equipped to correct and contain these events before they destabilise the system (Weick & Sutcliffe, 2007). The second indicator (acting resiliently) has to do with teams having the resources and flexibility to be able to bounce back from errors or unexpected events as they arise to maintain stability within the system (Weick & Sutcliffe, 2007).

Engaging in mindful organising also means that teams **defer to expertise.** This means that when facing unexpected events, decision-making migrates to those in the team with the best expertise rather than those with the highest rank. From the extant literature on mindful organising, it appears as if deference to expertise encompasses four behavioural indicators. When faced with an unexpected event or novel situation:

1. team members know each person's knowledge and capabilities, so they know who to call on to help make decisions,
2. "experts" within the system may be called upon to help make decisions,
3. those closest to the potential problem could become the sense makers and experts in certain cases, and
4. expert decision making sometimes comes from informal networks of people with a diversity of expertise making decisions together.

Deference to expertise refers to the practice of decisions migrating to those with the best expertise rather than the highest rank in the face of unexpected events or crises. This expertise could come in the form of first-hand knowledge, previous experience and educational expertise or even pooling of various capabilities in informal networks. Deference to expertise is an essential component of recovery and containment. The first and second indicators of deference to expertise speak to the practice of exposing team members to the human capital available within the system so that team members are aware of the skillsets of accessible people within the system (Weick & Sutcliffe, 2007). The third indicator of deference to expertise has to do with the practice of paying close attention to what people on the front-line are seeing and experiencing and empowering them to make decisions during unexpected events (Roberts et al., 1994; Weick et al., 1999). The fourth indicator explains the practice of collective pooling expertise to make better decisions (Weick & Sutcliffe, 2007).

By delving into the five processes of mindful organising, it becomes apparent that it is a complex team level capability which entails various practices, attitudes and norms. It appears, theoretically, that mindful organising comprises of two overarching factors: anticipation and containment. Within these two overarching factors, there are five subfactors. Despite the multifaceted nature of this team variable, research and measurement of mindful organising have tended to oversimplify the model, limiting its impact and validity.

2.3. MINDFUL ORGANISING WITHIN THE BROADER CONCEPT OF MINDFULNESS

Individual mindfulness as a concept was originally taken from Eastern practices to do with meditation. It is most widely defined as having two components: (1) present moment awareness of events happening internally and externally and (2) a stance of non-judgement of what is noticed (e.g.

Sheldon et al. 2015). Individual mindfulness is an intrapsychic state of consciousness whereby attention is focused on events occurring in the present moment. Since making its way into western society, research and practice into individual mindfulness have exploded as it has shown to have wide-reaching positive implications for wellbeing, emotion regulation and life satisfaction (Keng et al., 2011) to name a few. Although mindful organising is vastly different from the mainstream definition of individual mindfulness, mindful organising was conceptualised using Langer's (1989) definition of individual mindfulness. Langer posits that a mindful state comes from actively differentiating and clarifying existing categories and distinctions, creating new disconnected categories out of the connected series of events that happen in one's work or life. From this, a more nuanced appreciation of context, and alternative ways of dealing with one's context, arises. Mindful organising is characterised by noticing weak signals, critically analysing and reframing such signals leading to an enlarged understanding of what is noticed (Weick et al., 1999). This enlarged understanding of what is noticed is closely linked to an enlarged or wider repertoire of action capabilities (Westrum, 1988).

Despite the similarities in Langer's definition of individual mindfulness and mindful organising, labelling mindful organising as a form of mindfulness has been met with scepticism. This may be because the mainstream understanding of mindfulness is the ability to be present in the current moment, non-judgementally (Dane, 2011). Mindful organising researchers have argued that it is a form of mindfulness, but it is rather seen in actions and interactions among team members, rather than an intrapsychic process that happens in the minds of individuals (Morgeson & Hofmann, 1999). Some have also argued that the fact that mindful organising is conceptually so much more complex than individual mindfulness merely represents the richness and versatility at the core of the mindfulness construct (Sutcliffe et al., 2016). Despite this, some reviewers believe that the concept of mindful organising is too safety specific and that it cannot be considered as a widely useable team form of mindfulness. Some authors argue that team mindfulness should represent the more mainstream concept of individual mindfulness (present-moment attention to events happening in a team, non-judgementally). For example, Yu and Zellmer-Bruhn (2017) argue that team mindfulness is a set of shared practices among members of a team characterised by awareness and attention to events happening in the moment and non-judgementally processing experiences happening within the team.

Although mindful organising is said to represent a team form of mindfulness, it does not stay close to the original concept of mindfulness enough to be accurately called "team mindfulness". Mindful organising is more of a niche concept as it refers more to safety management capabilities in teams that require ongoing mindful interactions. Although it is different to the current research on "team mindfulness", we argue that it is it also a shared unit property that emerges from individual behaviours and perceptions to the team level (Renecle et al., 2020). Vogus and Sutcliffe (2012) posit that it is through task interdependence (working closely with one another) and attraction-selection-attrition processes (Schneider, 1987) that behaviours and perceptions to do mindful organising are likely to align among teammates.

Researchers within the HRO paradigm (Vogus & Sutcliffe, 2012) also introduced another form of mindful organising that extended to the norms and practices to do with the five processes of mindful organising on an organizational level, they called this construct organizational mindfulness. These researchers posit that organizational mindfulness encompasses much of the same content as mindful organising, but its referent and level of analysis is different. Organizational mindfulness is a top-down construct that is more enduring than mindful organising (which is said to be a bottom-up, fragile capability). The focus point of organizational mindfulness is top management and it is brought about through policies procedures and strategies enacted by these managers (Vogus & Sutcliffe, 2012). Although organizational mindfulness represents an interesting concept and appears to be a concept that would help to lay the infrastructure and culture to sustain and encourage mindful organising, there has not been much attention or research on organizational mindfulness, except conceptual studies from those who introduced it initially (e.g. Sutcliffe et al., 2016).

2.4. THE STATE OF THE LITERATURE ON MINDFUL ORGANISING

Since its inception, mindful organising research has been welcomed by some as an exciting new team construct to help us better understand team-based risk management and criticised by others as being unclear and impractical. In this section, we will discuss the state of the mindful organising literature.

2.4.1. Antecedents and consequences of mindful organising

The current literature identifies three main influences that are important for fostering mindful organising, they are: leadership behaviour, organizational practices and information technology. Most empirical research on mindful organising has been done in the medical sector, this is unsurprising as it is a sector that continues to grapple with safety issues related with human error and mismanagement of unexpected events (Makary & Daniel, 2016)

In terms of leadership behaviour, research has shown leaders that exhibit a clear purpose and use clear language enabled mindful organising in perinatal units (Knox, Simpson & Garite, 1999). Studies show that trust in leadership appears to be an important prerequisite for mindful organising in a school setting and nursing units of hospitals (e.g. Hoy, Gage & Tarter, 2006; Vogus & Sutcliffe, 2007). Ausserhofer et al. (2013) found that perceived leader supportiveness in general positively predicted mindful organising in nurses in hospitals. Similarly, Madsen et al. (2006) found that leadership support of front-line decisions had a positive impact on mindful organising in a paediatric intensive care unit. Madsen et al (2006) also found that leaders trained in HRO principles positively predicted mindful organising. More traditional, draconian leadership was found to negatively impact mindful organising in paediatric intensive care units (Roberts et al., 2005). A recent study by Gracia et al. (2020) showed that empowering leadership had a positive impact on mindful organising in a nuclear power plant. These studies show that although mindful organising is a bottom-up, team-level construct, leadership behaviour towards teams is an important condition to consider when trying to foster mindful organising, the above studies suggest that leaders need to take on more trusting, empowering and supportive leadership approaches to set the right conditions for mindful organising to develop.

In terms of organizational practices, active socialization of individuals and teams into the principles of HROs and mindful organising has been suggested as antecedents of mindful organising in traditional HROs through case study evidence (Weick & Roberts, 1993). Participatory communication (receiving information, sending information and organizational openness) was also found to positively predict mindful organising in a food processing plant (Novak & Sellnow, 2009). It was also found that post-event debriefs lead to higher mindful organising in paediatric intensive care units (Madsen et al., 2006). In all, these findings suggest that creating practices that encourage on-going, open communication within the organization could be important for mindful organising.

In terms of technology, in two case studies Valorinta (2009) found that information technology (IT) systems can increase mindful organising as it can help increase team's attention and awareness of IT risks, aid in the careful analysis of issues and can help with stimulating organizational collaboration. This author also argues that IT systems can expand a team's action repertoires by providing a platform for mandating change or innovation. However, Valorinta (2009) also found that in some ways IT systems can inhibit mindful organising by routinising and automating work, limiting the flexibility of teams to take ownership of emerging issues and act to contain them. This research suggests that organizations looking to foster mindful organising in their teams could use their IT systems as tools to help facilitate the processes of mindful organising. However, creating IT systems to facilitate mindful organising could bring greater complexity into the organizational system, creating more organizational system interactions that are difficult to understand, inevitably increasing unexpected events.

Most research on the outcomes of mindful organising has looked at the effect of mindful organising on performance. Mindful organising has been shown qualitatively to result in higher reliability in traditional HROs (LaPorte & Consolini 1991), more effective response to disasters and traumas in fire departments (Bigley & Roberts., 2001) and lead to fewer mortality rates (Madsen et al. 2006; Roberts et al. 2005) in medical settings. Quantitative studies also show that mindful organising leads to fewer medication errors (Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007), patient falls (Vogus & Sutcliffe, 2007) and workarounds leading to fewer safety failures (Dierynck et al., 2016) in studies done in hospitals. Hales et al. (2012) found that a 10-day mindful organising intervention led to fewer failed nurse inspections, a reduction of negative incidents between nurses and patients families and even a small increase in the number of patients discharged alive. Mindful organising also decreased the likelihood of aviation teams losing control of aircrafts in commercial aviation during unforeseen events (Oliver et al., 2019). Further studies found it has the potential to lead to better performance in sectors beyond traditional high-risk industries. It has shown to positively impact operational performance in a business unit (Su, 2017). Unsurprisingly, in non-high risk settings, mindful organising was found to be more beneficial for organizations in uncertain environments than those in stable environments. Finally, research by Kudesia et al. (2019) showed that mindful organising was associated with more effective problem solving and higher individual mindfulness. Taken together, these studies back up the original claims made by HRO researchers that mindful organising leads to enhanced performance.

Apart from the performance benefits, mindful organising may have benefits for workers' affective states and wellbeing. However, Vogus et al. (2014) argue that a complex relationship between mindful organising and worker wellbeing exists where mindful organising can be taxing for workers (negatively impacting wellbeing), however, it gives workers resources to cope in adverse circumstances. In their study with nurses, these authors found that mindful organising had a positive impact on wellbeing if nurses worked in environments with many adverse events, but it negatively impacted wellbeing in nurses that worked in environments with fewer adverse events. This has been reiterated by other authors such as Weick and Sutcliffe (2001) and Levinthal and Rerup (2006) who suggest that mindful organising is demanding for those who engage in it but it can be especially helpful in difficult circumstances (Levinthal & Rerup 2006, Schulman 1993, Weick & Sutcliffe 2001).

It is evident that of the current research on mindful organising, that although research in this area is growing, there is a basic understanding of what leads to mindful organising and what benefits can be seen from it.

2.4.2. Major research gaps and disputes

At present, research into mindful organising continues to thrive as more and more scholars and practitioners apply the five principles that are said to underlie higher reliability and better management of the unexpected. However, this body of work still faces major research gaps and criticisms, limiting its utility and applicability in research and practice as well as keeping it on the outskirts of more mainstream safety research. Issues to do with mindful organising's conceptualization, nomological network and measurement will be discussed in this section.

2.4.2.1. Conceptualization issues

The conceptualization of each of the five processes of mindful organising currently lacks clarity because the various accounts of each of these processes by the original authors of mindful organising merely present loose descriptions of each of the five processes, which change from one paper to the next (e.g. Weick et al., 1999; Vogus & Sutcliffe, 2007; Sutcliffe et al., 2016; Sutcliffe, 2011). Weick and Sutcliffe (2007; 2015) attempt to provide models for each of the five processes in their management books, however, there is some conceptual ambiguity in these models and there are many overlapping concepts across the five dimensions. Moreover, these models from the management books have not been translated into empirical research as most authors continue with the approach of briefly describing each of the five processes, often changing the main points in the definitions. Given the complexity and differences between the five processes, it becomes clear that mindful organising scholarship is in dire need of agreed upon, clearly outlined definitions and models for each of the five processes of mindful organising.

2.4.2.2. Limited nomological network

Although progress has been made in showing which leadership behaviours, organizational practices and technological factors can positively affect mindful organising, as seen in the section before, we still do not know enough about the predictors of mindful organising to understand the conditions that are important to create and sustain it in practice. Of particular relevance, is the lack of research on team norms and conditions that may be important for sustaining mindful organising. It is argued that mindful organising research doesn't show how it can be socially embedded in an organization (Martínez-Córcoles & Vogus, 2020). It is for this reason that building our understanding of mindful organising's nomological network is so important, because the model of mindful organising is complex and relies on certain conditions, leadership characteristics and organizational norms to be created and sustained in practice.

Some authors posit that a good starting point for understanding the conditions needed for mindful organising is to properly examine the communication norms and climates that are important for limiting and sustaining organising mindfully (Ford, 2018), as communication and conversations between team members are said to be a vital driver of the five processes of mindful organising (Sutcliffe et al., 2016). Other than Novak and Sellnow's (2006) paper looking at the impact of a few information sharing and communication practices on mindful organising, there has not been much investigation into communication norms and climates that could help in predicting mindful organising.

Of particular relevance, is the lack of research positioning team mindful organising within other important safety-related variables. One of the biggest contributions to safety management from the social sciences in recent years is the concept of safety culture and safety climate (Zohar, 1980). From this, it has been widely shown that group safety climate is a powerful driver of safety behaviour (e.g. Clarke, 2006; Griffin & Curcuruto, 2016). However, the nature of the relationship between safety climate and mindful organising has never been studied. This is interesting because early theorizations of mindful organising spoke of the five processes of mindful organising as the "enactment of safety climate" (Vogus & Sutcliffe, 2007). The underlying premise of this idea was that mindful organising was the team attitudes and practices that facilitated a prioritization of safety. Previous literature has not looked at the nature of the relationship between mindful organising and safety climate. This is interesting because mindful organising is described as somewhat unstable, and in need of constant reinforcement, therefore the team level normative conditions (such as safety climate) should be important drivers of mindful organising.

In terms of outcomes of mindful organising, there is still much work to be done to fully understand the utility of mindful organising in safety research and practice. There is evidence that it can lead to better safety performance in medical settings (e.g. Madsen et al., 2006) and better performance in various other settings (e.g. Su, 2017). However, there is controversy about the impact of mindful organising on worker wellbeing (Vogus et al., 2014) and few studies have looked at how mindful organising impacts affective responses (Sutcliffe et al., 2016). This leaves us to speculate about the sustainability of mindful organising, as it could be taxing and unpleasant for employees and that could be the reason for its fragility and need to be constantly reinforced.

We also do not know much about the impact of mindful organising on more general, individual safety behaviours and attitudes. Except for one study that looks at the impact of mindful organising on safety compliance and participation (Gracia et al., 2020), there has been no enquiry on how mindful organising may affect individual proactive safety behaviours such as safety citizenship behaviours (e.g. Neal & Griffin, 2006; Curcuruto et al., 2015; Curcuruto et al., 2019). We also do not yet understand how mindful organising may affect individual motivational states. Without further insight into how mindful organising may affect individual safety behaviours, we may end up drawing incorrect conclusions about how mindful organising leads to better objective safety outcomes (such as fewer accidents or errors). In other words, it may be through important individual safety behaviours that mindful organising leads to higher reliability in teams.

2.4.2.3. Measurement issues

The major instability within mindful organising research at the present moment largely comes from the way it has been measured. Majority of the enquiries into mindful organising have been qualitative in nature (Martínez-Córcoles & Vogus, 2020; Sutcliffe et al., 2016), opening up the research stream for greater conceptual ambiguities and subjective conclusions. Qualitative studies have been, and will continue to be, valuable in setting the groundwork needed to better understand mindful organising through identifying the behavioural indicators that make up mindful organising as well as identifying the emergent barriers and facilitative factors of this construct in various settings. However, these kinds of limit our understanding of the validity of mindful organising or show us anything about the strength and nature of the relationships between mindful organising and other key organizational factors. There is a clear need for more quantitative enquiries into mindful organising. However, quantitative research on mindful organising has been criticised as being too narrow in its level of analysis and its focus (Martínez-Córcoles & Vogus, 2020).

Mindful organising is a social construct that can be seen in the actions and interactions of team members (Sutcliffe et al., 2016; Vogus and Sutcliffe, 2012; Weick et al., 1999; Weick and Sutcliffe, 2001). Therefore, it is "a shared unit property", which means that individual behaviours and perceptions will emerge to form a team level phenomenon. This emergence of mindful organising from the individual level to a shared unit construct happens through isomorphism (Kozlowski and Klein, 2000). Vogus and Sutcliffe (2012) argue that the behaviour and attitudes that sustain mindful organising are likely to merge into team level shared norms through both attraction-selection-attrition processes (Schneider, 1987) as well as through social learning within task interdependence.

Most of the quantitative research into mindful organising do not look at the cross-level effects of mindful organising on individual variables, which also limits our understanding of how the team norms may impact, and be impacted by, individual-level variables. In addition, the current tool most widely used to measure mindful organising in the extant literature is a 9-item, unidimensional scale introduced by Vogus and Sutcliffe (2007). This scale does not fully and comprehensively measure the five processes of mindful organising as its length inevitably leads to only certain aspects of each of the processes being included. The one-factor structure limits the diagnostic capability of the scale and our ability to individually study the various processes of mindful organising and how these processes may predict certain outcomes. However, the one-factor structure has shown to be statistically valid and can give an overall score of mindful organising, which has clear benefits for quicker assessment and for analysis of an overall mindful organising score.

2.4.3. Mindful organising's utility in research and practice

Despite the current shortcomings of mindful organising research, the model represents a promising framework to understand and enhance team-based safety management. Practically, this model is growing in utility, with a rising number of intervention projects taking place in the medical sector, especially in the US, which has shown that implementing the five processes of mindful organising can lead to a significant reduction in safety events ranging from 55% to 100% in some cases (Veazie, 2019). The approaches behind the success of these interventions are yet to be fully reported on, but some preliminary studies appear to show that these projects have yielded valuable insight for the organizations taking part in them (e.g. McFarland & Doucette, 2018). Theoretically, the concept of mindful organising has gained rising attention in various industries as researchers and leaders try to better manage risk and enhance their safety management systems. Mostly, studies published in this area confirm that mindful organising is living up to its hype in positively influencing safety outcomes.

2.5. CONCLUSIONS

It is becoming clear that we are moving into an era where the biggest threats to safety and reliability in organizations will increasingly come from their vulnerability to unexpected events, as the rising complexity of our socio-technical systems of safety cannot foresee every interaction, threat or issue at play (Furuta, 2015). From this, we will need to build organizational capabilities for resilience, so that in the face of these unexpected events, these organizations are able to keep functioning and hopefully thrive. Mindful organising could help to set up the social and relational infrastructure needed to enhance organizational resilience if we manage to increase its validity and usefulness through ongoing research in this area.

To increase the utility of mindful organizing as a concept in research and in practice we need to continue to enhance our understanding of its nomological network. In doing so, we need to empirically investigate this novel construct using quantitative research and find ways to clarify the conceptualization of the five processes of mindful organising. The present research has attempted to tackle some of these issues

CHAPTER III: THESIS OBJECTIVES AND METHODOLOGY

3.1. INTRODUCTION

The following chapter describes the methodology and analyses used to carry out the research work of this thesis through four main sections. First, we start by outlining the main objectives of our research. Second, we describe the samples used and data collection procedures followed to carry out our studies. Third, we describe the measures used to answer our research questions. Lastly, we present the analyses conducted in each of the included studies.

3.2. THESIS OBJECTIVES

This thesis aims to build on our current understanding of mindful organising's nomological network through empirical research using both team and individual data conducted with workers in high-risk industries. Mindful organising offers scholars and leaders a promising framework to use to enhance team-based safety management. Nevertheless, mindful organising has not been a large feature in mainstream safety research as yet. This may be because mindful organising research has been criticised for being too narrow in focus, too linear in its level of analysis and not socially embedded enough, making it difficult to create and sustain in practice (Martínez-Córcoles & Vogus, 2020). Mindful organising was discovered in the unique organizational context of high reliability organizations, with various conditions and practices that allow for this team level capability to be constantly enacted and re-enacted in teams. To advance our understanding of mindful organising, we need to attempt to build a map of key factors and organizational practices that are important for creating and sustaining mindful organising.

In high-risk environments concerned with safety, we have empirical evidence that specific leadership characteristics and certain practices such as training can have a positive impact on mindful organising (Sutcliffe et al., 2016). However, there have hardly been any investigations into the team level conditions and norms that are important for mindful organising, even though it is described as a bottom-up, fragile emergent property in teams (Vogus & Sutcliffe, 2011). We also know that mindful organising leads to better safety performance by looking at objective safety indicators and safety reports in high-risk settings (e.g. Oliver et al., 2019; Ausserhofer et al. 2013), but we still have a very limited understanding of how it impacts individual safety behaviours and attitudes. Examining these relationships empirically will allow us to understand whether the safer practices found in teams that engage in mindful organising come just from mindful organising, or whether mindful organising promotes better safety practices on an individual-level too.

Therefore, our research has three overarching main objectives: (1) To clarify the concept of mindful organising by theoretically and empirically differentiating it from related team level constructs, (2) to understand which team level climates and norms to do with safety and communication are important for mindful organising and (3) to understand the impact of mindful organising on individual safety behaviour and commitment while investigating motivational and affective mechanisms that may act as mediators of these relationships.

As discussed in chapter II, there has recently been an increasing number of quantitative studies into mindful organising, but, our understanding of mindful organising comes largely from case studies and qualitative investigations. This leaves those interested in mindful organising with many questions about its conceptualisation as there has been limited testing of the psychometric properties of mindful organising scales and it has not been empirically differentiated from related team safety variables. Earlier research into mindful organising described it as "the team level enactment of safety culture" (Vogus & Sutcliffe, 2007), as these authors claimed that mindful organising represents the team level behaviours that drive safety culture in organizations". However, the conceptualisation of safety culture (e.g. Zohar, 2008) differs substantially from mindful organising. Later Sutcliffe et al. (2016) recognised that mindful organising needs to be differentiated empirically from constructs that measure the team or organizational prioritisation of safety such as safety culture and safety climate. These authors also highlighted that mindful organising needs to be differentiated from other related team level behaviours such as team learning too.

Therefore, this is the first overall research question we wanted to answer: **Is mindful organising a distinct construct from other important team safety variables?**

We attempt to answer this question in study 1 where we validate a measure of mindful organising (in Spanish), exploring its factor structure, whether it can be reliably aggregated to a team level as well as its distinctiveness from team safety climate, organizational safety climate and team learning. We also looked at the incremental validity of mindful organising in predicting safety outcomes (safety compliance and participation) over and above these three important safety variables.

Mindful organising is said to be observed in the actions and interactions of team members, with conversations between team members described as an important driver each of the five processes (Sutcliffe et al., 2016). However, little is known about which communication conditions and norms are important for mindful organising to develop. This led us to ask our second overall research question: **Which team level participatory communication conditions are important for mindful organising to develop?**

The impact that mindful organising has on employee's wellbeing and affective responses at work is a subject of some controversy. It is expected that in intensive, high-risk environments (nursing units in hospitals), mindful organising gives teams' resources to cope which positively impacts their well-being, however, it negatively impacts wellbeing in less intensive environments as it is taxing making it difficult to maintain (Vogus et al., 2014). This raises important questions about the sustainability of mindful organising in high-risk environments that experience less consistent adversity than some medical settings as it could be too taxing for employees to consistently engage in. This led us to ask a third overall research question: **What impact does mindful organising have on team's subjective experience at work and individual's propensity to leave their organization?**

Study 2 attempts to answer our second and third research question by drawing on the current theory about engagement, voice and psychological safety to propose two specific participatory communication predictors of mindful organising: participation climate and perceived safety for upward dissent. We also draw on the job demands-resources model (Bakker & Demerouti, 2006) and traditional needs theory (Maslow, 1981) to extend theory and test the impact of mindful organising on team's job satisfaction and individual's turnover intention. We do so by testing a time-lagged multilevel structural equation model using data from 47 teams working in a nuclear power plant.

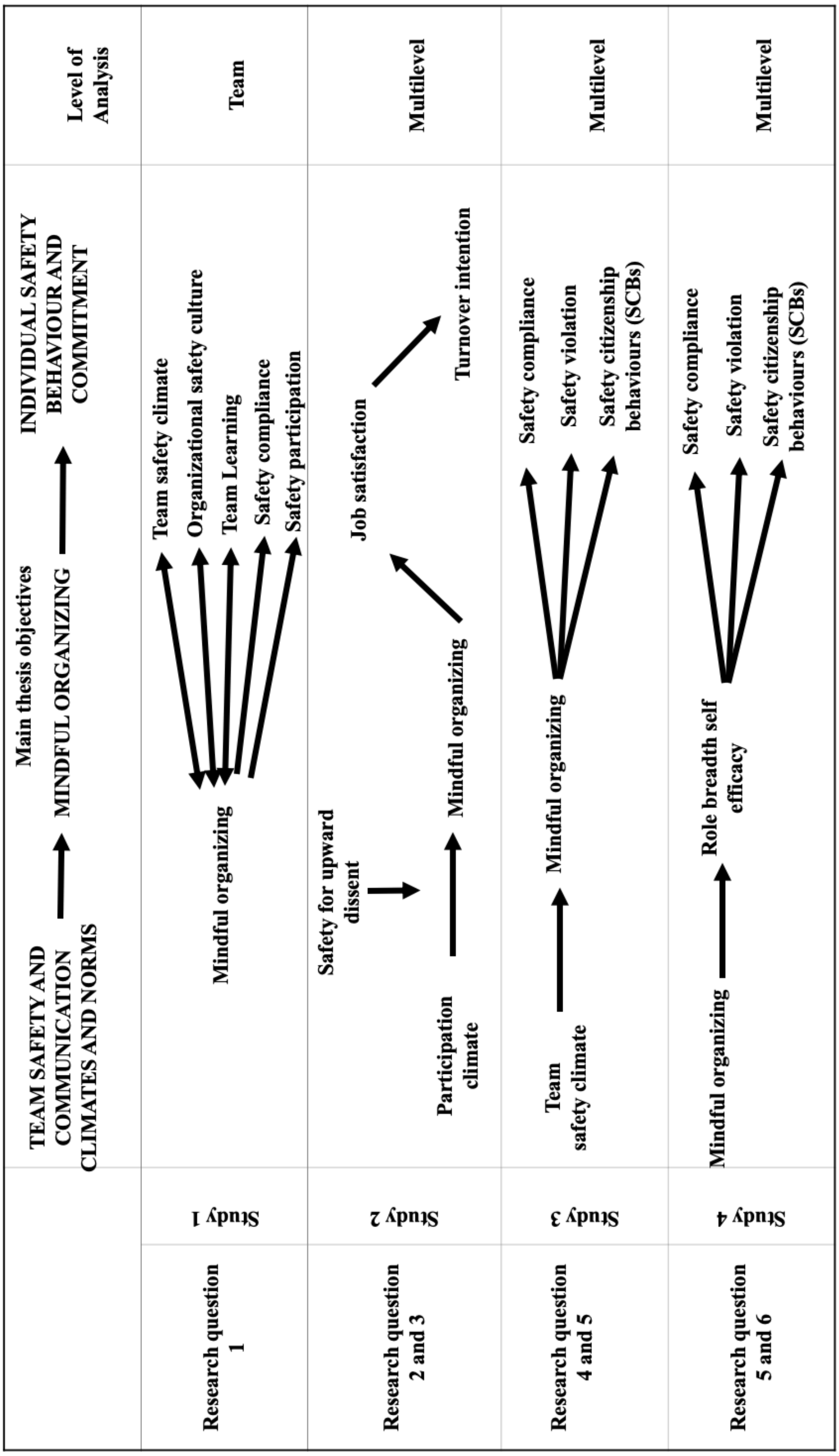
Study 1 showed us that mindful organising is related to, but distinct from, team safety climate. It is argued that mindful organising may have a reciprocal relationship with safety climate (Sutcliffe et al., 2016). However, the nature and direction of the relationship between team safety climate and mindful organising have virtually been unexplored. This led us to ask our fourth overall research question**: Can team safety climate aid in fostering mindful organising?**

Various studies have shown that mindful organising improves objective indicators of safety in high-risk environments (e.g. Vogus & Sutcliffe, 2007; Ausserhofer et al. 2013). Although useful in showing us the objective value of mindful organising in enhancing safety, these models do not test which individual safety behaviours are stimulated by team level mindful organising leading to increased reliability and fewer accidents. Models using objective indicators of safety (e.g. medication errors) are also specific to certain environments and industries, not offering much insight to other organizations about how mindful organising may effect more generalisable, individual behaviours. We also do not know which cognitive-motivational mechanisms mindful organising may impact leading to individual safety behaviours. This leads us to have an incomplete understanding of the impact of team mindful organising on individual performance in high-risk industries. Therefore, our fifth overall research question is: **Does mindful organising increase individual in-role and extra-role safety behaviours?**

And if so, it leads us to the formulation of our and sixth overall research question: **Do capability motivational drivers mediate the relationship between mindful organising and individual safety behaviours?**

We attempt to answer the fourth, fifth and sixth research questions by two studies (study 3 and 4) within a sample of chemical workers in Russia and Ukraine. Study 3 will assess whether mindful organising mediates the relationship between team safety climate and safety citizenship behaviours. Study 4 will explore whether mindful organising affects worker’s capability motivational state (role breadth self-efficacy), leading to increased safety citizenship behaviour.

Figure 1. Depiction of the objectives, research questions and studies that form part of this thesis.



3.3. SAMPLES AND DATA COLLECTION PROCEDURES

The four studies within this thesis have been carried out with three different samples in two types of high-risk industries: nuclear power plants and chemical plants. The data has been collected in three different countries: Spain, Russia and Ukraine.

3.3.1. Samples

3.3.1.1. Study 1

The first study included a sample of 573 Spanish nuclear power plant workers, who made up 47 teams. The response rate for this study was 72.5%. The age distribution of the sample was as follows: 64.4% of the sample were over the age of 45, 27.4% were between 30 and 45 years old, 5.1% were below the age of 30 and 3.1% of respondents did not indicate their age. The average group size was 12.19 (SD = 10.83). The largest team size included 48 members and the smallest team size included three members.

3.3.1.2. Study 2

Study 2 utilised a time-lagged design, so there were two data collection points (in 2014 and 2016) using the same teams from a Spanish nuclear power company. In 2014 (Time 1), 58 teams comprising of 615 employees participated in the study, yielding a response rate of 76.3%. In 2016 (Time 2), 54 teams comprising of 607 employees participated in the study, yielding a response rate of 72.5%. The final sample included 47 teams (comprising 425 employees), which were those that answered both in 2014 (N = 427) and in 2016 (N = 425) and had at least 2 subjects each time (Kozlowski & Bell, 2003). The average group size was 9.06 (SD = 5.67). The largest team size included 28 members and the smallest team size included 3 members. Regarding participants' age, at Time 1, 3.3% were under 30 years, 19.1% were between 30 and 45 years, and 77.6% were older than 45 years. At Time 2, 2% were under 30 years, 25.5% were between 30 and 45 years, and 72.5 % were older than 45 years.

As our sample showed participant withdrawal from Time 1 to Time 2, we conducted a response-nonresponse analysis. First, we tested for mean differences on two of our study variables 'participation climate' and 'perceived safety for upward dissent' (see study model in figure 1 above) among the subjects collected in 2014 that were included in the sample of the study (individuals who responded in both Time 1 and Time 2) and the ones that were not included in the study (those who responded only at Time 1). Results of a t-test indicated that respondents did not differ from non-respondents in participation climate ($t\ (615) = -0.04$, $p > 0.05$) and perceived safety for upward dissent ($t\ (615) = -0.59$, $p > 0.05$). Further, we compared subjects collected in 2016 that were included in the sample of the study (individuals who responded at both Time 1 and Time 2) to those who were not included (individuals who only responded in Time 2) with respect to our study variables collected at Time 2 (mindful organising, job satisfaction and turnover intention, see study model in figure 1 above). Results of the t-test indicated no differences on mindful organising ($t\ (604) = 0.99$, $p > 0.05$), job satisfaction ($t\ (603) = 1.73$, $p > 0.05$), and turnover intention ($t\ (538) = 0.84$, $p > 0.05$).

3.3.1.3. Study 3

As mentioned previously, the data used in study 3 was collected within a sample of Russian-based chemical plant workers ($N = 1112$) comprising of 98 teams. This study did not analyse participants ages, however, tenure and job function were recorded and analysed. The average length of tenure was 4.7 years (SD = 9.58). Participants were employed in production (49.2%), chemical treatment (24.5%), packaging (22.1%) or maintenance (4.3%). Employees in the sample worked in various departments within the plant such as secondary production (42%), primary production (18.5%), filter making (16.8%), in the warehouse (13.7%), quality assurance (3.6%), engineering (3%) or other areas (2.4%). In terms of safety roles, 11% of respondents were either a team safety head or manager and the majority of participants were ordinary workers (88.1%).

3.3.1.4. Study 4

The data for study 4 came from a sample of Ukraine-based chemical plant workers (N = 443) comprising of 50 teams, from the same parent company as study 3. As in study 3, this study did not analyse participants ages, however, tenure and job function were recorded and analysed. Regarding tenure, majority of participants (59.7%) had been working in the company for more than 10 years, 32.7% had been working in the company for 5 to 10 years, 2.7% had been working in the company for 2 to 5 years and 2% had been in the company for less than 5 years. Regarding job function, participants were employed in primary and secondary production (30.4%), the filter production workshop (12.1%), the warehousing department (15.4%), quality assurance department (12.8%), the engineering department (7,8%) and 21.5% came from other departments.

3.3.2. Data collection procedures

All four studies were conducted in accordance with international ethical guidelines, which are consistent with the American Psychological Association (APA) guidelines. The data captured and utilized in this thesis formed part of two big safety research projects. The first project was an ongoing safety behaviour and culture study conducted within a Spanish nuclear power company with two separate plants. The data collected and used for study 1 and 2 were from this Spanish nuclear power plant research project. The second project was a broad-based safety behaviour project for a multinational chemical company with chemical plants all across Europe. The data collected and used for study 3 and 4 were taken from the Russian and Ukraine plants of this multinational chemical company research project. These two plants were chosen over other samples (such as the German or Italian samples) largely due to their sample size, as the Russian and Ukraine samples had a large enough sample of teams (50 and higher) to enable us to have enough statistical power to perform our multilevel analyses. The data collection for each study is described in more detail below:

For study 1 and study 2, our study variables formed part of a battery of questionnaires designed to assess different constructs related to safety culture. This battery was administered annually, and the data used in our two studies came from the questionnaires administered in time 1 (study 2 predictor variables) and time 2 (study 1 variables and study 2 outcome variables). For both data collection time points, researchers were on site at the nuclear power plant to inform participants about the purpose of the study and to provide instructions about the way the questionnaires should be completed. Researchers administered the questionnaires and addressed any questions and concerns as participants completed the questionnaires. The administration of the questionnaires took place in small groups during work time, in a quiet room. Participants were encouraged to answer honestly, and it took around 30 minutes to complete the questionnaires. Participation was voluntary and confidentiality and anonymity were guaranteed.

Although study 3 and 4 used data collected at different workplaces, the data collection procedure was the same for both. Hard copy questionnaires were administered to workers during work time in each of the plants (Russian based and Ukraine based). Participation was voluntary and confidentiality was guaranteed. All workers were informed that the data would be used for scientific research and to gain insight into safety culture improvements in each plant.

3.4. VARIABLES USED

This research measured a total of sixteen variables across the four studies. The scale that remained the same in terms of content was the mindful organising scale (used in all 4 studies), taken from Vogus and Sutcliffe (2007). Since the first two studies were conducted with Spanish nuclear power workers, we translated the Vogus and Sutcliffe (2007) mindful organising scale from English to Spanish for these studies. Likewise, since the last two studies were conducted with Russian and Ukrainian chemical workers, we translated the Vogus and Sutcliffe (2007) mindful organising scale from English to Spanish for these studies. Translations were done using the back translation method with a certified translator and subject matter expert. All scales for study 1 and 2 (apart from the mindful organising and team safety climate scale) were originally written in Spanish and translated in the academic papers (including this thesis) for ease of understanding. The original scales for both study 3 and 4 were in English, so all questionnaires administered in these two studies were translated from English (the original versions) to Russian using the back-translation methods with two bilingual experts and industry personnel.

All the scales below used a five-point Likert scale.

3.4.1. Common measures

3.4.1.1. Mindful organising

The scale used to measure mindful organising in all four studies is a 9-item validated scale taken from Vogus and Sutcliffe's (2007b) original scale. The questions asked participants to rate the extent to which they agree that their team does the following. The scale ranged from one (completely disagree) to five (completely agree). Some sample items are: "When discussing emerging problems with co-workers, we usually discuss what to look out for", "We talk about mistakes and ways to learn from them", "When a crisis occurs, we rapidly pool our collective expertise to attempt to resolve it." Internal consistency reliability of the scale was high for all four studies with values of .94 for study 1, .95 for study 2, .93 for study 3 and .94 for study 4.

3.4.2. Study 1 measures

3.4.2.1. Team safety climate

Team level safety climate was measured with a fifteen-item scale originally adapted from Zohar and Luria (2005) into Spanish by Latorre, Gracia, Tomás and Peiró (2013). Sample items are "we make sure we have everything we need to do the job in a safe way" and "my direct line manager frequently tells us about the hazards in our work". The scale ranged from one (completely disagree) to five (completely agree). This team safety climate scale had a Cronbach alpha value of .96.

3.4.2.2. Organizational safety culture

Safety culture was measured with the Safety Culture Enactment Questionnaire (López de Castro, Gracia, Tomás & Peiró, 2017). It is a twenty-one-item scale where participants are asked to rate the level of importance given to nuclear safety within the practices of the organization. The scale ranged from one (not at all) to five (quite a lot). A sample item is “to what degree is safety important in the process of making decisions about work?” This safety culture scale had a Cronbach alpha value of .96.

3.4.2.3. Team learning

Team learning was measured with a twenty-item scale which asks participants to rate the extent to which their team engages in behaviours and activities to encourage the development of competencies (such as knowledge, skills and attitudes) and better functioning of the team over time (Bresó et al., 2008). Participants are asked to rate how often certain situations occur within their team on a scale from one (never or almost never) to five (always or almost always). A sample item is “knowledge is shared among the different team members”. This team learning scale had a Cronbachs’ alpha value of .93.

3.4.2.4. Safety compliance

The Spanish version (Martínez-Córcoles et al., 2013) of the scale developed by Neal and Griffin (2006) was used to measure compliance with safety rules and procedures. This scale is made up of the following three items: ‘I use the correct safety procedures for performing my job’; ‘I use all the necessary safety equipment to do my job’; and ‘I ensure the highest levels of safety when I do my job’. Items are answered on a 5-point Likert response scale ranging from 1 (strongly disagree) to 5 (strongly agree). The safety compliance scale had a Cronbach alpha value of .89.

3.4.2.5. Safety participation

This variable was measured by means of the Spanish version (Martínez-Córcoles et al., 2013) of the scale developed by Neal and Griffin (2006). The scale is made up of three items rated on a 5-point Likert response scale ranging from 1 (completely disagree) to 5 (completely agree). Scale items were the following: ‘‘I promote the safety program within the organization’’; ‘‘I voluntarily carry out tasks or activities that help to improve workplace safety’’; and ‘‘I make extra effort to improve safety in the workplace’’. The safety participation scale had a Cronbach alpha value of .88.

3.4.3. Study 2 measures

The participation climate, perceived safety for upward dissent, job satisfaction and turnover intention scales were created by the research team. Since limited previous validation tests have been conducted for these scales, confirmatory factor analyses were conducted in the present study.

3.4.3.1. Participation climate

Participation climate was measured using a three-item scale and asked participants to rate the extent to which teams perceived that the organization encourages their participation and opinion in the running of everyday operations. The items in the scale are: “this company sincerely encourages the employees’ participation in its daily functioning”, “this company encourages its staff to express their ideas and suggestions”, and “this company is interested in listening to its employees’ opinions”. The scale ranged from one (completely disagree) to five (completely agree). Internal consistency reliability was .93.

3.4.3.2. Perceived safety for upward dissent

Perceived safety for upward dissent was measured using a three-item scale and asked participants to rate the extent to which they felt safe to challenge, or disagree with, their supervisor without fear of backlash. The items in the scale are "I can freely express any disagreements I have with my supervisor", "I can tell my supervisor when things are not going well" and "I feel free to talk to my supervisor about any problems and difficulties I have in my job without any fear at all". The scale ranged from one (completely disagree) to five (completely agree). Internal consistency reliability was .94.

3.4.3.3. Job satisfaction

This scale consists of three items that assess participant's global levels of satisfaction with their job, team and the company as a whole. The items in the scale asked participants to "please indicate, in general, how satisfied you are…" "with your job" "with your work unit or team" and "with your company". The scale ranged from one (completely dissatisfied) to five (completely satisfied). This scale was found to have discriminant validity from related constructs in a recent study by López de Castro, Gracia, Tomás and Peiró (2017). Internal consistency reliability was .85.

3.4.3.4. Turnover intention

A one-item scale which states "I would leave this organization if I could" was used to measure turnover intention. It focuses on the desirability to leave the organization ("I would leave this organization") and controls for the ease of leaving the organization ("if I could"). The scale ranged from one (completely disagree) to five (completely agree). Internal consistency could not be calculated as this is a single item measure.

3.4.4. Study 3 and 4 measures

Study 3 and 4 both looked at the same outcome variables (safety compliance, safety violation, and safety citizenship behaviours). Study 3 also measured team safety climate and study 4 measured role breadth self-efficacy.

3.4.4.1. Safety compliance and safety violation

Safety compliance is the degree to which an individual complies with the safety protocol of the chemical plant. Safety Violation is the extent to which an individual violates safety protocol. Both scales were taken from Hansez and Chmiel (2010). Safety compliance was measured using a 5-item scale (study 3 $\alpha = .81$; study 4 $\alpha = .82$), an example item is “rate the extent to which you voluntarily use protection, even if it is hard to find.” Safety violation was measured using a 5-item scale (study 3 $\alpha = .91$; study 4 $\alpha = .94$) and is inversely scored, an example item is “rate the extent to which you neglect some safety rules when performing familiar or routine work.” Both scales ranged from one (never) to five (very frequently).

3.4.4.2. Safety citizenship behaviours

Safety citizenship behaviours are discretionary and prosocial activities essential for managing risk in safety-critical industries (Curcuruto, Conchie & Griffin, 2019). For study 3 and 4, we analysed three SCBs, namely: voice, initiative and helping. Voice was measured using a 4-item scale (study 3 $\alpha = .91$; study 4 $\alpha = .92$), an example item is “rate the extent to which you voluntarily raise safety concerns in planning sessions” Initiative was measured using a 4-item scale (study 3 $\alpha = .84$; study 4 $\alpha = .87$), an example item is “rate the extent to which you voluntarily try to make policies and procedures safer”. Helping was measured using a 6-item scale (study 3 α

= .90; study 4 α = .90), an example item is "rate the extent to which you voluntarily help teach safety procedures to new crew members". All scales ranged from one (never) to five (very frequently).

3.4.4.3. Team Safety Climate

Team level safety climate was measured in study 3 with the sixteen-item scale originally developed by Zohar and Luria (2005). An example item is "My direct line manager frequently tells us about the hazards in our work". The scale ranged from one (completely disagree) to five (completely agree). This team safety climate scale had a Cronbach alpha value .94 in study 3.

3.4.4.4. Role-based Self Efficacy

Role-based self-efficacy is the confidence individuals have in their own ability to carry out a more participative and broader in safety processes, beyond formalised role requirements. It was measured in study 4 using a 5-item scale (α = .93) taken from Curcuruto, Mearns and Mariani (2016). An example item is "Feeling confident in devising new methods to improve safety in my work area". The response scale ranged from one (never) to five (very frequently).

3.5. ANALYSIS OF DATA

3.5.1. Analysis of preliminary data

3.5.1.1. Confirmatory factor analysis

In all four studies, confirmatory factor analyses (CFAs) were run using the programme Mplus (Muthén & Muthén, 1998–2010) to validate the factorial structure of the questionnaires used. Each CFA differed depending on the study model and are therefore described separately, the criteria used to evaluate the CFA's was the same for all models.

CFA Evaluation Criteria

For each of the CFAs, model fit was evaluated by considering the chi-square statistic as well as a few other goodness of fit indices, namely: the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI; Bentler, 1990), and the Tucker Lewis index (TLI; Tucker & Lewis, 1973). RMSEA values of .10 or more indicate poor fit, values between .08 and .05 indicate moderate fit, and values below .05 indicate good fit (Browne & Cudeck, 1993). CFI values close to 1 indicate good fit, with values above .95 considered acceptable fit (Hu & Bentler, 1999). TLI values near 1 indicate good fit and values approaching 0 indicate poor fit, with the conventional cut off used being .90 for acceptable fit (Tucker & Lewis, 1973).

We also used the following criteria for comparing alternative nested models: (1) whether the differences between TLI and CFI values of the competing models were larger than .01 (Cheung & Rensvold, 2002; Widaman, 1985), and (2) whether the differences between RMSEA values were larger than .015 (Chen, Curran, Bollen, Kirby & Paxton, 2008). These criteria indicate whether there is a notable disparity between the models and when these differences in practical fit indices are detected, the model showing better fit will be selected. Complementarily, the difference in chi-squared statistics along with the difference in degrees of freedom for competing models, was checked manually for significance using a χ^2 table. If the difference is significant, the model with the smaller chi-square value is argued to have a better fit to data (Schermelleh-Engel et al., 2003).

Study 1

The main aim of the CFA conducted in study 1 was to test the internal factor structure of the mindful organising scale. A CFA was run using Mplus

(Muthén & Muthén, 1998–2010) with individual-level responses. Additionally, as part of the hypothesis testing (as explained in the following section), a CFA was run to test the discriminant validity of the mindful organising scale in relation to the other variables included in the model (team safety climate, organizational safety culture and team learning).

Study 2

Given that three of the measures in study 2 were created by our research team and were not validated elsewhere, confirmatory factor analyses (CFA) of the four scales (participation climate, perceived safety for upward dissent, mindful organising, and job satisfaction) were carried out to gain evidence of the validity of these measures. This was done by testing the measurement model at the individual-level using Mplus (Muthén & Muthén, 1998–2010). Two alternative CFA models (a one-factor model with all the items loading onto one single factor, and a two-factor model with all the items loading onto two separate factors namely the participation climate scale and the perceived safety for upward dissent scale) were conducted and compared for the 2014 data.

Likewise, two CFA models (a one-factor model with all the items loading onto one single factor, and a two-factor model with all the items loading onto two separate factors namely the mindful organising and job satisfaction scale) were conducted and analysed for the 2016 data. The turnover intention scale was omitted since it is a one item measure.

Study 3

To test the discriminant validity of variables included in study 3, we ran five CFAs with the seven scales (team safety climate, mindful organising, safety compliance, safety violation, and the three safety citizenship behaviours (initiative, helping and voice)) to gain evidence of the validity of these measures. First, we ran a CFA with the seven-factor model where all the items loaded onto seven separate factors using individual-level data. Thereafter, four alternative CFA models were conducted, and the fit of these models was compared with the seven-factor model. The alternative models are: (1) a model with all the items of the seven scales loading onto one single factor, (2) a six-factor model with all items loading onto their corresponding factor but with team safety climate and mindful organising loading onto one single factor, (3) a five-factor model with all items loading onto their corresponding factor and the three SCBs (helping, initiative and voice) loading onto one single factor, and (4) a six-factor model with all items loading onto their corresponding factor but with safety compliance and safety violation loading onto one single factor. These models were then compared using the criteria stipulated above.

Study 4

To test the test the discriminant validity of the variables included in study 4, we also ran five CFAs with the seven scales (mindful organising, role breadth self-efficacy, safety compliance, safety violation, and the three safety citizenship behaviours (initiative, helping, voice)) to gain evidence of the validity of these measures. Just like study 3, we ran a seven-factor model with all the items loading onto seven separate factors using individual-level data with Mplus (Muthén & Muthén, 1998–2010). Thereafter, four alternative CFA models were conducted, and the fit of these models was compared with the seven-factor model. The alternative models are: (1) a one-factor model with all the items of the seven scales loading onto one single factor, (2) a six-factor model with mindful organising and role breadth self-efficacy both loading onto the same single factor and all the other items loading onto their corresponding factors (3) a five-factor model with the three SCBs (helping, initiative and voice) loading onto the same single factor and all the other items loading onto their corresponding factors (4) a six-factor model with safety compliance and safety violation both loading onto the same single factor and all the other items loading onto their corresponding factors. These models were also then compared using the criteria stipulated above.

3.5.1.2. Descriptive and reliability analyses

For each of the four studies enclosed within this thesis, various preliminary descriptive analyses were conducted. Descriptive statistics were calculated and reported for the data within each study (e.g. means and standard deviations). The reliability of each of the scales (as reported above) was also calculated using Chronbach's alpha coefficient (1951).

For study 1, which entailed the validation of a Spanish version of the mindful organising scale, various other reliability analyses were carried out, over and above the Cronbachs alpha coefficient. The average variance extracted (AVE) value and composite reliability value (rho) were also examined to ascertain the internal consistency of the scale. For AVE, values of .50 or greater indicate satisfactory reliability as the variance of the construct is greater than the error variance (Fornell & Larcker, 1981). For composite reliability (rho values), a score of .70 or greater indicates good reliability (Raykov, 2001).

3.5.1.3. Aggregation indices

Mindful organising is a team construct, therefore for every study in this thesis individual's scores were aggregated to form a team mindful organising score as is common practice in measuring this variable (e.g.

Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007b). Likewise, team safety climate (measured in study 1 and study 3), organizational safety culture and team learning (both measured in study 1), as well as participation climate, perceived safety for upward dissent and job satisfaction (all measured in study 2), were also analysed at the team level by aggregating individual scores.

Before aggregating the scores of these seven variables (mindful organising, team safety climate, organizational safety culture, team learning, participation climate, perceived safety for upward dissent and job satisfaction), we had to calculate the aggregation indices for each of these variables. Calculating aggregation indices are essential to demonstrate that each member's score was similar enough to those within their team, and different enough from those not in their team, to justify aggregating these scores. Therefore, in every study, we calculated various aggregation indices such as the average deviation index (ADI; Burke, Finkelstein, & Dusig, 1999), the intra-class correlation coefficients (ICC; Bliese, 2000), the rwg(j) statistic (James, Demaree, & Wolf, 1984) and the analysis of variance (ANOVA) scores. Average Deviation Indices (ADIs), intra-class correlation coefficients (ICC1 and ICC2) and rwg(j) statistics were computed and analysed to ensure within-team agreement. Analysis of Variance (ANOVA) was computed to ascertain the between-team distinctiveness of scores. Since items were measured using a 5-point Likert response scale, the cut-off value for the ADI was .83 (Burke & Dunlap, 2002), consequently, we concluded that there was within-team agreement when the ADI value was ≤ .83. ICC provides an estimate on the proportion of total variance attributable to within-team homogeneity, that is, it indicates to what extent the studied variables are shared within teams. Recommended cut-off values for ICC(1) typically range between .05 and .20 (Bliese, 2000), with values within, or above, this range deemed as acceptable. The rwg(j) statistic shows evidence of within team agreement and scores need to be above the cut-off of .70 to justify aggregation of team member scores. Finally, we also carried out a one-way analysis of variance (ANOVA) to determine whether there was statistically significant between-team discrimination in mindful organising among teams. If the ANOVA values were significant, we would conclude that there was enough difference among teams.

3.5.2. Data analysis for hypothesis testing

3.5.2.1. Correlation, data aggregation and CFA

Study 1 aimed to validate a measure of mindful organising. To do so, mindful organising was correlated with team safety climate, organizational safety culture, and team learning. This analysis was done with the aggregated group level scores. Thereafter, a CFA was run with Mplus to show the distinctiveness of mindful organising compared with the other three variables included in the study (team safety climate, organizational safety culture, and team learning). We compared two alternative models: a one-factor model (with all items loading in a single factor), and a four-factor model (with items loading in their corresponding scale). For running the CFA individual-level scores were used, as a large number of items prevented us from using scores aggregated to the team level. WLSMV was used as the method of estimation, considering the ordinal nature of data. Model fit indices were analysed according to the criteria mentioned at the beginning of the CFA section.

3.5.2.2. Hierarchical regression analyses

Finally, we tested the criterion-related validity of the Mindful Organising Scale by demonstrating the utility of the scale in predicting various workplace safety outcomes. We tested the incremental validity of the scale by checking if mindful organising added more explained variance to two workplace safety outcomes (safety compliance and safety participation) after controlling for other constructs (safety culture, team safety climate and team learning). With this purpose, we run hierarchical regression analyses using safety compliance and safety participation as dependent variables. We then introduced the control variables (safety culture, team safety climate and team learning) as independent variables. Thereafter, we introduced mindful organising. The hierarchical regression analyses were carried out at both, individual and team level.

3.5.2.3. Multilevel Structural equation models

Study 2

Study 2 aimed to test a multilevel structural equation model (MSEM) of predictors and outcomes of mindful organising with two time points. The model chosen is a moderated mediation model. The proposed model wanted to test whether the interaction of participation climate and perceived safety for upward dissent leads to mindful organising (hypothesis 1) and whether job satisfaction mediates the relationship between mindful organising and turnover intention (hypothesis 2). All variables were measured at the team level, except turnover intention, which was measured at the individual-level. The model was tested using a robust maximum likelihood estimation (RML).

To test the first hypothesis, the statistical significance of a_3 (the coefficient estimating the moderator effect of perceived safety for upward dissent in the relationship between participation climate and mindful organising) was tested. To further probe the interaction effect we used the Process macro for SPSS (Hayes, 2018) to estimate the slopes of the relationship between participation climate and mindful organising at high and low values (one standard deviation above and below the sample mean) of perceived safety for upward dissent and to plot the corresponding regression lines.

To test the significance of the indirect effect stated in the second hypothesis, we used bias-corrected (BC) bootstrap confidence interval (CI) method (MacKinnon, Lockwood, & Williams, 2004) as implemented in Mplus. A bootstrap sample size of 5000 was used. The b_1c_1 indirect effect was calculated, where b_1 is the coefficient estimating the relationship between mindful organising and job satisfaction, and c_1 is the coefficient estimating the relationship between job satisfaction and turnover intention. Mediation is supported when the BC bootstrap confidence interval for the indirect effect does not include the zero value.

Finally, to test the conditional indirect effect stated of our study model, we also used BC bootstrap confidence interval method as implemented in Mplus. The $(a_1+a_3W)b_1c_1$ conditional indirect effect was calculated, where W is the moderator variable (perceived safety for upward dissent), a_1 is the coefficient estimating the relationship between participation climate and mindful organising, and a_3, b_1 and c_1 are the coefficients estimating the relationships previously stated. The conditional indirect effect is supported when the BC bootstrap confidence interval for the difference in the indirect effect (diff_IE) among different levels of the moderator does not contain zero (Preacher et al., 2007), which implies that the strength of the indirect effect (a_1b_1) depends on the level of the moderator variable (W).

Study 3

To test our proposed model in study 3, we ran a multilevel structural equation model (MSEM). This model wanted to ascertain whether mindful organising mediated the relationship between team safety climate and five individual safety behaviours. Team safety climate and mindful organising were analysed at the team level and the five individual safety behaviours (safety compliance, safety violation, and the three SCBS (voice, initiative and helping)) were analysed at the individual-level. To confirm the proposed model, we first analysed the model fit indices (using the same criteria indicated for the CFA stipulated in the previous section). If the model fit was satisfactory, we considered the pathway estimates by looking at whether they were significant and the strength of each pathway. Thereafter, Monte Carlo (MC) confidence intervals were used for testing the significance of the indirect effects, as it is argued to be a more viable and robust method for calculating confidence intervals for complex and simple indirect effects when working with a multilevel model (Preacher & Selig, 2012).

Study 4

For study 4 we also ran a multilevel structural equation model (MSEM) to assess our proposed mediation model and the pathways between our variables. This model wanted to test whether role breadth self-efficacy mediated the relationship between mindful organising and the five safety behaviours (safety compliance, safety violation, and the three SCBs (voice, initiative and helping)). For this analysis, mindful organising was aggregated to the team level, and role breadth self-efficacy and the five safety behaviours were operationalised at the individual-level. To confirm the proposed model, we first analysed the model fit indices (using the same goodness of fit indices criteria indicated in the previous section). If the model fit was satisfactory, we considered the pathway estimates by looking at whether they were significant and the strength of each pathway. Monte Carlo (MC) confidence intervals were used for testing the significance of the indirect effects, as it is argued to be a more viable and robust method for calculating confidence intervals for complex and simple indirect effects when working with a multilevel model (Preacher and Selig, 2012).

CHAPTER IV: SPANISH VALIDATION OF THE MINDFUL ORGANISING SCALE

4.1. INTRODUCTION

Mindful organising is the collective capability to discern discriminatory detail about emerging issues and act swiftly in response to such details (Vogus & Sutcliffe, 2012; Weick & Sutcliffe, 2006; Weick, Sutcliffe, & Obstfeld, 1999). The concept first came into fruition when researchers such as Weick et al. (1999) started investigating social processes that allow high-reliability organizations (hereinafter HROs) such as air traffic control centres and nuclear power plants to operate almost flawlessly when the potential for catastrophe is so high. These researchers discovered that in these organizations, employees engage in mindful organising allowing them to anticipate, detect, and recover from, errors. In such dynamic and intense environments, this capability could be the difference between life and death. Research in this area has thrived as mindful organising has shown to result in fewer accidents and safer performance, especially in the health care sector (Sutcliffe, Vogus & Dane, 2016). Teams engaging in mindful organising were found to have fewer occupational safety failures and errors in studies done with nurses (Ausserhofer et al., 2013; Dierynck, Leroy, Savage & Choiz, 2017; Vogus & Sutcliffe, 2007). Other studies also show mindful organising leads to better responses to adversity in firefighters (Bigley & Roberts, 2001) and higher reliability in air traffic controllers (Weick et al., 1999).

Research on mindful organising is still in its infancy and the majority of the studies done to try to understand it have been qualitative in nature. More research needs to be done for mindful organising to be empirically and theoretically considered a distinct construct from other team and safety-related variables (Sutcliffe et al., 2016). At the heart of gathering empirical evidence to further the case of studying and fostering mindful organising in modern organizations is the validation of measures for its assessment. There are a few articles validating mindful organising measures, but many of these articles do not show sufficient evidence of sound psychometric properties of their scales (Sutcliffe et al., 2016). Furthermore, validated scales to measure mindful organising are offered in English (Vogus & Sutcliffe, 2007), French, German and Italian (Ausserhofer et al., 2013), but no Spanish validated version of the scale exists. This not only means all Spanish speaking organizations in the 20 countries where it is an official language do not have a validated mindful organising scale to use for empirical research, but it also leaves the question as to whether mindful organising is manifested in the same way in a Spanish cultural context as it is in other contexts where it has been studied (such as the United States). In addition, although the theoretical paradigm of mindful organising is based on qualitative research in traditional HROs, of the validation studies that do exist, most research is not conducted in traditional HROs (e.g. Ausserhofer et al., 2013; Vogus & Sutcliffe, 2007). Validating a measure of mindful organising in a traditional HRO setting will be valuable as it is within these high-reliability contexts that the construct was discovered. Therefore, within traditional HROs, there is likely to be a truer, more accurate embodiment of this collective capability than in non-traditional HRO contexts.

The main purpose of the present study is to translate Vogus and Sutcliffe's (2007) "Safety Organising Scale" (later referred to as the "Mindful Organising Scale") to Spanish and to validate this new version of the scale. We attempt to provide evidence of the validity and reliability of the Spanish version of the scale by testing its unidimensional factor structure and checking the internal consistency. In addition, we attempt to justify the aggregation of individual scores to group scores by testing whether there was group consensus among team member's mindful organising scores. We also examine the relationships between team's mindful organising scores and their safety culture, team safety climate and team learning scores to gain further evidence of convergent validity. Additionally, we gather evidence of discriminant validity by checking the distinctiveness of individual-level mindful organising with other team level constructs considered important for safety (safety culture, team safety climate and team learning scales). Finally, we test for evidence criterion-related validity for the Spanish version of the mindful organising scale, by testing the predicting incremental validity of the scale in predicting workplace safety variables (safety compliance and safety participation).

4.1.1. Mindful organising

In line with the positive psychology movement, there has been a body of safety researchers that have begun to shift the focus of their research away from accidents and mistakes to rather analysing the billions of cases where safe performance is consistently achieved (Dekker, 2015; Hollnagel, 2014; Rochlin, La Porte & Roberts, 1987; Weick & Roberts, 1993). Hollnagel (2014) argues that trying to uncover safety lessons through only analysing accidents and mistakes is not always useful as these situations represent an absence of safety. He argues that the high-risk environments where safe performance is desired are usually complex with many different variables and unexpected events at play. This results in acceptable and unacceptable outcomes often stemming from the same practice or behaviour. Hollnagel (2014) believes more models, ideas and frameworks are needed to understand the many cases where safety is present, and nothing goes wrong despite high-risks as these are the cases where we can extrapolate lessons about how to achieve consistently safe performance. A useful source of insight into consistently safe performance is HROs as these organizations manage to operate almost error-free when there is constant potential for catastrophe (Rochlin et al., 1987).

As HRO research was initially starting to accelerate, Weick and Roberts (1993) wanted to uncover which team characteristics and capabilities existed in HROs that enabled these organizations to respond so effectively to unexpected events and maintain unwavering performance when the risks for error were so high. These authors conducted extensive field research in an aircraft carrier. Here, they discovered that the teams in this setting organised themselves in such a way that they were able to engage in a pattern of highly attentive interrelations of actions among each other which allowed them to better understand the adversity they faced and respond more effectively to unexpected events. They called this capability collective mindfulness (later called mindful organising) following Langer's (1989) conceptualisation of individual mindfulness which emphasizes that the new perspective or action that arises from a mindful state (or act of noticing) is just as important as achieving that mindful state. The collective form of mindfulness seen in HROs involves noticing weak signals, then critically analysing and reframing these signals leading to an expanded understanding of what is noticed. This greater understanding of what is noticed is closely linked to a wider repertoire of action capabilities which is a defining feature of what makes HROs effective.

Later, Weick et al. (1999) analysed various case studies of HROs with the aim of creating a clear specification of the behaviours and processes that constituted this team level capability to anticipate and recover from, unexpected events. They found that there were five interrelated processes that underlie mindful organising, namely preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise (Weick et al., 1999). It is through the first three processes that rich discriminatory detail about current operations is created (a capability to anticipate unexpected and potentially risky events) and through the last two processes that unexpected events are contained through a collective ability to pool resources in a flexible manner (a capability for resilience) (Vogus, 2011). These five processes are seen in the actions and interactions of team members on the front line. It is a fragile process that is constantly enacted and re-enacted by those on the front line.

Preoccupation with failure means teams are constantly paying attention to, and worrying about, any small error that has occurred or may occur (Weick et al., 1999). They treat these potential or actual errors as possible indicators of bigger problems (LaPorte & Consolini, 1991). This manifests in teams consistently searching for any anomalies that occur during operations as well as routinely checking weak, mixed or routine signals as evidence of potential failures (Weick & Sutcliffe, 2015). This preoccupation with failure also means that teams are suspicious during quiet periods where there are no unexpected events as this may indicate that they have missed something (Weick & Sutcliffe, 2015). Preoccupation with failure also means that teams treat near misses as failures and lessons to be learned rather than a success (Weick & Sutcliffe, 2015).

Reluctance to simplify interpretations means teams try to understand the full, detailed picture of an unfolding event, rather than jumping to conclusions or using simplified models to explain operations (Weick & Sutcliffe, 2015). Teams will question received wisdom and look for alternative explanations to try to uncover potential weak points, not allowing past information or assumptions to cloud their judgement of new events (Weick et al., 1999). They allow uncertainty to build up before labelling a situation preventing them from incorrectly diagnosing an unexpected event before they have enough information to understand it.

Sensitivity to operations means teams are constantly monitoring and updating their current understanding of the human, technical and organizational factors that affect operations so as to build an integrated and up-to-date picture that represent the overall situation and operational status of their work (Weick et al., 1999). Through constant interaction, everyone in the team has a shared understanding of the intricacies of their current operations and each team member's unique skills (Vogus & Sutcliffe, 2007). An important part of sensitivity to operations is that it focuses on understanding what is actually happening on the front line, regardless of intentions, designs and plans (Weick & Sutcliffe, 2015).

Commitment to resilience involves always trying to grow employee and organization-wide capabilities to best learn, adapt and improvise to bounce back from unexpected events (Van Dyck, Frese, Baer & Sonnentag, 2005). A commitment to resilience means teams will pay attention to which capabilities, knowledge and resources are most important when responding to unwanted surprises (Weick & Sutcliffe, 2015). It also means that teams will analyse previous mistakes and setbacks for their lessons in order to use these as opportunities to grow team-wide capabilities (Weick et al., 1999). A commitment to resilience also requires quick, real-time feedback so teams are best equipped to deal with surprises as they unfold (Weick & Sutcliffe, 2015).

Deference to expertise means that during unexpected events, decisions are made by those best equipped to deal with the current situation, rather than those with the highest hierarchical rank (Weick et al., 1999). This requires that team members have a good understanding of each other's expertise, so they know who to call on during unexpected events (Roberts, Stout & Halpern, 1994). It also means that all team members feel the same responsibility to contribute to safety performance regardless of how many years of experience they have (Weick & Sutcliffe, 2015). Deference to expertise also means that those closest to the potential problem become the sense makers of that problem and experts will listen to new employees with humility (Weick & Sutcliffe, 2015)

4.1.2. Mindful organising's nomological network

Vogus and Sutcliffe (2012) stress the importance of distinguishing mindful organising from related mindfulness concepts such as organizational mindfulness and individual mindfulness, as they may seem similar but are theoretically and operationally different. Mindful organising also bears some similarities to other team-related variables that are known to be important for predicting safety performance such as transactive memory systems and team situational awareness. In order to deepen the conceptualization of mindful organising, the following section will distinguish mindful organising from other mindfulness variables (individual and organizational mindfulness) as well as other similar team-related constructs (transactive memory systems and team situational awareness).

Individual mindfulness is the most widely studied and best understood of all the mindfulness constructs. It refers to a state of consciousness where attention is focused on events occurring in the present moment: both internally and externally (Dane, 2011). It is a mental activity or a state of concentration that occurs in one’s mind. Mindful organising is different from individual mindfulness as it is not an intrapsychic process that occurs in the mind of individuals or teams (Morgeson & Hofmann, 1999). Rather, mindful organising is a social process of organising in such a way that sustains attention to salient stimuli that may pose a threat to the operation of the organization, sparking corrective action (Vogus & Sutcliffe, 2012). It can be seen and recorded in the conversations, interactions, and actions of team members.

Mindful organising is also different from organizational mindfulness (Vogus & Sutcliffe 2012). Organizational mindfulness is more similar to mindful organising than individual mindfulness as it is also a collective capability to anticipate and recover from unexpected events. However, organizational mindfulness is a strategic top-down construct which is more enduring in an organization as it is brought about through the practices, strategies, and structures put in place by top management (Vogus & Sutcliffe, 2012). In contrast, mindful organising is a bottom-up collective process enacted by those on the front line; it is fragile and needs constant reinforcement (Weick & Sutcliffe, 2007).

An interesting team-related variable that bears some similarities to mindful organising is transactive memory systems. Transactive memory is a shared memory system where knowledge is collectively stored, encoded and retrieved among pairs or groups (Wegner, 1987). This develops when people in close relationships are aware of the content of each other's knowledge and therefore use one another as memory storage locations (Xiao, Moss, Mackenzie, Seagull & Faraj, 2002). In teams, group-level transactive memory can be formed where team members rely on each other's knowledge to reduce their cognitive load and deepen their own area-specific knowledge, depending on one another for information retrieval when needed (Lewis, 2003). This group-level transactive memory is seen when teams (1) show a differentiated structure of members specialised knowledge (specialization), (2) believe in and trust in the legitimacy of each other's expertise (credibility) and (3) have an effective coordinated way of processing knowledge (coordination) (Moreland & Myaskovsky, 2000). This transactive memory system is believed to allow teams to combine their expertise and coordinate their actions better (Lewis, 2003).

Transactive memory systems largely focus on the coordinated storage and processing of knowledge and information among teams bearing some similarities to two elements of mindful organising: sensitivity to operations and deference to expertise. Sensitivity to operations has to do with teams having a thorough, up-to-date understanding of the human factors that affect operations (Vogus & Sutcliffe, 2007). This is similar to specialization in transactive memory systems which speaks to team members understanding their and other team members specialised skills. In addition, deference to expertise speaks directly to decision making power being transferred to those with the best expertise at hand as well as pooling collective expertise to best deal with unexpected events (Weick et al., 1999) which bears some similarities to drawing on others differentiated knowledge to increase collective expertise for effective knowledge processing. Although transactive memory systems focus on the division of labour according to expertise and do not directly speak to pooling of collective expertise.

Despite these interesting overlaps, the two variables have key differences in the way they are defined and operationalised. The main goal of mindful organising is achieving safer and more reliable performance by anticipating, and recovering from, unexpected events (Weick & Sutcliffe, 2001). Three of the five processes of mindful organising (preoccupation with failure, reluctance to simplify interpretations and sensitivity to operations) have to do with anticipating events, or information, which is largely future-oriented. The main goal of transactive memory systems seems to be achieving greater efficiency and effectiveness through storing, sharing and processing of knowledge. This process is largely based on recovering past knowledge or know-how, therefore, it is largely past-oriented. Mindful organising is also focused on error anticipation, detection, and recovery, which does not feature in the definition and operationalisation of transactive memory systems. Transactive memory systems have to do with the collective storing, sharing and processing of previous knowledge (Lewis, 2003), which is important for certain elements of mindful organising (e.g. sensitivity to operations) but is not central to the construct's core.

Mindful organising also places importance on teams always considering alternative explanations and new ways of working and resisting the temptation to use old strategies to face familiar problems (reluctance to simplify interpretations). Transactive memory systems aim for efficiency and rely on trusting each other's expertise in knowledge processing (Lewis, 2003) and may even have risks of simplified interpretations as teams are likely to rely on solutions that worked in the past to solve problems. Mindful organising is also largely focused on constantly growing team and system-wide capabilities to better adapt to unexpected events (commitment to resilience) (Van Dyke et al., 2005). Transactive memory systems rely on expected well-established roles of members and their corresponding expertise, without attention put on continuously enhancing and growing this expertise by monitoring external demands.

Another team-related variable which has some similarities to mindful organising is team situation awareness. Team situation awareness is defined as two or more people actively constructing a situation together by partly sharing the sensemaking and partly distributing it and, therefore, they are able to anticipate important upcoming states in the future (Salas, Prince, Baker & Shrestha, 1995). It is the shared understanding of a situation among team members at a given point in time (Salas et al., 1995). It requires all team members to exhibit individual situational awareness and team processes that facilitate information exchanges and team coordination (Schwartz, 1990).

Team situational awareness bears some similarities to the "anticipation" part of mindful organising as Vogus (2011) argues that preoccupation with failure, sensitivity to operations and reluctance to simplify interpretations allows teams to generate a rich awareness of discriminatory detail of their current operations to best anticipate unexpected events. In addition, both mindful organising and team situational awareness have been studied in high-risk environments with the goal of achieving safe performance. The time orientation of team situational awareness and mindful organising are also somewhat similar, with mindful organising being largely future-oriented and team situational awareness being present to short term future-oriented. Teams engaging in mindful organising maintain an acute awareness of any potential errors or anomalies through proactive and pre-emptive discussion and analysis of their current operations (preoccupation with failure). In addition, teams actively maintain a constant up-to-date understanding of the human and organizational factors that affect their operations through their actions and interactions with one another (sensitivity to operations). These two processes of mindful organising are similar to the individual and collective sense making in the moment to best anticipate upcoming future states which is central to team situational awareness. In fact, Weick & Sutcliffe (2015) argue that situational awareness is an important prerequisite for "sensitivity to operations".

Even within the processes of mindful organising that have to do with "anticipation", there are important distinctions with team situational awareness. Reluctance to simplify interpretations means teams constantly interpret new cues updating previous assumptions, which is similar to the sensemaking in team situational awareness. However, this process (reluctance to simplify interpretations) puts a strong emphasis on questioning previous ways of working and not allowing previous assumptions to cloud new interpretations of cues (Schulman, 1993; Weick & Sutcliffe, 2015). Team situational awareness does not emphasize questioning assumptions and looking at alternative ways of working or tackling a problem. Instead, it speaks to the immediate use of pre-dispositions and pre-existing assumptions in the sensemaking process (Salas et al., 1995). Mindful organising also places specific emphasis on constantly focusing on error detection and system weaknesses (preoccupation with failure), whereas team situational awareness is more generally focused on collectively developing a deep understanding the intricacies of a situation to anticipate events in the future.

Team situational awareness may have some similarities to the "anticipation" part of mindful organising, but it does not include the action component of mindful organising. Through the processes of commitment to resilience, teams generate a capacity for action during unexpected events. Through deference to expertise, teams learn who to call on during unexpected events. The scope of team situational awareness seems to largely focus on sensemaking as teams create moment-to-moment assessments of a situation and does not speak to actively growing team capabilities to increase team effectiveness or understanding which team members to call on during these unexpected events.

4.1.3. Mindful organising correlates

A comprehensive review of the current literature on the antecedents and consequences of mindful organising can be found in the meta-analysis by Sutcliffe et al. (2016). In this paper, we aimed to provide evidence of validity by examining the relationship between mindful organising and concepts that have been theoretically and empirically associated with mindful organising in previous studies, such as safety culture (Vogus & Sutcliffe, 2007), team safety climate (Knight, 2004) and team learning. Additional evidence of validity was shown by checking the discriminant validity of mindful organising with these related constructs. The below section presents the similarities and key distinctions between mindful organising and safety culture, team safety climate and team learning. This section also describes how these concepts are related and how mindful organising can uniquely predict safety performance in high-risk environments, above and beyond these variables.

Safety culture is defined as a subset or facet of the organizational culture where safety has an overriding priority (IAEA, 1991). Following the classical conceptualization of organizational culture by Schein (1985), safety culture can be defined as stable and shared basic assumptions, beliefs, values and norms regarding the importance of safety at work (López de Castro, Gracia, Peiró, Pietrantoni & Hernández, 2013). In Vogus and Sutcliffe's (2007) original validation paper of the Mindful Organising Scale, these authors suggest that mindful organising is the behavioural enactment of safety culture. Although the nature of the relationship between mindful organising and safety culture is not yet fully understood, Sutcliffe et al. (2016) argue that mindful organising and safety culture may have a relationship that is reciprocal. They believe that on the one hand, the bottom-up social actions and interactions that occur during mindful organising, such as constant questioning of received wisdom and deferring decision-making power based on the best expertise, may amplify and reinforce safety norms and values. On the other hand, the top-down effects of strong safety culture on determining how things are done may boost teams' capability to anticipate and recover from unexpected events concerning safety. It is therefore likely that safety culture and mindful organising will be positively related.

Although teams that exhibit mindful organising are likely to work in organizations that exhibit a strong value for prioritising safety, mindful organising encompasses more than just prioritising safety. Mindful organising details the team behaviours and processes needed to anticipate, contain and bounce back from events that could threaten safety. It is possible to have high safety culture in an organization without strong mindful organising. This is because mindful organising speaks to front-line team level actions and interactions where teams notice weak signals and analyse these signals leading to a broader understanding of what is noticed which then widens the repertoire of action capabilities at the team's disposal (Weick et al., 1999). It is possible to have a high safety culture but not understand the team processes needed to achieve safe performance. Mindful organising should be a more powerful team level predictor of safety performance than organizational safety culture in high-reliability settings rife with unexpected events as it encompasses more intricate details of team dynamics that are needed to best comprehend and respond to these unexpected events.

Safety climate has been defined as employees' shared perceptions about safety policies, procedures, and practices at any given moment in time (Zohar, 1980; Zohar & Luria, 2005). Safety climate is a manifestation or 'snapshot' of safety culture (Flin, Mearns, O´Connor & Bryden, 2000; Mearns, Flin, Gordon, & Fleming, 1998); therefore, it is more transient and less stable than safety culture. Just like mindful organising, safety climate has long been considered a predictor of safety in organizations (Hofmann, Morgeson, & Gerras, 2003: Zohar, 1980). Knight (2004) found that mindful organising is positively related to safety climate. His measure of safety climate was on the organizational level. Zohar and Luria (2005) found alignment between organizational safety climate and group-level safety climate in their multilevel study. It is expected if a team perceives that there is a high value placed on safety within their team at a given point in time, they are more likely to engage in collectively mindful actions and interactions. Therefore, it is expected that the team safety climate may also be strongly positively related to mindful organising.

Mindful organising bears some similarities to team safety climate as it is a team level construct that prioritises safety. It is also fragile and needs constant reinforcement by team members. However, team safety climate is about shared perceptions of the importance of safety and mindful organising speaks to a set of team level practices that allow for teams have a deeper, more nuanced comprehension of potential safety risks and to act swiftly in response to these risks. Teams that have high levels of mindful organising are likely to have strong perceptions of safety climate. Nevertheless, the ability to mindfully organise is likely to uniquely predict safety performance in HROs rife with unexpected events. This is because the manner in which teams proactively comprehend and respond to potential errors is critical, above and beyond the shared team perception that safety policies, procedures and practices should be prioritised.

Team learning can be defined as regular activities and behaviours carried out by teams to acquire and develop competencies (e.g. knowledge, skills and attitudes) and achieve better performance over time (Bresó, Gracia, Latorre & Peiró, 2008). Gärtner (2013) found that mindful organising leads to a greater learning orientation in workers. However, to the knowledge of the authors, the relationship between mindful organising and learning in teams has never been tested. Teams scoring highly in mindful organising are committed to developing capabilities that will enable them to more quickly detect, contain and bounce back from errors that have occurred and have the potential to cause more harm (Vogus & Sutcliffe, 2007). As a team, those that are collectively mindful are likely to grow their knowledge and capabilities together. Therefore, mindful organising is expected to be positively related to team learning.

Mindful organising does encompass elements of team learning, but engaging in activities to grow team-wide capabilities to best respond to unexpected events is just one element of mindful organising. The construct also encompasses other important team practices to do with anticipation and recovery from unexpected events in volatile environments. Although team learning is an invaluable part of building capable teams that are more likely to have highly reliable performance, this one aspect alone is unlikely to be as strong of a predictor of safety performance as mindful organising is, given the wider scope and depth of the mindful organising construct.

4.1.4. Mindful organising questionnaires

There are a large number of qualitative studies in mindful organising research, so not many quantitative instruments used in the literature. Of the questionnaires that are used, there is much variation among them. Quantitative measures of mindful organising normally take on two forms; multifactor scales (which try to encompass a separate factor for each of the five processes of mindful organising) or unidimensional scales (which treat mindful organising as one underlying dimension). Nevertheless, there are few studies that show sound psychometric properties of mindful organising measures (Sutcliffe et al., 2016). These questionnaires are described below.

Multifactor questionnaires of mindful organising have been used in many different industries and vary in length and focus. Weick and Sutcliffe (2001) initially proposed a 47-item mindful organising questionnaire that encompasses the five processes of mindful organising (preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise) for managers to assess how mindful their organizations were. Ray, Baker and Plowman (2011) then sought to gain evidence of the validity of this scale by refining and slightly adapting this questionnaire to a 43-item questionnaire, to be used in a business school setting. These authors managed to successfully validate this scale as it emerged to have the five interrelated factors proposed by Weick and Sutcliffe (2001). These factors were different perceptually but highly related to one another. Before this, Mu and Butler (2009) created a 38-item questionnaire of mindful organising for student and professional service organizations based on the same five factors proposed by Weick and Sutcliffe (2001). These authors successfully validated the five-factor structure of the scale in their study which compared the difference between senior management and workers perceived importance of each of the five mindful organising dimensions.

There have been a few two-factor scales that have emerged, such as the 20-item scale created by Hoy Gage and Tarter (2004) to be used in schools. These authors validated their scale to compose of two factors: mindful organising of principals and mindful organising of the faculty. They successfully aggregated individual scores to the group-level and linked mindful organising to dimensions of trust. Barrett, Novak, Venette and Shumate (2006) created their own 10-item Mindful Organising Scale for firefighters and called it the measure of high-reliability organization (HRO) perceptions scale. These authors also proposed that this HRO perceptions scale consisted of two factors: the perceived capacity for avoiding crises (self-efficacy) and the perceived ability to communicate in a way that avoids or responds well to crises (organizational risk response). These authors found their measure of mindful organising was positively linked to self-efficacy and risk responsiveness. However, the scale was not aggregated to the group-level and these authors did not manage to find an adequate fit in the confirmatory factor analysis for their proposed two-factor model.

Vogus and Sutcliffe (2007) validated the first unidimensional questionnaire in their research on mindful organising in the medical sector. The scale was originally developed by these authors and they based the items on theorised behavioural markers of "collective mindfulness" (Weick et al., 1999; Weick & Sutcliffe, 2001) as well as detailed case studies of HROs such as aircraft carriers (Weick & Roberts, 1993) and nuclear power plants (Schulman, 1993). These authors also used case studies from health care organizations following the principles of HROs (Roberts et al., 1993; Wilson, Burke & Priest, 2005) This nine-item scale depicts the five interrelated processes of mindful organising (Weick & Sutcliffe, 2001) with one to two items for each process. It is one of the few measures of mindful organising to show sound psychometric properties in terms of (1) evidence of validity based on relationships with other variables (e.g., discriminant and criterion), (2) sound reliability and (3) evidence justifying the aggregation of individual scores to the group-level. Evidence of discriminant validity was obtained by running a factor analysis of the mindful organising items with the items of other scales measuring related but differentiated constructs, such as trust in leadership and effective commitment. Evidence of criterion validity was shown by testing the relationships of mindful organising with individual and organizational outcomes such as exhaustion and turnover.

Ausserhofer et al. (2013) also validated Vogus and Sutcliffe's (2007) Mindful Organising Scale in French, German and Italian, with all these scales emerging as unidimensional scales. Both the original validation of the Mindful Organising Scale by Vogus and Sutcliffe (2007) and the translated versions of the scale by Ausserhofer et al. (2013), were conducted with samples of nurses. Later, Magnano et al. (2017) validated an Italian version of the scale. These authors confirmed a unidimensional structure of the scale and showed sound internal consistency of the scale and concurrent validity of mindful organising from commitment to change and perceived organizational support. These authors, however, omitted one item from the scale, did not show any evidence for aggregating scores to a team level and used a sample of individual Italian workers from different organizations not within high-reliability.

The multidimensional scales are useful as they offer richer diagnostic value so researchers and practitioners can comprehensively see which aspects of each of the five mindful organising processes are lacking. However, having larger scales can be challenging in applied research. Studies that measure mindful organising will almost always measure other variables too (such as safety performance, safety culture, leadership practices, etc.) and presenting participants with long and time-consuming questionnaires can lead to response biases due to fatigue as well as take more time away from people doing their job. Therefore, it is unsurprising that in the extant literature to do with empirical research in various different contexts on mindful organising, the nine-item scale by Vogus and Sutcliffe (2007) is one of the most widely used scales (e.g. Ausserhofer et al., 2013; Dierynck, Leroy, Savage & Choi, 2016; Magnano et al., 2017; Zaheer, 2017). The wide use of the scale by researchers is likely to also stem from its focus and quality. The original scale items, which encompass all five of the mindful organising dimensions (Vogus, 2011), were clearly worded and not specific to a certain industry or sector, making it easy to adapt to other sectors. It is also the only mindful organising scale that has shown sound psychometric properties in all the needed aspects (reliability, discriminant validity, criterion validity and successful aggregation of scores to the group-level) (Sutcliffe et al., 2016). However, in terms of gaining further evidence of sound psychometric properties of a mindful organising scale, there is a need for further evidence of the discriminant validity of mindful organising from related concepts such as safety culture and climate and other group processes (Sutcliffe et al., 2016). This will expand our understanding of mindful organising's nomological network and distinguish it as a unique construct from these related variables.

Interestingly, to the knowledge of the authors, no study to date has empirically tested the reliability and factor structure of a mindful organising measure in more traditional HRO settings like nuclear power plants. Instead, samples have come mostly from reliability seeking organizations such as hospitals (e.g. Ausserhofer et al., 2013; Vogus & Sutcliffe, 2007) and fire departments (Barrett et al., 2006), or non-traditional HRO industries like information technology firms (e.g. Mu & Butler, 2012) and educational institutions (e.g. Hoy et al., 2004; Ray et al., 2011). This is especially interesting as the original conceptualization of mindful organising by Weick et al. (1999) bases much of the theoretical foundations of the construct on HROs following the safety research paradigm interested in understanding the human factors in organizations where safety is consistently achieved. Validating an instrument to measure this team level capability in organizations that fully embody the characteristics of an HRO, such as nuclear power plants, is likely to add real value as it is within these environments that mindful organising is most accurately represented.

Besides the impact of organizational norms on how mindful organising is manifested, national cultures are also likely to have a noteworthy impact on how this construct plays out in teams. An English, Italian and German version of Vogus and Sutcliffe's (2007) mindful organising scale exist; the English version of the scale was validated in the United States and the French, German and Italian versions of the Scale were validated on French, German and Italian samples (Ausserhofer et al., 2013; Magnano et al., 2017).To our knowledge, there have not been any attempts to create and validate a Spanish version of the scale. Even if the Vogus & Sutcliffe (2007) scale has been validated in these other languages and countries, it does not mean that it is valid for a Spanish sample as cross-cultural differences may affect the way mindful organising is manifested. In fact, Noort, Reader, Shorrock and Kirwan (2015) found that differences in cultural dimensions such as Hofstede's (2001) uncertainty avoidance (where people prefer sticking to rules, avoid confrontation and dislike change) across countries have an impact on attitudes and practices for managing safety (e.g. reliance on protocols, openness to different perspectives and concerns over reporting incidents). This is noteworthy given that Spain is an uncertainty avoidant (score of 81) nation, which is slightly higher than three of the four other countries the mindful organising scale has been validated (the United States scores 46, Germany scores 65, Italy scores 75, France scores 86) (Hofstede, 2001). Therefore, a Spanish version of a mindful organising scale validated with a culturally Spanish sample will add to our understanding of whether mindful organising is embodied in the same way in Spain as it is in other countries and thus provides some evidence for whether the construct is relevant across cultures.

Mindful organising can be seen in the actions and interactions of team members and is a bottom-up construct that is fragile and continually re-enacted by those on the front line (Sutcliffe et al., 2016; Vogus & Sutcliffe, 2012; Weick et al., 1999; Weick & Sutcliffe, 2001). Mindful organising is a shared unit property, meaning it emerges from individual perceptions and behaviours to a team level phenomenon. The assumption is that shared unit constructs manifest between organizational levels (individual and team levels) through isomorphism (Kozlowski & Klein, 2000). Therefore, shared unit construct scores have the same content, meaning and construct validity on both the individual-level and the team level (Jones & James, 1979; Kozlowski & Hults, 1987). Vogus and Sutcliffe (2012) argue that behaviour in line with, and perceptions about, mindful organising are likely to coalesce and converge among members of a team due to attraction-selection-attrition processes (Schneider, 1989) and due to task interdependence. These authors argue that attraction-selection-attrition processes can strengthen and reinforce similarities in mindful organising among team members as members that exhibit similar behaviours are favoured in selection and retention. They also posit that task interdependence and the influence of social learning that is facilitated through ongoing social interactions during the time teams work together can create greater convergence in mindful organising among team members.

The subject and content of all mindful organising scale items refer to team level practices and behaviours but are rated by individuals about their team (e.g. Vogus & Sutcliffe, Ray et al., 2011). Due to the fact that mindful organising is conceptualised as a shared unit property, an essential part of creating empirical evidence to back up the theoretical understanding of mindful organising is to show that individual team member's mindful organising scores can be aggregated to the group-level (Sutcliffe et al., 2016). Aggregating individual responses about team level practices and behaviours to create a team score is meaningful provided that adequate consensus is found between scores.

4.1.5. The aims

This paper aims to validate a Spanish version of the Vogus and Sutcliffe (2007) unidimensional Mindful Organising Scale using a sample from a nuclear power plant in Spain. It will be done by (1) providing evidence of internal structure validity (2) providing evidence of reliability of the scale (3) testing the appropriateness of aggregating mindful organising scores to a group-level, (4) providing evidence of convergent validity based on the relationship of mindful organising with other team-related variables (safety culture, team safety climate and team learning), (5) providing evidence of discriminant validity with these concepts by checking the distinctiveness of the scales, and (6) collecting evidence of criterion-related validity in predicting workplace safety outcomes (safety compliance, safety participation).

4.2. MATERIALS AND METHODS

4.2.1. Procedure and sample

This study was conducted in accordance with international ethical guidelines, which are consistent with the American Psychological Association (APA) guidelines. Data collection took place in 2016. The Spanish version of the Mindful Organising Scale was part of a battery of questionnaires designed to assess different constructs related to safety culture. Researchers were on site at the nuclear power plant to inform participants about the purpose of the study and to provide instructions about the way the questionnaires should be completed. Researchers administered the questionnaires and addressed any questions and concerns as participants completed the questionnaires. The administration of the questionnaires took place in small groups during work time, in a quiet room. Participants were encouraged to answer honestly, and it took around 30 minutes to complete the questionnaires. Participation was voluntary and confidentiality and anonymity were guaranteed.

The sample in the present study comprises of 573 workers from 47 different teams working in a Spanish nuclear power plant, yielding a response rate of 72.5%. A team was considered as 2 or more staff working toward a common goal (Kozlowski & Bell, 2003). These teams worked in all functionalities within the nuclear power plant (e.g. Operation, Maintenance, Engineering, Radiological Protection, Chemistry, etc.). Regarding age distribution, 64.4% of the sample were over the age of 45, 27.4% were between 30 and 45 years old, 5.1% were below the age of 30 and 3.1% of respondents did not indicate their age. The average group size was 12.19 (SD = 10.83). The largest team size included 48 members and the smallest team size included three members.

4.2.2. Measures

4.2.2.1. Mindful organising

Mindful organising was measured by means of nine items that assess the extent to which teams pay attention to discriminatory detail of emerging issues and act swiftly in response to such details (Vogus & Sutcliffe, 2012; Weick & Sutcliffe, 2006; Weick et al., 1999). Participants rate the extent to which the nine items accurately describe their team on a five-point Likert scale ranging from one (completely disagree) to five (completely agree). The scale was taken from the Mindful Organising Scale by Vogus and Sutcliffe (2007). A complete list of the items can be found in Table 1. The scale was translated into Spanish following established guidelines for test translation and adaptation from one culture to another (Balluerka, Gorostiaga, Alonso-Arbiol, & Haranburu, 2007; Muñiz, Elosua, & Hambleton, 2013). In doing so, we chose the back-translation method, where our measure was translated from the original English version to Spanish and then the Spanish version was translated back to the English. This technique was chosen as it is the best way to ensure the translated words and sentences are conceptually and functionally equivalent. This back translation was performed by two separate certified translators. One of these translators had wide experience within academia and the other translator had wide experience in the nuclear industry. One translator did the original translation from English to Spanish and the other did the back translation from Spanish to English. Thereafter, the two translators met to analyse any discrepancies in the original scale, the Spanish version and the back-translated version. The translators then came to a consensus on a translation that accurately depicted the intent and wording of the original scale.

4.2.2.2. Team safety climate

Team level safety climate was measured with a fifteen-item scale originally adapted from Zohar and Luria (2005) into Spanish by Latorre, Gracia, Tomás and Peiró (2013). The scale asks respondents to rate the extent to which they agree with each item on a five-point Likert scale ranging from one (completely disagree) to five (completely agree). A sample item is “we make sure we have everything we need to do the job in a safe way." This team safety climate scale had a Cronbach alpha value of .96.

4.2.2.3. Organizational safety culture

Safety culture was measured with the Safety Culture Enactment Questionnaire (López de Castro, Gracia, Tomás & Peiró, 2017). It is a twenty-one-item scale where participants are asked to rate the level of importance given to nuclear safety within the practices of the organization on a five-point Likert scale ranging from one (not at all) to five (quite a lot). A sample item is "to what degree is safety important in the process of making decisions about work?" This safety culture scale had a Cronbach alpha value of .96.

4.2.2.4. Team learning

Team learning was measured with a twenty-item scale which asks participants to rate the extent to which their team engages in behaviours and activities to encourage the development of competencies (such as knowledge, skills and attitudes) and better functioning of the team over time (Bresó et al., 2008). Participants are asked to rate how often certain situations occur within their team on a scale from one (never or almost never) to five (always or almost always). A sample item is "knowledge is shared among the different team members". This team learning scale had a Cronbach's alpha value of .93.

4.2.2.5. Safety compliance

The Spanish version (Martínez-Córcoles et al., 2013) of the scale developed by Neal and Griffin (2006) was used to measure compliance with safety rules and procedures. This scale is made up of the following three items: 'I use the correct safety procedures for performing my job'; 'I use all the necessary safety equipment to do my job'; and 'I ensure the highest levels of safety when I do my job'. Items are answered on a 5-point Likert response scale ranging from 1 (strongly disagree) to 5 (strongly agree). The safety compliance scale had a Cronbach alpha value of .89.

4.2.2.6. Safety participation

This variable was measured by means of the Spanish version (Martínez-Córcoles et al., 2013) of the scale developed by Neal and Griffin (2006). The scale is made up of three items rated on a 5-point Likert response scale ranging from 1 (completely disagree) to 5 (completely agree). Scale items were the following: ''I promote the safety program within the organization''; ''I voluntarily carry out tasks or activities that help to improve workplace safety''; and ''I make extra effort to improve safety in the workplace''. The safety participation scale had a Cronbach alpha value of .88.

4.2.3. Analyses

First, a CFA was run using Mplus (Muthén & Muthén, 1998–2010), to test the internal factor structure of the Mindful Organising Scale. Individual-level responses were used (N = 573), and considering the ordinal nature of the items, the robust weighted least square (WLSMV) estimator was chosen. Model fit was evaluated by considering the chi-square statistic as well as a few other goodness of fit indices, namely: the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI; Bentler, 1990), and the Tucker Lewis index (TLI; Tucker & Lewis, 1973). RMSEA values of .10 or more indicate poor fit, values between .08 and .05 indicate moderate fit, and values below .05 indicate good fit (Browne & Cudeck, 1993). CFI values close to 1 indicate good fit, with values above .95 considered acceptable fit (Hu & Bentler, 1999). TLI values near 1 indicate good fit and values approaching 0 indicate poor fit, with the conventional cut off being .90 for acceptable fit (Tucker & Lewis, 1973).

Second, the reliability of the Mindful Organising Scale was assessed using individual scores by computing the Cronbach alpha coefficient (□). The average variance extracted (AVE) value and composite reliability value (rho) were examined to ascertain the internal consistency of the scale. The average variance extracted values of .50 or greater indicate satisfactory reliability as the variance of the construct is greater than the error variance (Fornell & Larcker, 1981). For composite reliability (rho values), a score of .70 or greater indicates good reliability (Raykov, 2001).

Third, aggregation indexes were calculated for team level scores. Mindful organising is a social construct that operates within the actions and interactions of teams, therefore individuals' scores were aggregated to form a team mindful organising score. Before this, it was essential to demonstrate that each member's score was similar enough to those within their team, so as to justify aggregating these scores. Therefore, the average deviation index (ADI; Burke, Finkelstein, & Dusig, 1999) and the $r_{WG(J)}$ (James, Demaree, & Wolf, 1984) were computed and analysed for the Mindful Organising Scale to ensure within-team agreement. Since items were measured using a 5-point Likert response scale, the cut-off value for the ADI was .83 (Burke & Dunlap, 2002); $r_{WG(J)}$ values above .70 are considered to provide evidence of agreement (Bliese, 2013). We also computed the intraclass correlation coefficients (Bliese, 2000): ICC (1) indicates the level of consistency of responses among team members; ICC(2) estimates the reliability of the team means. Recommended cut-off values for ICC(1) typically range between .05 and .20 (Bliese, 2000); LeBreton and Senter (2008) have suggested that an

ICC(1)=.05 (which indicates that 5% of the variance in the variable is explained by the clustering structure of the data) represents a small to medium effect, suggesting further investigation concerning the viability of aggregating scores within groups is needed. Bliese (2000) also suggests that values of ICC (2) above 0.70 should be considered acceptable. Finally, we also carried out a one-way analysis of variance (ANOVA) to determine whether there was statistically significant between-team discrimination in mindful organising among teams. All other variables in the study (safety culture, team safety climate, team learning, safety compliance, and safety participation) were also operationalised by aggregating team members' scores, and therefore, the aforementioned aggregation indices were also estimated for them. Aggregation indices and ANOVA were estimated with R 3.5.0 (R Core Team, 2018).

Fourth, to show evidence of validity, mindful organising was correlated with safety culture, team safety climate and team learning. This analysis was done with the aggregated group-level scores. The correlation analysis was also used to collect evidence of discriminant validity. It is widely accepted that factor discrimination can be established when inter-factor correlations are below .85 (Kline, 2005).

Thereafter, a CFA was run using individual scores (N = 573) to show the distinctiveness of mindful organising compared with these three variables (safety culture, team safety climate and team learning). Two alternative models were compared: a one factor model (with all items loading in a single factor), and a four-factor model (with items loading in their corresponding scale). WLSMV was used as the method of estimation, considering the ordinal nature of data. Model fit indices were analysed according to the above-mentioned criteria. Regarding the practical fit indices based on modelling rationale, the following criteria were used to compare the alternative models: (a) if the difference between the NNFI values or between the TLI values of the competing models is less than .01, it is considered practically inconsequential (Cheung & Rensvold, 2002; Widaman, 1985), (b) support for a more parsimonious model can be claimed when the RMSEA increases by less than .015 (Chen, 2007). Both CFA's were run using individual-level scores due to the size of our sample. The sample size affects the stability of the parameter estimates. Different studies (e.g., MacCallum et al., 1999; MacCallum et al., 2001), have pointed out that using small sample sizes, implies a considerable risk of misspecification of the model. Although the recommended "cutoff value" varies widely, scholars appear to agree that a sample size of at least 200 cases is recommended to evaluate the factorial structure of a test (Ferrando & Anguiano-Carrasco, 2010; Lloret et al., 2014). For this reason, carrying out the CFA at the team level (n = 47) was not possible in the present study.

Finally, we tested the criterion-related validity of the Mindful Organising Scale by demonstrating the utility of the scale in predicting various workplace safety outcomes. We tested the incremental validity of the scale by checking if mindful organising added more explained variance to two workplace safety outcomes (safety compliance and safety participation) after controlling for other constructs (safety culture, team safety climate and team learning). With this purpose, we run hierarchical regression analyses using safety compliance and safety participation as dependent variables. We then introduced the control variables (safety culture, team safety climate and team learning) as independent variables. Thereafter, we introduced mindful organising. The hierarchical regression analyses were carried out at both, individual and team level.

4.3. RESULTS

4.3.1. The internal structure of the mindful organising scale

The results of the CFA indicated that the proposed unidimensional model indicated satisfactory fit (χ^2 = 157.84, df = 27, $p < .01$; RMSEA = .092; CFI =.988; TLI =.984). All items had a statistically significant factor loadings with values ranging from .89 to .96, which is well above the recommended cut off of .72 (Stevens, 2002).

4.3.2. Descriptive statistics and reliability of the mindful organising scale

The wording of the items and their corresponding descriptive statistics (mean, standard deviation, skewness, and kurtosis) can be found in Table 1. The Cronbach's alpha coefficient of the translated scale was .94, providing evidence of satisfactory reliability. Corrected item-scale correlations ranged from .72 to .83, showing strong internal consistency for the scale. The AVE value was .70 and the rho value was .95, which are above the cut-off values indicating sound reliability.

Table 1

Descriptive statistics and item-total correlations for the items of the mindful organising Scale

Items	*M*	*SD*	*Item Total R*	*Skewness*	*Kurtosis*
Preoccupation with failure					
a. Cuando surgen problemas, hablamos con los compañeros sobre qué cosas deberíamos tener en cuenta. (When discussing emerging problems with co-workers we normally discuss what to look out for.)	4.26	.87	.82	-1.32	1.82
b. Pasamos tiempo identificando actividades que no queremos que vayan mal. (We spend time identifying activities we do not want to go wrong.)	3.98	.88	.75	-.75	.43
Reluctance to simplify interpretations					
c. Discutimos alternativas sobre cómo realizar nuestras actividades laborales normales. (We discuss alternatives as to how to go about our normal work activities.)	3.92	.95	.80	-.79	.27
Sensitivity to operations					
d. Tenemos un buen “mapa” de las capacidades y competencias de cada persona. (We have a good “map” of each person’s talents and skills.)	3.74	1.04	.72	-.72	.12

e. Hablamos acerca de nuestras competencias únicas de forma que sabemos quién tiene destrezas y conocimiento especializado. (We discuss our unique skills with each other so that we know who has relevant specialised skills and knowledge.)	3.82	.98	.82	-.74	.27
Commitment to Resilience					
f. Hablamos acerca de errores y maneras de aprender de ellos. (We talk about mistakes and ways to learn from them.)	4	.96	.83	-.84	.26
g. Cuando aparecen errores, hablamos sobre cómo podríamos haberlos impedido. (When errors happen, we discuss how we could have prevented them.)	4.23	.85	.83	-1.22	1.78
Deference to Expertise					
h. Cuando tratamos de solucionar un problema, aprovechamos las competencias únicas de nuestros compañeros. (When attempting to solve a problem, we take advantage of the unique skills of our colleagues.)	4.03	.92	.76	-.92	.72
i. Cuando ocurre una crisis, rápidamente unimos nuestro conocimiento experto colectivo para intentar resolverlo. (When a crisis occurs we rapidly pool our collective expertise to attempt to resolve it.)	4.29	.90	.79	-1.29	1.22

4.3.3. Justification for aggregating individual scores to collective/group scores

The Mindful Organising Scale had a mean ADI score below the proposed cut off of .83 with low variability among the scores (M = .68, SD = .18). Likewise, the ADI scores were well below the cut-off with low variability for safety culture (M =.60, SD = .16), team safety climate (M = .60, SD = .22), team learning (M =.73, SD = .16), safety compliance (M = .37, SD = .23), and safety participation (M = .57, SD = .19). The $r_{WG(J)}$ values were all above the cut-off of .70 for mindful organising ($r_{WG(J)}$ = .88), safety culture ($r_{WG(J)}$ = .97), team safety climate ($r_{WG(J)}$ = .92), team learning ($r_{WG(J)}$ = .89), safety compliance ($r_{WG(J)}$ = .92), and safety participation ($r_{WG(J)}$ = .85). This suggests there is strong agreement among the members within each team. The ANOVA values indicated significant differences among team's scores for mindful organising ($F(46,525) = 1.67$, $p < .01$), safety culture ($F(46,518) = 1.65$, $p < .01$), team safety climate ($F(46,523) = 2.33$, $p < .01$), team learning ($F(46,460) = 1.48$, $p < .05$), safety compliance ($F(46,525) = 1.67$, $p < .01$), and safety participation ($F(46,525) = 1.62$, $p < .01$). The ICC(1) for the variables included in the model were all above .05 (except for team learning and safety participation), indicating that 5.2% of the variance of mindfulness, 5.1% of the variance of safety culture, 9.9% of the variance of team safety climate, 4.3% of the variance of team learning, 5.2% of the variance of safety compliance, and 4.9% of the variance of safety participation, were respectively explained by the clustering structure (i.e., team) of the data. ICC(2) values where the following: mindful organising (ICC(2) = 0.40), safety culture (ICC(2) = 0.39), safety climate (ICC(2) = 0.57), team learning (ICC(2) = 0.33), safety compliance (ICC(2) = 0.40), and safety participation (ICC(2) = 0.38). ICC(2) values indicated low interrater reliability. However, ICC(1) values indicated a small to medium effect, suggesting that additional investigations concerning the viability of aggregating scores within groups would be justified. Finally, following LeBreton and Senter (2008), interrater agreement indices (ADI and $r_{WG(J)}$) indicated strong agreement in our data for all the measured variables. In summary, the above indices all together provided a reasonable justification for data aggregation.

4.3.4. Evidence of validity based on relationships with other variables

The aggregated team level scores of mindful organising were correlated with the aggregated team level scores of safety culture, team safety climate, and team learning. Pearson correlations between each of the variables are presented in Table 2. The results were as expected, with all correlations being positive and statistically significant. Mindful organising was positively related to safety culture, team safety climate and team learning at the group-level. Table 2 also shows the relationships between mindful organising and workplace safety outcomes (safety compliance and safety participation).

Table 2

Descriptive Statistics and Correlations among the Study Variables at The Group-level

	M	*SD*	1	2	3	4	5
1. Mindful Organising	4.03	.30					
2. Safety Culture	4.11	.28	.67**				
3. Team Safety Climate	4.24	.29	.72**	.59**			
4. Team Learning	3.81	.35	.77**	.50**	.69**		
5. Safety Compliance	4.71	.21	.58**	.45**	.63**	.53**	
6. Safety Participation	4.39	.29	.59**	.43**	.68**	.53**	.70**

Note. ***p* < .001, all variables are at the group-level.

As shown in Table 2, correlations between mindful organising and the other team-related variables (safety culture, team safety climate and team learning) were high, ranging from .67 to .77. However, these values did not exceed the accepted cut-off (Kline, 2005), thus supporting factor discrimination. In terms of the CFAs, as mentioned above, two models using individual-level scores were tested to show further evidence of discriminant validity between the Spanish version of the Mindful Organising Scale and safety culture, team safety climate and team learning. The goodness of fit indices were compared for both the four-factor model and the one-factor model as shown in Table 3.

Table 3

The Goodness of Fit Indices for the Competing Models

Model	χ^2	*df*	*RMSEA*	*CFI*	*TLI*
1 factor	13046.29	2015	.098	.862	.857
4 factor	5851.61	2009	.058	.952	.950

In the one-factor model, the items of all four scales loaded onto one factor. In the four-factor model, all the items of safety culture loaded onto one latent factor, all items of team safety climate loaded onto one latent factor, all items of team learning loaded onto one latent factor and all items of mindful organising loaded onto one latent factor. The one-factor model indicated poor fit and the four-factor model provided evidence for satisfactory fit within the recommended cut-offs previously stipulated. The differences between the two models were substantial (ΔRMSEA = .040, ΔCFI = .090, ΔTLI = .093).

4.3.5. Evidence of criterion validity in predicting workplace safety outcomes

Results of the hierarchical regression analyses carried out at the team level indicated that the percentage of explained variance that mindful organising added to safety compliance (□R2 = 0.13, $p > .05$) and safety participation (□R2 = 0.15, $p > .05$) controlling for safety culture, team safety climate, and team learning was not statistically significant. That is, the percentage of explained variance that the other variables added to safety compliance (□R2 = 0.09, $p > .05$) was not statistically significant. However, the percentage of explained variance that the other variables added to safety participation (□R2 = 0.14, $p < .05$) was statistically significant. Nonetheless, we should remark that we are comparing one variable against three altogether with a small sample size.

When the hierarchical regression analyses were carried out at the individual-level, results indicated that the percentage of explained variance that mindful organising added to safety compliance (□R2 = 0.03, $p < .01$) and safety participation (□R2 = 0.04, $p < .01$) was statistically significant when controlling for safety culture, team safety climate, and team learning . This gives some evidence of incremental validity of mindful organising, as it seemed to have a unique contribution in prediction of workplace safety outcomes on an individual-level (safety compliance and safety participation) over and above three important team variables to do with safety.

4.4. DISCUSSION

The present study set out to validate an adapted version of the Vogus and Sutcliffe (2007) Mindful Organising Scale. This adapted version translated the Mindful Organising Scale from English into Spanish to be used in HROs in Spain. Given the notable lack of validation studies of mindful organising measures, this paper contributes to the current literature through providing evidence of sound psychometric properties of the Spanish version of Vogus and Sutcliffe's (2007) Mindful Organising Scale. To do so, we provided evidence of internal factor structure validity, reliability of the scores, convergent validity and discriminant validity with related variables, as well as incremental validity in predicting workplace safety outcomes (safety compliance and safety participation) above and beyond other team-related variables. The present study also provided evidence of within and between team agreement of mindful organising scores, adding to the case that mindful organising is a social construct that operates within the actions and interactions of teams.

4.4.1. Theoretical contributions

The present study has been useful in refining the definition and conceptualization of the construct of mindful organising when compared with other related constructs, clarifying its similarities but also its specificities. We started with theoretically expanding our understanding of mindful organising's nomological network. To do so, we first conceptually differentiated mindful organising from individual mindfulness and organizational mindfulness (Vogus and Sutcliffe, 2012). Then we conceptually differentiated mindful organising from other team-related variables that appear to be theoretically and operationally similar such as transactive memory systems (Lewis, 2003) and team situational awareness (Salas et al., 1995). When compared with constructs such as organizational mindfulness, mindful organising's bottom-up and collective nature (as seen in the high consensus among team member scores) is important to consider to better understand its relationships with antecedents and outcomes, as well as other emergent and unfolding processes. When compared with constructs such as transactive memory systems (Lewis, 2003) and team situational awareness (Salas et al., 1995), what is unique about mindful organising is the combination of the five processes carried out by teams. These processes facilitate rich pathways and team dynamics that lead to a present and future mindful orientation towards safety (including a genuine interest of learning from failure, a shared reluctance to simplify interpretations, sensitivity to operations, showing resilience in the face of difficulties and deferring to decision making power to those with the best expertise). These five critical processes strengthen the group ability to consistently ensure safe performance in a complex sociotechnical context. We argue that the depth and versatility within mindful organising go beyond the scope and possible benefits of transactive memory systems or team situational awareness.

We have theoretically discussed the main similarities and differences between mindful organising and safety culture, team safety climate and team learning. We also provide an explanation of how mindful organising can uniquely predict safety performance in high-risk environments above and beyond these variables. Our empirical analysis confirmed that mindful organising is positively related to safety culture, team safety climate and team learning, but they are distinct variables from one another. This is notable as a recent review of mindful organising by Sutcliffe et al. (2016) highlights that there is a critical lack of discriminant validation of mindful organising from related constructs such a safety climate and other teamwork behaviours.

The current study builds on our empirical understanding of mindful organising by validating a mindful organising measure in a traditional HRO setting in a new cultural context. It also shows that mindful organising uniquely predicts safety compliance and safety performance over and above safety culture, team safety climate and team learning on an individual-level. Through this, we demonstrate the value of these five critical processes that enable mindful interactions and actions in individuals in the HRO setting. This is especially relevant as these environments do not allow for trial and error learning and require vigilant and highly coordinated processes within work units. Unsurprisingly, the Spanish version of the Mindful Organising Scale is also measuring one latent variable, just like studies conducted by Vogus & Sutcliffe (2007) and Ausserhofer et al. (2013). We were also able to show that mindful organising can reliably be aggregated to a group-level. Sutcliffe et al. (2016) argue that this kind of validation is vital for mindful organising research to keep progressing significantly in mainstream organizational psychology and organizational behaviour.

4.4.2. Practical applications

The present validation of the Spanish version of the Mindful Organising Scale has notable practical implications. We have developed a tool that can be used globally in Spanish speaking organizations interested in testing the level of mindful organising among teams, which has been shown to lead to safer and more reliable performance (Ausserhofer et al., 2013; Bigley & Roberts, 2001; Vogus & Sutcliffe 2007; Weick & Roberts 1993). Since Spanish has the second most native speakers in the world next to mandarin (Central Intelligence Agency, 2018), a Spanish version of the Mindful Organising Scale could be hugely valuable for organizations looking to measure this construct in the 20 countries where Spanish is an official language. The Spanish version of the mindful organising scale provides HRO practitioners with a short tool for evaluating this collective capability to anticipate and recover from errors and unexpected events that leads to safer performance. The length of the instrument has obvious advantages in the high pressure and fast-paced environments inherent in most HROs. The shorter scale leaves space in questionnaires for important antecedent or outcome variables and it minimises the risk of biases due to response fatigue. This scale can also be used for multiple purposes such as diagnosing the strength of overall mindful organising in teams, detecting training needs in mindful organising or evaluating training actions designed to improve mindful organising. Moreover, we have presented the procedure and statistical analyses to be computed to use the team level indicators of this construct which are essential in tackling the improvement of mindful organising.

4.4.3. Limitations and future research

The current study has some limitations. Firstly, the sample size for the team-level analyses was small (47 teams). Although this sample size was close to the minimum of 50 teams recommended in the literature (e.g., Hox, 2010; Maas & Hox, 2005), it did reduce the power of the statistical tests carried out. For this reason, some of the analyses were conducted using individual-level scores (n = 573 workers). Team-level scores were used to test the relationship (correlations) between mindful organising and other team-related variables (safety culture, team safety climate and team learning), providing initial evidence of convergent validity. The CFA conducted to provide evidence of discriminant validity with respect to the other related variables (safety culture, team safety climate, and team learning) was carried out with individual-level scores. Furthermore, hierarchical regression analyses to test for the incremental validity of mindful organising in explaining variance in safety participation and safety compliance above and beyond safety culture, team safety climate and team learning were conducted both at the team and the individual-level. Although team level analyses would have been preferable in all the cases, it was not possible given the small sample of teams. Future studies should replicate the findings that support the distinctiveness of the scales using team-level scores (with a larger team sample size). Secondly, the Spanish Mindful Organising Scale has been successfully validated in a sample from the nuclear power industry, which may jeopardize its generalizability to other industries. That being said, the item content is general and does not focus on any specific issues or idiosyncrasies of the nuclear power industry. In addition, the English version of the scale has also been successfully used in hospitals (e.g. Vogus & Sutcliffe, 2007).

4.4.4. Conclusion

More work still needs to be done in order to understand the true influence and potential of mindful organising. Future research needs to continue to test models of antecedents and consequences of mindful organising in various organizational contexts to gain a fuller picture of how it can be leveraged in organizations and to uncover all the benefits it may lead to.

CHAPTER V:
DEVELOPING MINDFUL ORGANISING IN TEAMS: A PARTICIPATION CLIMATE IS NOT ENOUGH, TEAMS NEED TO FEEL SAFE TO CHALLENGE THEIR LEADERS

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5.1. INTRODUCTION

Modern organizations are operating in increasingly volatile, uncertain, complex and ambiguous environments and their success in these environments becomes contingent on their ability to effectively adapt to, and recover from, unexpected events and demands (Bartscht, 2015; Weick & Sutcliffe, 2015). Researchers have identified a set of organizations called High-reliability Organizations (HROs) that manage to operate almost error-free under trying conditions rife with unexpected events (Rochlin, La Porte & Roberts, 1987; Rochlin, 1993; Weick, Sutcliffe & Obstfeld, 1999). Scholars and practitioners have thus turned to HROs (such as air traffic control centres and nuclear power plants) to extrapolate lessons about how these organizations manage to hardly ever have unwanted, unanticipated, and unexplainable variance in their performance (Hollnagel, 1993). Through observational research and numerous case studies on how HROs operate, researchers found that at the heart of this highly reliable performance is a form of collective mindfulness (or mindful organising) allowing teams to anticipate, and recover from, any errors or unexpected events that arise (Weick & Roberts, 1993; Weick et al., 1999)

Since its discovery, research into mindful organising has thrived as this collective capability has been found to result in many positive organizational outcomes such as higher reliability and better performance (e.g. Knight, 2004; Rerup, 2009; Vogus & Sutcliffe, 2007; Weick & Roberts, 1993). Still, research into mindful organising is in its infancy as there is a notable lack of quantitative empirical evidence to support the validity and usefulness of this construct (Ray, Baker & Plowman, 2011). The current theory on mindful organising is mostly informed by qualitative studies (Sutcliffe, Vogus & Dane, 2016), which has provided rich detail about the behaviours associated with mindful organising and the conditions under which it thrives. However, there is a need for greater quantitative investigations into mindful organising to further advance our understanding of mindful organising's nomological network so that it can have more impact in organizational scholarship and practice.

Of the few documented antecedents of mindful organising, the focus has been largely on leadership approaches and organizational practices (such as training and socialization) (Sutcliffe, et al., 2016). The specific communication practices and participatory conditions needed to foster mindful organising has largely been unexplored (Ford, 2018). However, the importance of corrective feedback (or voice) on the front line as a mechanism through which mindful organising is formed and sustained is stressed in most of the mindful organising theory (Sutcliffe et al., 2016; Vogus & Rerup, 2017; Weick & Sutcliffe, 2015). Similarly, active engagement and participation from all team members is referenced to in observational research and theoretical arguments about mindful organising (Weick & Roberts, 1993; Weick et al., 1999; Weick & Sutcliffe, 2015). However, there are barely any quantitative investigations testing which communication and participatory mechanisms are important for mindful organising (Ford, 2018). Examining the impact of these conditions on mindful organising could add to our limited empirical understanding about team-level communication conditions that are important for mindful organising. These conditions have the potential to be greatly impactful as mindful organising is said to be a fragile construct, needing constant reinforcement by those on the front line (Vogus & Sutcliffe, 2012).

In terms of outcomes of mindful organising, there is a growing body of evidence in various organizations showing the positive impact mindful organising has on performance and safety-related behaviours such as decreased occupational safety failures (Dierynck, Leroy, Savage & Choi, 2017), more effective response to disasters and traumas (Bigley & Roberts., 2001; Klein, Ziegert, Knight & Xiao, 2006) and fewer errors in hospitals (Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007). Not much is known about the effects of mindful organising on team's affective and attitudinal responses at work, such as team job satisfaction or turnover intention. This is interesting because on the one hand, the process of engaging in mindful organising gives teams collective and personal resources to cope in a demanding work environment (Vogus, Cooil, Sitterding & Everett, 2014; Weick & Sutcliffe, 2007; Sutcliffe et al., 2016), which should positively impact team's affective and attitudinal responses at work. However, mindful organising can also be taxing and costly as it requires continuous, emotionally demanding effort from those on the front line (Levinthal & Rerup, 2006; Vogus, Cooil, Sitterding & Everett, 2014; Vogus & Welbourne, 2003; Weick & Sutcliffe, 2001). Some authors have pointed out the need to more closely study the attitudinal and affective outcomes (such as job satisfaction and turnover intentions) of mindful organising to shed light on these competing notions (Vogus & Sutcliffe, 2012). This has consequences for the performance and safety benefits of mindful organising as it will not be sustainable if the demands mindful organising places on teams outweighs the resources it gives them in a high-risk environment.

In our paper, we build on and extend the current mindful organising theory which focuses mainly on top-down predictors and performance outcomes of mindful organising. We draw on current theory about engagement, voice and psychological safety in the literature and propose two specific participatory communication predictors of mindful organising: participation climate and perceived safety for upward dissent. We also draw on the job demands-resources model (Bakker & Demerouti, 2006) and traditional needs theory (Maslow, 1981) to extend theory and test the impact of mindful organising on team's subjective experience at work and individual's propensity to leave their organization.

We will investigate the above research questions through testing a time-lagged multilevel structural equation model using data from 47 teams working in a nuclear power plant. By testing our proposed model, we contribute in two specific ways to the mindful organising literature. First, we gain insight into specific participatory communication conditions that may be important in fostering mindful organising. This adds to the current limited understanding of the communication conditions that predict mindful organising within its nomological network. This knowledge could help decision makers in HROs and in the growing number of modern organizations operating in increasingly uncertain and fast-changing environments to create more meaningful changes, interventions, and management approaches to foster mindful organising in their teams, which is at the heart of reliable performance. Second, we will shed light on the impact of mindful organising on team's satisfaction in their job, and through this, the impact on individual's intention to leave the organization. This advances our theoretical knowledge of mindful organising by offering some insight into the current controversy around whether the taxing nature of mindful organising outweighs the benefits employees gain from an enhanced ability to perform their job.

5.2. CONCEPTUAL BACKGROUND

5.2.1. Mindful organising

Weick and Roberts (1993) wanted to uncover what made HROs operate almost error-free when the potential for catastrophe is so high. Through extensive field research in an aircraft carrier, these authors found that teams exhibited a pattern of highly attentive interrelations of actions. Building on previous theories of organizations as entities capable of thought (e.g. Sandelands & Stablein, 1987), Weick and Roberts (1993) called these patterns of attentive interrelations of actions a kind of "collective mind". This is because they represented aggregated mental processes, which appeared to be more developed in these HROs than in organizations primarily focused on efficiency. Later, Weick, Sutcliffe & Obstfeld (1999) did case study analyses of various high reliability organizations and showed that in these contexts there exists a joint capability to bring about both a rich awareness of discriminatory detail and a capacity for action in teams. They finally coined this capability "mindful organising" (also referred to as collective mindfulness). Mindful organising is characterised by noticing weak signals, then critically analysing and reframing such signals, leading to an enlarged understanding of what is noticed (Weick et al., 1999). This enlarged understanding of what is noticed is closely linked to a larger repertoire of action capabilities which is a defining feature of what makes HROs effective (Westrum, 1988). As Weick and Sutcliffe (2007) explain, mindful organising is a stable and consistent way of organising a team's behaviour that leads to greater variability in performance. This allows teams to respond to, and contain, unexpected events in a dynamic environment effectively. Mindful organising is not a static characteristic that teams have, rather, it is something that teams do. It is also not an intrapsychic process that happens in the minds of team members, rather, it is seen in the actions and interactions of team members. Therefore, it is a fragile capability that needs constant reinforcement.

Through investigations of accidents and accounts of effective practice in HROs, Weick et al. (1999) found that mindful organising appeared to be created by five interrelated processes. These five processes, which were later refined, are: a preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise (Weick et al., 1999; Weick & Sutcliffe, 2001; Weick & Sutcliffe, 2007). *Preoccupation with failure* involves constantly worrying about and paying attention to, any error or failure that may occur or has occurred as well as treating any small mistake as a possible indicator of bigger problems (LaPorte & Consolini, 1991). *Reluctance to simplify interpretations* involves trying to uncover potential weak points by constantly questioning received wisdom and looking for alternative explanations (Schulman, 1993). *Sensitivity to operations* means teams are involved in the creation and maintenance of an integrated and up-to-date understanding of their work operations within the moment, paying special attention to events happening in the front line (Weick et al., 1999). *Commitment to resilience* involves attempts to always grow employee and organization-wide capabilities to best adapt, learn and improvise in order to recover from unexpected events (Van Dyck, Frese, Baer & Sonnentag, 2005). Finally, *deference to expertise* means that decision making power goes to those with the best expertise to solve the problem at hand, rather than those with the highest rank, especially in situations where unexpected events take place (Roberts, Stout & Halpern, 1994). It is through the first three processes that the collective capability to anticipate unexpected events is created, and it is through the last two processes that the collective capability to contain and overcome these unexpected events is formed (Weick & Sutcliffe, 2007).

The five processes of mindful organising are said to underpin the success of high-reliability organizations (Weick et al., 1999). This is because these organizations operate in complex, dynamic and interdependent environments under time pressure (Vogus, 2011), which requires teams to consistently be anticipating and recovering from any unexpected events that arise. Complexity comes from the intricate technical knowledge that is needed to operate in HROs. Dynamism comes from the fact that the knowledge used, and needed, is constantly evolving as new problems are always emerging. Interdependence comes from the fact that the organization is run by employees working together collectively and not through the sum of individual achievements. The time pressure comes from action having to happen in the moment without being put off. In these environments, mindlessness can be dangerous. Mindlessness can be seen in teams tending to operate on “automatic pilot” as they rely on past categories and exhibit a lack of awareness of alternative explanations to rationalise a given situation and only consider a single perspective (Weick et al., 1999). Mindlessness leads to a limited range of cognitive processes which results in a more outdated and limited repertoire of action capabilities (Osborn & Jackson, 1988; Weick et al., 1999). As a consequence, mindlessness results in a decreased ability to manage unexpected events, which are rife in these contexts, effectively leading to a potential catastrophe. On the other hand, if HROs are able to cultivate mindful organising, it is argued that through this collective capability they are able to solve problems that arise from these trying conditions (Weick & Sutcliffe, 2007; Vogus, 2011).

In today's business environment, change has become exponential with the start of the fourth industrial revolution and many organizations are operating in increasingly complex, dynamic and interdependent environments under time pressure. Therefore, HROs that are able to suppress mindlessness in these conditions are an important source of insight for many modern organizations to learn how to avoid their own tendency to drift toward mindlessness. Although research in the field is moving to modern organizations (e.g. Carlo, Lyytinen, & Boland, 2012), most of the empirical research on mindful organising has been conducted in hospitals. We chose to conduct our study in a nuclear power plant, as these kinds of organizations get to the heart of reliable performance. They are interesting to examine because it is in these environments that mindful organising is likely to be best embodied and much can be learned from the way these HROs operate.

5.2.2. Participatory communication and mindful organising

Organizations have begun to see the value in engaging and ‘representing’ as many individuals and groups in the formulation, modification and execution of work activities (Cheney et al., 1998). This active participation and sharing of diverse ideas among many different stakeholders are said to enhance a shared purpose and collectively desired outcomes (Kassing, 2001). In these “democratic” workplaces, individuals are given access to information about their work as well as the space to express their opinions which may affect decision making in the broader organizational context (Cheney et al., 1998; Mohrman et al., 1986). Workplace democracy is built on practices that are designed to encourage participatory communication or employee ‘voice’ (Cheney, 1995). That is, practices that allow for employees and teams to be actively engaged in the running of the organization by offering diverse opinions, suggestions and corrective feedback with the intent of improving organizational functioning.

In high risk environments full of unexpected events, like HROs, the collective sense making needed for anticipating potential threats and quickly containing such threats (mindful organising) requires participatory communication from everyone, especially those on the front-line (Ford, 2018; Novak & Sellnow, 2009; Vogus & Rerup, 2017). This is because the complexity of the ever-evolving environment and interdependence within the organizational system necessitates that organizational hierarchies flatten so that each person operating in the system is sharing what they notice, and groups are digesting and comprehending new insights together. If sense making and decision making is reserved for only a few senior people or managers within the organizational system, the nuances of the evolving complex environment organizational members face are likely to be lost (Novak & Sellnow, 2006). This would leave teams vulnerable to missing important details that could lead to catastrophic events.

5.2.3. Participation climate and safety for upward dissent

Whether employees and teams engage in the participatory communication practices (such as expressing diverse opinions, suggestions and corrective feedback) that are needed for mindful organising or not is dependent on whether they perceive that the organization and leaders genuinely encourage and listen to employees' ideas, suggestions, criticisms and general feedback. The concept of psychological safety is essential in understanding participatory communication (Detert & Burris, 2007). A team is said to have high psychological safety if all members believe that the team is safe to take interpersonal risks (Edmondson, 1999). A lack of psychological safety stops individuals and teams from engaging in what Edmondson (1999) calls 'learning behaviours'- sharing information, seeking feedback, talking about errors, asking for help and experimenting. Team members are likely to withhold from sharing their unique knowledge, admitting errors, discussing problems or asking for help if they believe that doing so may lead to potential threat or embarrassment (Edmondson, 1999). The learning behaviours investigated in this psychological safety research align with the needed behaviours for the five processes of mindful organising. Therefore, we propose that in order for teams to enact and sustain mindful organising, there needs to be perceived encouragement of participatory communication (workplace democracy) under psychologically safe conditions. To test this, we propose that the interaction of two variables will predict mindful organising in a high-risk environment: participation climate and perceived safety for upward dissent.

Participation climate is defined as the extent to which employees perceive that the company is interested in their opinions, encourages them to share their ideas and wants them to actively participate in the everyday functioning of the organization. Active communication and participation among teams on the front line are central to the creation and maintenance of mindful organising (Ford, 2018; Vogus & Rerup, 2017; Weick & Sutcliffe, 2007). If team members believe that their company does not value or seek out their ideas, suggestions and feedback, they are unlikely to continuously engage in the communication practices and active engagement needed for mindful organising. *Perceived safety for upward dissent* is defined as the perceived safety employees feel to express disagreement, concerns or critical feedback to their superiors without fear of backlash. Mindful organising requires teams to be empowered to address any errors or deviations in performance through freely reporting their concerns and criticisms to management (Burgeon, Berger & Waldron, 2000; Vogus & Sutcliffe). Expressing critical or challenging views to managers entails considerable interpersonal risk and employees are unlikely to engage in such behaviour without perceived safety that voicing their disagreement will not lead to punishment or embarrassment (Edmondson, 1999).

Although both variables represent a perceived climate for participatory communication, they differ in two important aspects: their content and referent. The content of participation climate is more general than perceived safety for upward dissent. This is because the types of opinions, ideas and suggestions encouraged could be either "affiliative" as they tend to solidify or preserve the relationship between employees and the organization, or they could be "challenging" because the employee runs the risk of damaging their relationship with the organization (Van Dyne, Cummings & McLean Parks, 1995). The content of perceived safety for upward dissent focuses just on encouraging teams to express opinions, ideas and suggestions that are "challenging". The referent is also wider in the case of participation climate than in the case of perceived safety for upward dissent. The referent for participation climate is the whole organization, whereas for perceived safety for upward dissent, taking into account our operationalisation (see the measures section), is just the immediate supervisor. When an employee answers about the organization, they may think about their immediate supervisor, but also about other supervisors, top managers, as well as organizational policies, practices, and procedures.

5.2.4. Interaction of participation climate and perceived safety for upward dissent

We believe that the organization creates the context for mindful organising by encouraging employee engagement, but it is not enough to foster mindful organising by itself. If a participation climate is not accompanied by the perception that one can take interpersonal risks by being critical of operations to their supervisor without fear of threat or humiliation, this participation will be weaker or will take the form of only "affiliative" kinds of participation. "Challenging" forms of participation are needed in order to foster mindful organising. The proposed interaction effect of these conditions can more clearly be seen by examining the five processes of mindful organising.

Preoccupation with Failure. Teams that are said to be collectively mindful pay close attention to, and discuss, any small errors as an indication of bigger system-wide vulnerabilities (Weick & Sutcliffe, 2007). They also remain suspicious and sceptical during quiet periods when an unexpected event has not happened in a while (Weick & Sutcliffe, 2015). The continuous attentiveness to any deviations in performance requires team members to believe that their involvement, observations and opinions are valued by the organization. However, without the perception that they are safe to report errors and discuss potential vulnerabilities to their supervisors, this mindful organising process is unlikely to develop. This is because the potential threat of discussing errors or emerging issues from defensive or punitive supervisors will cause team members to disengage in the analytical behaviours needed for preoccupation with failure.

Reluctance to Simplify. Collectively mindful teams are reluctant to simplify their interpretations of current operations as it may mean omitting potentially vital information (Weick & Sutcliffe, 2007). They resist jumping to conclusions or relying on previous schemas to understand operations. They believe that it takes a complex system to serve a complex environment (Weick et al., 1999). It is evident that encouraging active participation from employees is vital for this element of mindful organising as employees need to feel encouraged to voice their observations and opinions in order to capture and discuss the details of operations. In addition, safety for upward dissent is vital for this dimension, as team members need to feel safe to take risks by challenging possible simplifications of their current operations and by coming up with alternative interpretations to their manager. Employees would not be trying to uncover potential issues within the system by resisting simplifying interpretations if they felt their supervisors were unwilling to listen to critical feedback.

Sensitivity to Operations. Collectively mindful teams stay focused on the "messy reality" of what is going on in the front line in the moment by constantly maintaining an up-to-date understanding of all events that occur (Weick & Sutcliffe, 2007). This is achieved by integrating the real-time status of all the various processes in the system into one picture that represents the overall situation and status of their operations (Weick & Sutcliffe, 2015). This element of mindful organising requires constant interaction and collective story building among team members (Weick & Sutcliffe, 2007). If employees perceive as if their opinions, suggestions, and ideas matter and that their organization values and encourages their active involvement, they are more likely to interact more regularly and share their observations and ideas about their area of work in the system. This engagement adds to the creation and maintenance of the better, more accurate picture of the bigger system. This has to be accompanied by psychological safety for upward dissent because teams need to be able to focus on, and report on, negative events happening on the front line and not just positive events. If there is fear about discussing potential issues, then an inaccurate, positively skewed picture of current operations is likely to be projected by teams.

Commitment to Resilience. Mindful organising also requires teams to be committed to bouncing back from any setbacks through growing employee and organization-wide capabilities so that the organization can continue working under strain and bounce back from crises while learning from these adverse events (Weick & Sutcliffe, 2007). This commitment to bouncing back also means team members pay attention to which capabilities, knowledge and resources are needed in their teams in order to best respond to unexpected events (Weick & Sutcliffe, 2015). It also requires analysing any error or small failure that happens for its lessons to grow team-wide capabilities (Weick et al., 1999). Team members are unlikely to actively look for the capabilities, knowledge, and resources needed to enhance their team's ability to bounce back if they do not feel as if their ideas are encouraged and valued by the organization. Without perceived safety to disagree with management, voice concerns and talk about mistakes and errors, the learning needed for commitment to resilience which entails looking for, and discussing, the team's shortcomings and possible improvement areas would be hindered. Lack of safety for upward dissent may even result in teams hiding or ignoring these possible areas of growth and or inadequacy.

Deference to expertise. Collectively mindful teams award decision making authority to those with the best expertise for the matter at hand, rather than those with the highest rank (Roberts et al., 1994). This involves having a good understanding of each member in the system's expertise and capabilities and knowing which channels to follow to reach these members during unexpected events (Weick & Sutcliffe, 2007). If team members do not feel encouraged to get involved with the everyday functioning of the organization and to express their opinions and suggestions, it won't be apparent who has the most expertise in any given situation and those with the most expertise would not step up and voice their opinions when they are needed most. Deference of expertise directly speaks to the breaking down of formal ranks in decision making, and without a safe space to disagree with a superior, this vital function of mindful organising would be stifled.

We believe that these participatory communication conditions need to be an ongoing norm within teams in order to facilitate mindful organising over time. Therefore, based on the arguments aforementioned the following is hypothesized:

Hypothesis 1: Perceived safety for upward dissent moderates the relationship between participation climate and mindful organising, so that the relationship will be positive and statistically significant when perceived safety for upward dissent is high, and non-statistically significant when perceived safety for upward dissent is low.

5.2.5. The emotional and attitudinal outcomes of mindful organising

There is some controversy in the current literature about the relationship between mindful organising and employees' positive experience at work. Mindful organising requires continuous demanding commitment from employees on the front line so it can be taxing, effortful and costly (Levinthal & Rerup, 2006; Vogus & Sutcliffe, 2012; Vogus & Welbourne, 2003; Weick & Sutcliffe, 2001). It is speculated that this, on top of the elevated physical, psychological and emotional demands teams face in high risk environments (such as hospitals and nuclear power plants), it may negatively impact affective responses at work (Vogus & Sutcliffe, 2012). However, despite the somewhat taxing nature of mindful organising, it is likely that aspects and outcomes of mindful organising gives teams much needed resources to cope with the substantial demands these teams face in their environment (Vogus et al., 2014; Weick & Sutcliffe, 2007; Sutcliffe et al., 2016). Mindful organising is likely to cultivate increased job control, team effectiveness, social support, learning and empowerment. These resources will make it easier for teams in high-risk environments to cope in the complex, dynamic and interdependent work environments they face. Vogus et al. (2014) found that mindful organising gives nurses resources to cope in trying conditions but was strenuous and had negative consequences in more "neutral" conditions. Therefore, based on the Job Resources-Demands (JDR) model (Bakker & Demerouti, 2006), we speculate that the resources offered by mindful organising counterbalance the demands in taxing, high risk settings. In addition to the JD-R model, the relationship between mindful organising and job satisfaction can also be examined using traditional needs theory (Maslow,1981). Teams are likely to feel that their safety needs are met by their organization if there are high levels of mindful organising in their team, contributing to their satisfaction at work in an industry where safety is of paramount importance (Huang et al., 2016).

We expect that high levels of mindful organising will lead to higher levels of team job satisfaction in HROs. To our best knowledge, examining how mindful organising affects team job satisfaction has never been investigated. The notion that a team can share similar levels of job satisfaction comes from the idea of "affective team climates", as researchers found that teams working together in the same organizational context can have homogenous emotional reactions (De Rivera, 1992; George, 1990). This is due to the fact that members of a group have shared cognitive perceptions of their work environment and this predicts shared affective responses over time (González Romá, Peiró & Bravo, 1996). Therefore, if a team collectively engages in mindful organising (has homogenous mindful organising scores), this should predict their shared affective response to their job (job satisfaction). We predict that this relationship will be positive given the resources mindful organising gives team members in trying, high-risk conditions and given that mindful organising is likely to meet teams safety needs.

Turnover intention is defined as the extent to which an employee would leave the company if they could. Turnover intention has become an important indicator in organizations as it shows the level of commitment employees have toward the organization and the likelihood of retaining employees. The scale used in the present study (see measures section) focuses on the desirability to leave the organization "I would leave this organization" and controls for the ease of leaving the organization "if I could". It is unsurprising that most management literature has found an inextricable link between job satisfaction and turnover intention as those with high levels of satisfaction in their job are likely to want to continue working in such a fulfilling environment (Tett & Meyer, 1993; Coomber & Barriball, 2007; Kim & Kao, 2014). Some research has been conducted on mindful organising and turnover, such as in hospitals (Vogus et al, 2014) and in this context mindful organising lead to lower turnover intention. In high-risk environments, we argue that the team satisfaction employees experience from engaging in mindful organising will decrease their desirability to leave their organization. This relationship can be explained by social exchange theory

(Emerson, 1976). Teams with high levels of mindful organising are likely to be more satisfied with their jobs and perceive that their safety needs are met are more likely to "pay back" their organization by committing to stay in their jobs. In other words, we expect that mindful organising will result in lower turnover intention, through increasing teams' satisfaction at work.

Therefore, we hypothesize the following:

Hypothesis 2: Job satisfaction mediates the relationship between mindful organising and turnover intention.

5.2.6. Integrated model

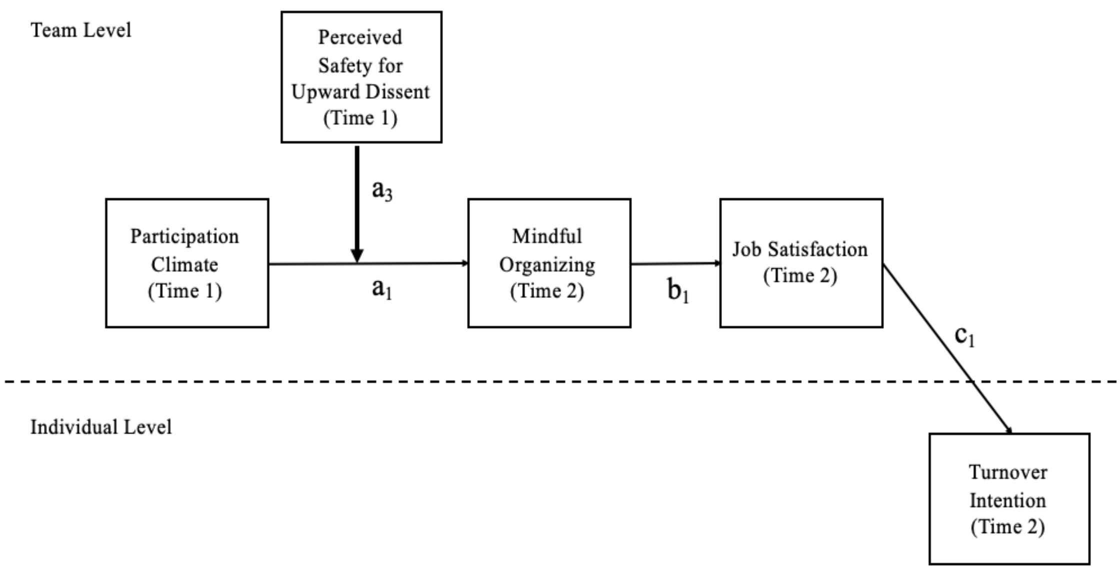
We expect that in a high risk, high safety orientated environment like a nuclear power plant, the importance of perceived safety for upward dissent is critical for facilitating the relationships between our study variables. Without the perceived psychological safety to be candid about "challenging" feedback and ideas or feeling safe to admit fault, mindful organising will be stifled. The positive impact of mindful organising on team satisfaction which will reduce individual's desirability to leave the organization will then be stifled too. Therefore, the relationships between the variables in our model will be largely dependent on perceived safety to express challenging views to leaders. Such that, if teams do not feel safe to express these challenging opinions to leaders, participation climate will not result in lower turnover by fostering higher mindful organising and more satisfied teams. On the other hand, participation climate in an environment where teams feel safe to express "challenging" opinions to leaders will result in lower individual turnover intentions through fostering mindful organising and increasing team satisfaction.

Therefore, the following is hypothesized:

Hypothesis 3: Perceived safety for upward dissent moderates the negative indirect effect of participation climate on turnover intention through mindful organising and job satisfaction, so that the effect is negative and statistically significant when perceived safety for upward dissent is high and non-statistically significant when perceived safety for upward dissent is low.

The study model is represented in Figure 1. The hypothesized relationships and interactions are studied in a nuclear power setting that relies heavily on team work. Mindful organising is a team variable and the operationalisation of perceived safety for upward dissent, participation climate and job satisfaction has also been on a team level. Turnover intention, however, is an individual variable and an individual's intention to stay in an organization is dependent on personal variables. Therefore, turnover intention was measured at an individual level.

Figure 1. Hypothesized MSEM model.



5.3. METHOD

5.3.1. Design

A time-lagged study was conducted in two nuclear power plants belonging to the same company, where participants answered the corresponding questionnaire in 2014 (Time 1) and in 2016 (Time 2).

5.3.2. Participants and Sampling

In 2014 (Time 1), 58 teams comprising of 615 employees participated in the study, yielding a response rate of 76.3%. In 2016 (Time 2), 54 teams comprising of 607 employees participated in the study, yielding a response rate of 72.5%. The final sample included 47 teams (comprising 425 employees), which were those that answered both in 2014 (N = 427) and in 2016 (N = 425) and had at least 2 subjects each time (Kozlowski & Bell, 2003). The average group size was 9.06 (SD = 5.67). The largest team size included 28 members and the smallest team size included 3 members. In our sample of teams, all the areas and departments of the plant were represented (operations, maintenance, engineering, radiological protection, etc). We expect that mindful organising is important for all departments, as mindful organising is critical for safe performance and safety is the main priority in nuclear power plants.

Regarding participants' age, at Time 1, 3.3% were under 30 years, 19.1% were between 30 and 45 years, and 77.6% were older than 45 years. At Time 2, 2% were under 30 years, 25.5% were between 30 and 45 years, and 72.5 % were older than 45 years. As our sample showed participant withdrawal from Time 1 to Time 2, we conducted a response-nonresponse analysis. First, we tested for mean differences on participation climate and perceived safety for upward dissent among the subjects collected in 2014 that were included in the sample of the study (individuals who responded in both Time 1 and Time 2) and the ones that were not included in the study (those who responded only at Time 1). Results of a t-test indicated that respondents did not differ from non-respondents in participation climate ($t(615) = -0.04$, $p > 0.05$) and perceived safety for upward dissent ($t(615) = -0.59$, $p > 0.05$). Further, we compared subjects collected in 2016 that were included in the sample of the study (individuals who responded at both Time 1 and Time 2) to those who were not included (individuals who only responded in Time 2) with respect to variables collected at Time 2 (mindful organising, job satisfaction and turnover intention). Results of the t-test indicated no differences on mindful organising ($t(604) = 0.99$, $p > 0.05$), job satisfaction ($t(603) = 1.73$, $p > 0.05$), and turnover intention ($t(538) = 0.84$, $p > 0.05$).

5.3.3. Procedure

Data was collected in the form of hardcopy questionnaires. Participation was voluntary and confidentiality was guaranteed. The questionnaires administered in the current study were part of a wider battery of questionnaires titled “Questions about Safety” which also evaluated safety culture and other safety issues. The questionnaire was administered at Time 1 (2014) and at Time 2 (2016). The researchers were on site during both Time 1 and Time 2 of data collection. They explained the aims of research to participants and were available to answer any questions participants may have had.

5.3.4. Measures

The participation climate, perceived safety for upward dissent, turnover intention and job satisfaction scales were created by the IDOCAL research team. The mindful organising scale was adapted from Vogus and Sutcliffe's (2007b). Participants were asked to rate their agreement with each item on a 5-point Likert scale, with 5 indicating the highest agreement and 1 indicating the lowest agreement. Since limited previous validation tests have been conducted for these scales, confirmatory factor analyses were conducted in the present study.

5.3.4.1. Participation climate

The items in the scale are "This company sincerely encourages the employees' participation in its daily functioning", "This company encourages its staff to express their ideas and suggestions", and "This company is interested in listening to its employees' opinions". Internal consistency reliability was .93.

5.3.4.2. Perceived safety for upward dissent

The items in the scale are "I can freely express any disagreements I have with my supervisor", "I can tell my supervisor when things are not going well" and "I feel free to talk to my supervisor about any problems and difficulties I have in my job without any fear at all". Internal consistency reliability was .94.

5.3.4.3. Mindful organising

The scale used to measure mindful organising is 9-items validated Spanish version of the Vogus and Sutcliffe's (2007b) original scale (Renecle, Tomás, Gracia, & Peiró, 2020). Some sample items are: "When discussing emerging problems with co-workers, we usually discuss what to look out for", "We talk about mistakes and ways to learn from them", "When crisis occurs, we rapidly pool our collective expertise to attempt to resolve it." Internal consistency reliability of the scale was .95.

5.3.4.4. Job satisfaction

This scale consists of three items that assesses participant's global levels of satisfaction with their job, team and the company as a whole. The items in the scale asked participants to "please indicate, in general, how satisfied you are…" "with your job" "with your work unit or team" and "with your company". This scale was found to have discriminant validity from related constructs in a recent study by López de Castro, Gracia, Tomás and Peiró (2017). Internal consistency reliability was .85.

5.3.4.5. Turnover intention

A one item scale which states "I would leave this organization if I could" was used to measure turnover intention. It focuses on the desirability to leave the organization ("I would leave this organization") and controls for the ease of leaving the organization ("if I could"). Internal consistency could not be calculated as this is a single item measure.

5.3.5. Analysis

Given that three of the measures were created by our research team and were not validated elsewhere, confirmatory factor analyses (CFA) of the four scales (participation climate, perceived safety for upward dissent, mindful organising, and job satisfaction) were carried out in order to gain evidence of the validity of these measures. This was done by testing the measurement model at the individual level using Mplus (Muthén & Muthén, 1998–2010). Two alternative CFA models (a one factor model with all the items loading onto one single factor and a two-factor model with all the items loading onto two separate factors) were conducted and compared for the 2014 data, namely the perceived safety for upward dissent scale and the participation climate scale. Likewise, two CFA models (a one factor model with all the items loading onto one single factor and a two-factor model with all the items loading onto two separate factors) were conducted and analysed for the 2016 data, namely the mindful organising and job satisfaction scale. The turnover intention scale was omitted since it is a one item measure. All the variables were measured with Likert response scales, thus, considering the ordinal nature of the data (Field, 2013) the method of estimation used was ULSMV. Model fit was evaluated by considering the chi-square statistic as well as a few other goodness of fit indices, namely: the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI; Bentler, 1990) and the Tucker Lewis index (TLI; Tucker & Lewis, 1973). RMSEA values of .10 or more indicate poor fit, values between .08 and .05 indicate fair fit or a reasonable error of approximation, and values below .05 indicate good fit (Browne & Cudeck, 1993; Browne & Du Toit, 1992). CFI values close to 1 indicate good fit, with values above .95 considered acceptable fit (Hu & Bentler, 1999). TLI values near 1 indicate good fit and values approaching 0 indicate poor fit, with the conventional cut off used being .90 for acceptable fit (Tucker & Lewis, 1973). We used the following criteria for comparing the alternative models: (1) whether the differences between TLI and CFI values of the competing models were larger than .01 (Cheung & Rensvold, 2002; Widaman, 1985), and (2) whether the differences between RMSEA values were larger than .015 (Chen, Curran, Bollen, Kirby & Paxton, 2008). These criteria indicate whether there is a notable disparity between the models and when these differences in practical fit indices are detected, the model showing better fit will be selected.

Mindful organising is a social construct that operates within the actions and interactions of teams, therefore each individual's score was aggregated to form a team mindful organising score as is common practice in measuring this variable (e.g. Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007b). Since the analysis was done on a team level (except for turnover intention), similarly, the antecedent variables (perceived safety for upward dissent and employee participation) and outcome variable (job satisfaction) were also aggregated to analyse the team level responses. Beforehand, it was essential to demonstrate that each member's score was similar enough to those in their team, so as to justify aggregating these scores. In order to do so, we ran three kinds of analyses. Firstly, average deviation indexes (ADI; Burke, Finkelstein, & Dusig, 1999) were computed and analysed for each of the five scales to ensure within-team agreement. Since all the scales used a 5-point Likert response scale, the cut-off value for the ADI was .83 (Burke & Dunlap, 2002), therefore, we concluded that there was within-team agreement when the ADI values were $\leq .83$. Secondly, we examined the extent to which employees from the same team shared similar perceptions in the study variables by computing the intra-class correlation coefficient ICC(1) (Bliese, 2000). ICC(1) provide an estimate on the proportion of total variance attributable to within-team homogeneity, indicating how much the studied variables are shared within the teams. Recommended cut-off values for

ICC(1) typically range between .05 and .20 (Bliese, 2000). Finally, we carried out one-way analyses of variance (ANOVA) to ascertain whether there was statistically significant between-team discrimination in perceived safety for upward dissent, participation climate, mindful organising, and job satisfaction among teams. Turnover intention was operationalised at the individual level.

Multilevel structural equation modelling (MSEM) with Mplus was conducted to test the proposed model in which the interaction of perceived safety for upward dissent and participation climate leads to mindful organising, and job satisfaction mediates the relationship between mindful organising and turnover intention. All variables were measured at the team level, except turnover intention, which was measured at the individual level. Thus, the proposed model in this study was a 2x(2→2)-2-1 model (Preacher et al., 2016, Zhang et al., 2009). The model was tested using robust maximum likelihood estimation (RML).

To test Hypothesis 1, the statistical significance of a_3 (the coefficient estimating the moderator effect of perceived safety for upward dissent in the relationship between participation climate and mindful organising) was tested. To further probe the interaction effect we used the Process macro for SPSS (Hayes, 2018) to estimate the slopes of the relationship between participation climate and mindful organising at high and low values (one standard deviation above and below the sample mean) of perceived safety for upward dissent, and to plot the corresponding regression lines.

To test the significance of the indirect effect stated in Hypothesis 2, we used bias-corrected (BC) bootstrap confidence interval (CI) method

(MacKinnon, Lockwood, & Williams, 2004) as implemented in Mplus. A bootstrap sample size of 5000 was used. The b_1c_1 indirect effect was calculated, where b_1 is the coefficient estimating the relationship between mindful organising and job satisfaction, and c_1 is the coefficient estimating the relationship between job satisfaction and turnover intention. Mediation is supported when the BC bootstrap confidence interval for the indirect effect does not include the zero value.

Finally, to test the conditional indirect effect stated in Hypothesis 3 we also used BC bootstrap confidence interval method as implemented in Mplus. A bootstrap sample size of 5000 was used. The $(a_1+a_3W)b_1c_1$ conditional indirect effect was calculated, where W is the moderator variable (perceived safety for upward dissent), a_1 is the coefficient estimating the relationship between participation climate and mindful organising, and a_3, b_1 and c_1 are the coefficients estimating the relationships previously stated. The conditional indirect effect is supported when the BC bootstrap confidence interval for the difference in the indirect effect (diff_IE) among different levels of the moderator do not contain zero (Preacher et al., 2007), which implies that the strength of the indirect effect (a_1b_1) depends on the level of the moderator variable (W).

5.4. RESULTS

5.4.1. Confirmatory factor analysis

The hypothesized 2-factor model with the variables measured at Time 1 showed a satisfactory fit to data (χ^2 = 12.49, df = 8, p > .05; RMSEA = .04; CFI = 1.00; TLI = 1.00), and all the items showed statistically significant factor loadings in their corresponding factors (*p* < .01). For the participation climate scale, factor loadings ranged from .92 to .95. For the perceived safety for upward dissent scale, factor loadings ranged from .94 to .96. The differences between the two models were non-negligible (ΔRMSEA = .25, ΔCFI = .07, ΔTLI = .12), indicating the two-factor model as the best fitting model, and thus, providing support for the discriminant validity of the two constructs (participation climate and perceived safety for upward dissent). As expected, the 1-factor model with the variables measured at Time 1 (participation climate and perceived safety for upward dissent) showed unsatisfactory fit to data (χ^2 = 322.77, df = 9, p > .05; RMSEA = .29; CFI = .93; TLI = .88), and all the items showed statistically significant factor loadings onto the one factor ranging from .84 to .88 ($p < .01$).

The hypothesized 2-factor model with the variables measured at Time 2 showed an adequate fit to data (χ^2 = 216.50, df = 53, p > .05; RMSEA = .09; CFI = .98; TLI = .97), and all the items showed statistically significant factor loadings in their corresponding factors ($p < .01$). For the mindful organising scale, factor loadings ranged from .79 to .91. For the job satisfaction scale, factor loadings ranged from .80 to .90. The differences between the two models were notable (ΔRMSEA = .08, ΔCFI = .06, ΔTLI = .07), showing that mindful organising and job satisfaction were identified as two different constructs. The 1-factor model with the variables measured at Time 2 (mindful organising and job satisfaction) also showed unsatisfactory fit to data (χ^2 = 696.85, df = 54, p > .05; RMSEA = .17; CFI = .92; TLI = .90), and all the items showed statistically significant factor loadings onto the one factor ranging from .65 to .91 ($p < .01$).

5.4.2. Justification of data aggregation

The results showed that the average ADI value was below the proposed cut off of .83 for the mindful organising scale (M = .58, SD = .17), the perceived safety for upward dissent scale (M = .68, SD = .29), the participation climate scale (M = .66, SD = .23), and the job satisfaction scale (M = .58, SD = .26), indicating that there was strong consensus within teams. The ANOVA values indicated significant differences among team's scores for perceived safety for upward dissent ($F(46,380) = 1.92$, $p < .01$), and participation climate ($F(46,380) = 3.02$ $p < .01$). However, the ANOVA values for mindful organising ($F(46,378) = 1.29$ $p > .05$) and job satisfaction ($F(46,377) = 1.29$ $p > .05$) were non-significant. The ICC(1) values for the variables included in the model indicated that 9% of the variance of perceived safety for upward dissent, 18% of the variance of stimulating employee participation, 3% of the variance of mindful organising, and 3% of the variance of job satisfaction, were respectively explained by the clustering structure (i.e., team) of the data. These values show the degree to which group members' responses are influenced by group membership. The above indices all together provided a reasonable justification for data aggregation.

5.4.3. Hypothesized model

Correlations between our study variables can be found in Table 1. Although both participatory communication variables (participation climate and perceived safety for upward dissent) were highly correlated with one another, a correlation of .68 is below the widely accepted cut-off of .85 for factor discrimination (Kline, 2005). All the study variables were measured and analysed on a team level (N = 47), except turnover intention, which was measured at an individual level (N = 425). Participation climate was positively and significantly related to perceived safety for upward dissent (r = .68, p < .001), mindful organising (r =.40, p <.001) and job satisfaction (r = .29, p <.05). Perceived safety for upward dissent was positively and significantly related to mindful organising (r =.36, p <.05) and job satisfaction (r =.29, p <.05). Job satisfaction was positively and significantly related to mindful organising (r =.56, p <.01), and negatively and significantly related to turnover intention (r =.-21, p <.001).

Table 1

Descriptive Statistics and Correlations Among Team Level Study Variables

Variable	*M*	*SD*	1	2	3	4	5
1.Perceived safety for upward dissent	3.98	.49	--				
2. Participation Climate	3.61	.54	.68**	--			
3. Mindful organising	4.03	.30	.36*	.40**	--		
4. Job Satisfaction	4.26	.39	.29*	.29*	.56*	--	
5. Turnover Intention	2.17	.58	-.16	-.13	-.27	-52**	--

Note. * p < .05, **p < .001

The multilevel structural equation model ran showed excellent fit (χ^2 = 8.02, df = 9, p > .05; RMSEA = .00; CFI = 1.00; TLI = 1.03; $SRMR_{within}$ = .00; $SRMR_{between}$ = .09). All hypothesized pathways were significant (see Figure 2). Even though there was not a direct relationship between participation climate and mindful organising (a_1 = .11, p > .05), the pathway for the interaction effect of participation climate and perceived safety for upward dissent on mindful organising was positive and statistically significant ($a_3 = .30$, $p < .05$), providing initial support for Hypothesis 1. The results of the analysis carried out to interpret this interaction effect showed that the slope of the relationship between participation climate and mindful organising was positive and statistically significant ($B = .26$, $p < .05$; CI 95% = [.03, .49]) when perceived safety for upward dissent was high (+1 SD), but this slope was non-significant ($B = -.03$, $p > .05$; CI 95% = [-.31, .25]) for low values (-1 SD) of perceived safety for upward dissent (see Figure 3), providing further support for Hypothesis 1.

Figure 2. Unstandardized parameter estimates for the hypothesized model. **p* < .05, ***p* <.001

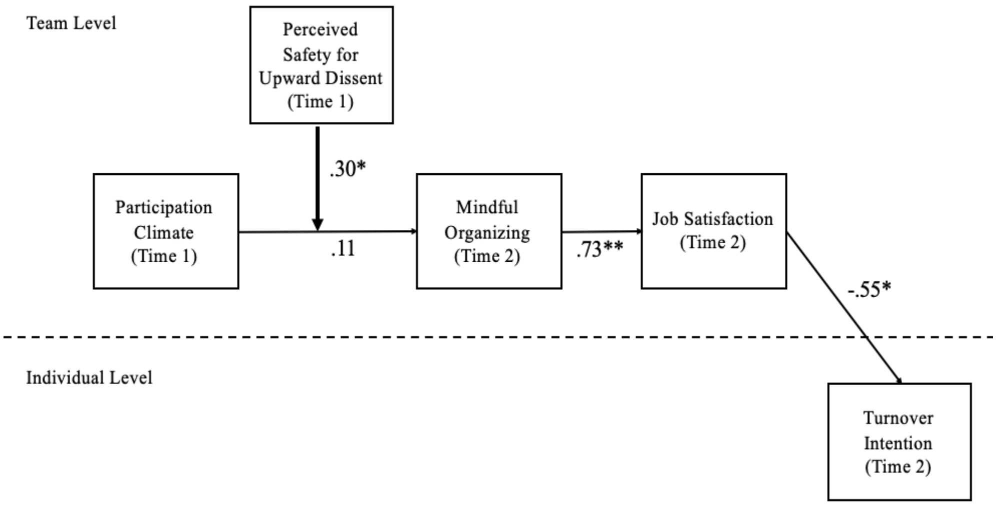
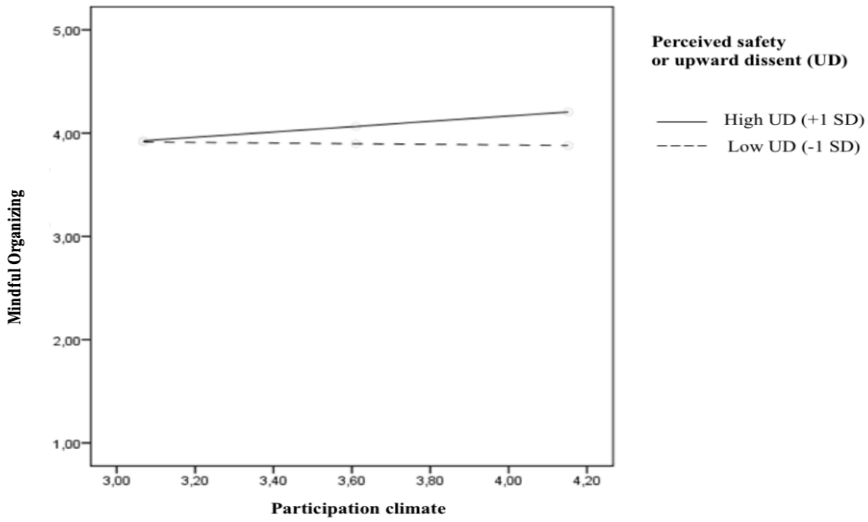


Figure 3. Interaction effect of perceived safety for upward dissent and employee participation on mindful organising.



The pathway from mindful organising to job satisfaction was positive and significant (b_1 = .74, p < .001). In addition, the pathway from job satisfaction to turnover intention was negative and statistically significant (c_1 = -.63, p <.001), and the BC bootstrap CI for the estimated indirect effect (b_1c_1 = -.47; CI 95% = [-.77, -.16]) did not include the zero value. Therefore, job satisfaction mediated the relationship between mindful organising and turnover intention, confirming Hypothesis 2.

Finally, we tested Hypothesis 3 by examining the conditional indirect effect. When perceived safety for upward dissent was high (1 SD above the mean), the indirect effect of participation climate on turnover intention through mindful organising and job satisfaction, was more negative compared to when perceived safety for upward dissent was low (1 SD below the mean). The confidence interval for the difference between indirect effects at high and low values of the moderator did not include the zero value. These results provided support for Hypotheses 3. The Bias Corrected Bootstrap Confidence

Intervals for the Indirect and Conditional Indirect Effects can be found in Table 2.

Table 2.

BC Bootstrap Confidence Intervals for the Indirect and Conditional Indirect Effects

	Estimate	95% CI
Indirect effect (b_1c_1)	-.47	[-.77, -.16]
Conditional indirect effect ($(a_1+a_3W)b_1\ c_1$)		
W mean – 1 *SD* (3.51)	-.57	[-1.11, -.03]
W mean + 1 *SD* (4.44)	-.69	[-1.36, -.03]
Difference between indirect effects	.13	[.01, .26]

Note. BC = bias-corrected; CI = confidence interval; a_1 = coefficient estimating the relationship between participation climate and mindful organising; a_3 = coefficient estimating the moderator effect of perceived safety for upward dissent in the relationship between participation climate and mindful organising; b_1 = coefficient estimating the relationship between mindful organising and job satisfaction; c_1 = coefficient estimating the relationship between job satisfaction and turnover intention; W = moderator variable (perceived safety for upward dissent); *SD* = standard deviation.

5.5. DISCUSSION

The present study set out to add to the current theoretical and empirical understanding of mindful organising through two main aims. Firstly, to test whether having perceived safety for upward dissent and participation climate together leads to higher mindful organising over time. Secondly, to assess whether mindful organising has a positive impact on team job satisfaction and whether this increased team satisfaction results in lower individual turnover intention. The results obtained were in line with what was expected.

5.5.1. Effect of perceived safety for upward dissent and participation climate on mindful organising

Perceived safety for upward dissent significantly moderated the relationship between employee participation and mindful organising. The aforementioned relationship was stronger for high values of perceived safety for upward dissent than low values, thus supporting Hypothesis 1. When perceived safety for upward dissent is present, the relationship between employee participation and mindful organising becomes positive and significant and as perceived safety for upward dissent becomes stronger so does the relationship between employee participation and mindful organising. At low levels of perceived safety for upward dissent, however, the relationship between mindful organising and participation climate becomes non-significant. This is in line with the argument that in order for mindful organising to develop, teams need to not only be encouraged to actively participate but also need to feel as if they can voice their concerns and disagreements with their superiors without fear of backlash. If teams are only encouraged to participate and share their ideas, but do not feel safe to be critical or disagree with management, mindful organising may not develop. The more teams feel safe and free to point out faults and concerns to their superiors the more likely mindful organising will develop in an environment that encourages participation. These two mechanisms (perceived safety for upward dissent and climate for employee engagement) work together to predict mindful organising and the presence of one does not lead to mindful organising without the other. These results are promising since the data are longitudinal, showing that the interaction of perceived safety for upward dissent and participation climate at time one leads to mindful organising at time two, giving some evidence of a possible dynamic relationship between these variables.

5.5.2. Mindful organising, job satisfaction, and turnover intention

The present study sought out to test empirically whether mindful organising has a positive impact on job satisfaction given the controversy around this relationship. The results of the pathway between mindful organising and team job satisfaction showed a strong positive and significant relationship, supporting Hypothesis 2. This suggests that in a tough work environment like a nuclear power plant, the arguments that mindful organising offers teams much needed resources to cope with the strenuous demands of their working environment. Therefore, the fact that mindful organising has such a strong positive effect on team job satisfaction shows that even though being collectively mindful can be taxing, it is far better for team's positive affective responses at work in HROs to engage in mindful organising than to not engage in mindful organising. Unsurprisingly, teams with high levels of mindful organising were more satisfied with their job and therefore team members in these teams had less intention to leave the organization. This is in line with the social exchange theory argument (insert citation) which posits that the satisfaction teams feel from having their basic safety needs met by their organization and from rewards they gain through mindful organising will lead to them wanting to reciprocate the commitment they perceive those in the organization have towards them by committing to staying in the company. These results provide evidence of the sustainability of mindful organising as it not only improves reliable and safe performance, but it also positively impacts emotional responses to the work environment.

5.5.3. Theoretical contributions and practical implications

Theoretically, this research contributes to the current understanding of mindful organising in HROs. It confirms that mindful organising is a team level construct as the aggregation indexes of teams showed favourable consensus in the mindful organising scores.

We build on our current understanding of predictors of mindful organising by showing that democratic high-risk organizations that value employee input and engagement in the functioning of the company will only develop a mindful orientation toward safety if there is perceived psychological safety to voice challenging opinions to supervisors. Mindful organising scholars have speculated about the importance of participatory communication in fostering mindful organising (e.g. Ford, 2018; Sutcliffe et al., 2016; Vogus & Rerup, 2017; Weick & Sutcliffe, 2015), however there has been little empirical investigation into which specific communication conditions predict mindful organising in an applied, "high risk" setting. Our study adds to the current understanding of how voice, psychological safety and participatory communication are important for mindful organising. The current speculation posits that both encouraging employee participation and safety to express challenging opinions are important for mindful organising (Vogus & Rerup, 2017; Sutcliffe et al., 2016; Weick & Sutcliffe, 2015). We add to these speculations by showing that in a high-risk applied setting, encouraging teams to express opinions and be actively involved in the functioning of the organization is not enough to foster mindful organising. Teams need to feel safe from threat or embarrassment to disagree with management and express challenging opinions in order for general participatory communication to lead to mindful organising.

The present study also offers some insight into how mindful organising impacts teams' subjective experience at work and therefore individuals' intentions to leave the organization. This adds to the current empirical evidence about the benefits of mindful organising in HROs, by extending quantitative research beyond performance-related outcomes. So far, mindful organising has been shown to lead to greater safety and more reliable performance in HROs (e.g. Barton, Sutcliffe, Vogus & DeWitt, 2015). We have obtained evidence of the role of mindful organising, at least in HROs, to reduce turnover intentions through the increasing team job satisfaction. This can be very important in industries such as nuclear power plants where replacing employees with a highly specialized knowledge can be a difficult feat. More holistically, without the specific communication mechanism of a high participation climate and perceived safety for upward dissent, mindful organising may not develop and the benefits that come with mindful organising such as increased job satisfaction and lower turnover intentions may not be seen. Although much work still needs to be done to further understand this novel construct, the present research offers an important piece of the mindful organising puzzle.

Practically, these results could be used by decision makers in high-risk organizations looking to create more meaningful changes, interventions, and management practices to foster mindful organising. In stimulating mindful organising, this research shows that possible interventions or trainings should not only focus on teaching the principles of mindful organising, but also the importance of genuine encouragement of employee participation in sharing ideas and creating safe space for teams to voice opinions and concerns that are critical about everyday operations. Strong emphasis should be placed on psychological safety for upward dissent as this condition is vital in fostering mindful organising, the collective capability that underpins high reliability and safety (Weick et al., 1999; Weick & Sutcliffe, 2007). Supervisors need to ensure that they do not respond defensively or punitively to challenging ideas, questions or help seeking behaviour in order to encourage talking about errors, challenging assumptions and admission of fault (Edmondson, 1999). This finding is especially relevant in organizational cultures that have high power distance between people and there is a large reliance on hierarchical order, such as the medical sector. Our research shows organizational decision makers that it is in interest to foster mindful organising, beyond the positive impact on performance, as it contributes to a more positive working experience and in turn less desire to leave the company. Given the present emphasis on retaining current employees in the nuclear power sector, we give evidence of an integrated model of conditions needed to lower turnover intention that could help decision makers in creating meaningful retention strategies in nuclear power plants.

5.5.4. Limitations and directions for further research

Although much can be learned from the results of the present study, there are some limitations to this research. The fact that the data is a self-report measure may have an impact on how truthful the answers were to the questionnaire. This is especially relevant given that all the employees were from a nuclear power plant, where safety is highlighted as important, so participants may have given into social desirability bias and rated their levels of mindful organising as higher than they actually were. Furthermore, given that participation was voluntary and convenience sampling was used, this may have attracted atypical respondents with special interests in safety which could affect the generalizability of the data. That being said, most behavioural science research relies on self-report measures and these kinds of measures form the basis of much well-known theory (Field, 2013). Some authors argue that people's perception of a given reality is often more powerful than the objective truth about such a reality (Hendriks, Putte & Bruijn, 2015). The literature on mindful organising and previous studies using the mindful organising scale (e.g. Vogus & Sutcliffe, 2007) also use self-report measures and convenience sampling. In addition, confidentiality and anonymity were guaranteed and participants were not asked to give demographic details that could be traced back to them, which would have enhanced the truthfulness of responses.

Given that the two mediator variables (mindful organising, job satisfaction) and the outcome variable (turnover intentions) were all measured at the same time (Time 2) we miss out on any potential for the dynamic development of these relationships. However, we used a time-lagged design with two-data collection points, allowing us to overcome the limitations associated with cross-sectional research. The use of a time-lagged design made it possible to test the hypothesized relationships of participation climate and perceived safety for upward dissent on mindful organising more rigorously. Another limitation of the present study is that the turnover intention measure only consists of one item. Although short scales for measuring performance have been used before in the literature (e.g. Baer & Frese, 2003), shorter scales raise concerns about content validity, so it is recommended that future studies replicate these findings with a larger turnover scale. Finally, the sample size was small with only 47 teams taking part in both Time 1 (2014) and Time 2 (2016) collection, this decreases the statistical power of the SEM and may have had an effect on the results (Rosnow & Rosenthal, 2013). However, the sample size is close to the recommended team level analysis sample size cut off of 50 teams (Hox, Maas & Brinkhuis, 2005).

The current research shed light on an important mechanism of how participation and perceived safety to share critical opinions interact to cause mindful organising over time. However, more research is still needed to better understand the set of variables that contribute to mindful organising. It could be particularly interesting to explore further communication-related variables that are important for fostering mindful organising (Ford, 2018). In this paper we have also suggested that the relationship between mindful organising and satisfaction is especially important in difficult environments, however, this relationship could be different depending on the importance of safety in different industries. Future research could further explore this by collecting data on mindful organising and job satisfaction in different teams in different industries. It would also be interesting to explore whether safety culture or the priority that different teams in different industries give to safety, moderates the relationship between mindful organising and job satisfaction.

Finally, future research about mindful organising should extend to other important outcomes in industries outside of the medical sector, such as safety performance or safety outcomes, that remains underdeveloped with quantitative research (Sutcliffe et al., 2016).

5.5.5. Conclusion

The hype around mindful organising will no doubt continue, however much work still needs to be done before this construct can be fully understood and utilized in organizations. The current research gave greater insight into mechanisms that may work together to foster mindful organising, namely perceived safety for upward dissent, and climate for employee engagement. Furthermore, the impact of mindful organising on job satisfaction was found to be positive which lead to less intention to leave the organization. Through adding further predictor variables to the study model and increasing the sample size, further exploration could be done on the factors that predict mindful organising, adding to international mindful organising theory in a meaningful way. Building onto mindful organising research is important as it could create insight that can furnish leaders with vital information on how to foster mindful organising leading to the error-free, reliable performance that many HROs enjoy today.

CHAPTER VI:
ENHANCING SAFETY IN HIGH-RISK OPERATIONS: THE ROLE OF MINDFUL ORGANISING IN DRIVING IN-ROLE AND EXTRA-ROLE SAFETY BEHAVIOURS

6.1. INTRODUCTION

Despite rapid advancements in technology and safety management systems, most organizations that operate in high-risk environments still experience errors and accidents that have dire consequences for their workers, customers and their communities. It is estimated that everyday more than 960,000 people get injured on the job and around 5,330 die due to work related injuries and diseases (Mekkodathil et al., 2016). Traditionally, safety research interested in improving the safety standards of particular industries or organizations would analyse accidents and errors to try to understand how to avoid them. This approach has since been criticized as not enough, as accidents and errors represent an absence of safety. In order to better manage safety and risk, we also need to uncover models and frameworks that represent the billions of cases where safety is present, and nothing goes wrong (Hollnagel, 2018). From these models and frameworks, we can extrapolate lessons about how to achieve higher safety standards in other settings.

One safety framework which has received rising attention is high-reliability organization (HRO) theory. High-reliability organizations (such as air traffic control centres or nuclear power plants) operate in trying conditions filled with constant risks and potential for error, and in these environments one error could lead to catastrophic consequences. What makes HROs remarkable is that they manage to operate almost error-free and maintain consistently stable performance (Rochlin et al., 1987). Through analyses of how these organizations managed to achieve such high resilience and reliability, researchers found that HROs designed for safety on a systems level and had a very intricate understanding of their operations with highly mapped our procedures and protocols (Schulman, 2004). Beyond that, they exhibited the social and relational infrastructure that allowed them to expertly manage unexpected events (Weick & Roberts, 1993). This social and relational infrastructure meant that teams working in these environments have a collective capability to anticipate, and quickly recover from, unexpected events and small errors so as to maintain stability within the system (Weick et al., 1999). This team capability has been called “mindful organising”, which is said to underpin the success of HROs (Weick & Sutcliffe, 2007). As our technologies become more sophisticated, modern organizations are experiencing higher levels of uncertainty, complexity and interdependence than ever before, which increases the number of unforeseen events occurring in modern organizations. This raises key questions for safety researchers about the new determinants of safety management in organizations (Griffin et al., 2014) as the ability to detect errors and unexpected events and quickly recover from them is becoming increasingly more relevant.

Mindful organising appears to have great potential in helping researchers and practitioners to create more resilient teams and organizations. However, a recent special issue on mindful organising highlights that mindful organising theory and empirical research is still limited, and is criticized for not being socially embedded enough, being too limited in focus and being too narrow in its level of analysis (Martínez-Córcoles & Vogus, 2020). This makes mindful organising difficult to sustain in practice. Of particular relevance, is the lack of research positioning team mindful organising within other important safety related variables, contextual variables (i.e. safety climate) and individual safety behaviours. In fact, the safety behaviours that teams engage in collectively has barely been studied, as most research on safety behaviour looks at individual behaviours such as safety compliance and safety participation (Neal et al, 2000) and individual proactive safety behaviours (e.g. Neal & Griffin, 2006; Curcuruto et al., 2015; Curcuruto et al., 2019) Extending our understanding of safety to the behaviours that teams engage in together expands our lens to the multileveled factors at play that could be enhancing more resilient and reliable performance in high-risk environments.

In a review of safety proactivity in organizations, Curcuruto and Griffin (2016) highlight that although the current literature shows that there appears to be positive links between climate dimensions (Zohar, 2008), team models such as mindful organising (Vogus & Sutcliffe, 2007; Weick et al., 1999) and individual behaviour models (e.g. Curcuruto et al., 2013; Hofmann et al., 2003; Parker & Collins, 2010), there is limited integration across levels and more empirical research is needed to better understand how these various factors relate to one another. This is especially important as creating meaningful safety models from a human behaviour perspective requires analysis of the complex systems and factors that affect, and are affected by, this behaviour. Therefore, it is becoming increasingly valuable to analyse organizational systems from a multi-levelled perspective to have a more holistic picture of these complex behavioural systems.

Within the current mindful organising literature, there are major gaps in our understanding of which contextual safety factors relate to mindful organising and how mindful organising may influence individual safety behaviour (Sutcliffe et al., 2016). It is widely accepted that strong organizational safety cultures translated into strong safety climates are powerful drivers of team and individual behaviour. Originally, early authors positioned mindful organising as "an enactment of safety climate" (Vogus & Sutcliffe, 2007), arguing that mindful organising may help to facilitate the behaviours associated with prioritizing safety on a team level. Since then, it has become apparent that mindful organising fundamentally differs from group safety climate conceptually and empirically (Renecle et al., 2020). However, the notion that mindful organising could facilitate the behaviours associated with prioritizing safety has never been tested empirically. In fact, the nature of the relationship between mindful organising and group safety climate is poorly understood, and no study to date has looked at the role of mindful organising in facilitating the relationship between group safety climate and individual safety behaviour. This is interesting because mindful organising has been criticized as "unstable" and in need of constant reinforcement. Building our understanding of contextual factors that may aid in creating and sustaining mindful organising can help in advancing how theoretically robust and practically relevant mindful organising can be (Martínez-Córcoles & Vogus, 2020).

The enactment of mindful organising on a team level has shown to improve objective safety outcomes (e.g. fewer medication errors (Vogus & Sutcliffe, 2007), and lower rates of mortality in patients (Madsen et al., 2006). Although there is value in analysing the direct impact of mindful organising on these outcomes, these models do not show us which individual safety behaviours are stimulated by team level mindful organising leading to increased reliability and fewer accidents. Models using objective indicators of safety (e.g. medication errors) are also specific to certain environments and industries, not offering much insight to other organizations about the how mindful organising may effect more generalisable, individual behaviours. The recent study conducted by Gracia et al. (2020) is the only research that has looked at the impact of mindful organising on the more general individual safety indicators of participation and compliance. Yet we still do not know what role mindful organising plays in predicting a more articulated cluster of extra role safety behaviour such as safety citizenship behaviours (SCBs) (Hofmann et al., 2003) and in preventing safety violation (Hansez & Chmiel, 2010). These individual safety behaviours have shown to be crucial for sustaining reliability in increasingly volatile, uncertain and complex environments (Curcuruto et al., 2015). Furthermore, little is known about the impact mindful organising has on individual cognitive-motivational states that could end up increasing desired safety behaviour in individuals. Recent studies (Curcuruto & Griffin, 2018; Curcuruto, Parker, & Griffin, 2019) showed the these safety-specific cognitive-motivational states are crucial in influencing individuals' to engage in highly valuable extra role safety behaviours in the workplace. Examining these relationships could help us to better understand value of mindful organising. It is possible that it is not team mindful organising alone that leads to better safety outcomes, but rather, it could be the individual motivational states and extra role safety behaviours stimulated by mindful organising that also play a big role in organizations achieving better safety outcomes.

The present research aims to position mindful organising as a collective, discursive form of safety related proactivity (Curcuruto & Griffin,

2016) which leads to increased individual safety behaviour through affecting individual cognitive-motivational states. It does so by conducting two studies with two samples of chemical workers. The first study will assess whether mindful organising mediates the relationship between group safety climate and safety compliance and safety citizenship behaviours. The second study will explore whether mindful organising affects role breadth self-efficacy, leading to increased safety compliance and safety citizenship behaviours.

6.2. THEORETICAL BACKGROUND

6.2.1. Mindful organising

Mindful organising is the collective ability of teams to anticipate, and recover from, unexpected events and errors. It encompasses various behaviours and norms that are seen in the actions and interactions of team members. It was originally discovered by Weick et al. (1999) during field and case study research on the human characteristics that made HROs manage to operate almost error free when the potential for errors and catastrophe is so high. They found that teams exhibited a highly attentive pattern of interrelating that allowed them to quickly detect when something was about to go wrong, and then act to maintain the stability of the organizational system. This ability allows teams, and the organizations in which they operate, to exhibit extreme resilience and reliability in their performance. Therefore, mindful organising has also called “the principles of high reliability” (Weick & Sutcliffe, 2007; Vogus & Sutcliffe, 2011). Mindful organising is a fragile construct, as it is enacted and re-enacted by those on the front line and it is a team level emergent phenomenon (Vogus & Sutcliffe 2012; Weick & Sutcliffe, 2007). Since its inception, mindful organising has been positioned within high reliability theory and has not been a big feature of mainstream safety behaviour research. This could largely be due to the fact that mindful organising research is still in its infancy, with most studies investigating mindful organising being qualitative in nature, limiting our understanding of mindful organising's nomological network (Martínez-Córcoles & Vogus, 2020; Sutcliffe et al., 2016).

Mindful organising is created and maintained through five interrelated processes, namely: (1) a preoccupation with error, (2) a reluctance to simplify interpretations, (3) sensitivity to operations, (4) a commitment to resilience and (5) deference to expertise (Weick & Sutcliffe, 2007). *A preoccupation with error* means that teams continuously try to anticipate everything that could go wrong and take any small deviation in performance as an indicator of potentially bigger problems (LaPorte & Consolini, 1991). *A reluctance to simplify interpretations* means that teams actively avoid simplifying their interpretations of events happening in their work as it could lead to incorrect conclusions (Schulman, 1993). This is seen in teams questioning assumptions made by others and allowing uncertainty to build up before making a diagnosis of a situation (Weick & Sutcliffe, 2015). *Sensitivity to operations* means teams remain aware of all of the details of current operations in any given moment (Weick et al., 1999). It also means teams keep managers informed of the realities of what is happening on the front line (Weick & Sutcliffe, 2015). *Commitment to resilience* means teams are able to quickly recover from unexpected events and errors, achieving stability of the system (Weick & Sutcliffe, 2007). It also means that teams actively try to develop and enhance their ability to bounce back from unexpected events (e.g. through learning from errors) (Van Dyck et al., 2005). *Deference to expertise* means that when teams are faced with unexpected events, decision making migrates to those with the best expertise or first-hand knowledge of the event, rather than to those with the highest rank (Roberts et al., 1994). It is through the first three processes that teams are able to anticipate when something is amiss or something unexpected is about to happen and it is through the last two processes that teams develop the ability to quickly contain, bounce back, and recover from, unexpected events and errors (Weick & Sutcliffe, 2007). Thus, mindful organising is about collective anticipation and containment-recovery.

In the present study, we posit that mindful organising is a form of team level safety proactivity (Curcuruto & Griffin, 2016). Safety proactivity is defined by encompassing three key elements (Parker & Collins, 2010): (1) it is self-initiated, (2) it is anticipatory and future focused, and (3) it is change-orientated. These features differentiate safety proactivity from proficient behaviour and adaptive behaviour (Griffin, Neal & Parker, 2007). Proficient behaviour in a high-risk context entails following rules and procedures to maintain a safe environment and adaptive behaviour entails reactively supporting safety in unpredictable changing environments (Curcuruto & Griffin, 2016). Adaptive behaviour bares more similarity to proactive safety behaviour than proficient behaviour, but it involves less initiative and anticipatory thinking. Mindful organising is an emergent phenomenon created and sustained by teams on the front line (self-initiated) (Sutcliffe et al., 2016), it involves teams initiating actions and communication about possible emerging issues and creating capacity to better respond to unexpected events in future (anticipatory and future focused) (Weick et al., 1999), it also focused on improving safety levels by changing the ways of working and growing team and system wide capabilities to best respond to unexpected events and errors (change-orientated) (Weick & Sutcliffe, 2007).

6.3. STUDY 3: THE ROLE OF MINDFUL ORGANISING IN LINKING SAFETY CLIMATE TO SAFETY BEHAVIOURS

6.3.1. Group safety climate and mindful organising

Safety climate is defined as shared perceptions about safety policies, procedures and practices (Zohar, 2008). Employees develop a collective understanding about the priority given to safety through internally consistent patterns of actions concerning safety from management and peers (Zohar & Luria, 2005). From this, employees form a consensus about what is valued. Safety climate has a subjective normative influence on individual and group behaviour (Zohar, 2008). This means that individuals and groups will conform to the group by repeating the patterns of action of others out of a desire to fulfil other's expectations and gain acceptance into the group or organization (Zohar, 2003). Safety climate differs from safety culture as safety culture refers to the underlying assumptions and values about safety that guide behaviour, whereas safety climate is the direct perceptions of the priority given to safety by individuals and groups. Safety culture is more difficult to directly measure as it represents implicit processes and intangible values, whereas safety climate is more accessible to conscious evaluation (Zohar, 2008; Griffin & Curcuruto, 2016).

Safety climate is also multileveled in that it can be conceptualized on an organizational level and on a group level. Zohar (2008) posits that organizational safety climate is reflective of the safety policies put into practice by senior management. In other words, if senior management consistently implements and enacts policies that prioritize safety above other competing demands, such as efficiency, employees are likely to perceive a high organizational safety climate. Group safety climate, on the other hand, is derived mainly from the safety practices that are executed by lower level leaders and team members, which may differ substantially from the implemented policies by senior management (Zohar, 2008). This is due to the fact that safety practices at a unit level depend on line managers discretion and interpretation of formal policies and procedures. It is also often the case that the policies and procedures implemented by senior management do not cover all the situations that teams may face in their work as the complexities of high-risk environments result in countless possible situations leaving the evaluation and implementation of practices to be prioritized up to lower level formal (and possibly informal) leaders (Zohar, 2008).

Safety climate has been linked to increased motivation to work safely, engaging in safer behaviour as well as fewer adverse safety outcomes (such as accidents and injury) (Nuhrgang et al., 2011). There are many theories as to why and how a high safety climate positively impacts safety behaviour, motivation and outcomes. The current literature on safety climate have explained the link between safety climate and safety motivation or safety behaviour through arguments using self-determination theory, psychological empowerment, social-exchange theory as well as theories about normative influence (Griffin & Curcuruto, 2016). The utility of each theory depends largely on the context, level of analysis (individual, team or organizational) as well as the safety variables in question.

The current study examines the effect of group safety climate on team mindful organising. Group safety climate was chosen to be included over organizational safety climate, because we believe the team level perception of the priority given to safety will be a more powerful and consistent driver of team safety behaviour. To our knowledge, no study exists that examines the direction and nature of the relationship between team mindful organising and safety climate and almost all safety climate research focuses on individual safety behaviour outcomes or collective objective indicator outcomes. We argue that group safety climate creates the psychosocial platform for teams to engage in the five processes of mindful organising through normative influences. We posit that mindful organising is an emergent, team level phenomenon that needs constant reinforcement in teams.

A weak group safety climate is likely to stifle mindful organising, whereas a strong group safety climate will influence team members to prioritize engaging in safer actions and practices over more efficient or quicker actions. The three processes to do with anticipation (preoccupation with error, reluctance to simplify interpretations and sensitivity to operations) require continuous attention and vigilance to detect any anomaly or change within the organization's internal or external system (Vogus, 2011). The anticipatory processes of mindful organising also require constant collective sensemaking as well as quick, real time feedback between team members (Weick & Sutcliffe, 2015). If teams do not believe that pursuing safety and safe outcomes is prioritized, expected and rewarded above other competing demands, it is highly unlikely that they will be able to sustain the continuous effort needed to engage in the process of anticipation. The two processes to do with containment (deference to expertise and commitment to resilience) have to do with creating capacity to contain unexpected events by using various team members knowledge and experience in a flexible manner (Vogus, 2011) as well as devoting time and energy towards growing team capabilities for bouncing back (Weick & Sutcliffe, 2007). It is unlikely that teams will take the personal responsibility, time and attention needed for quickly acting to contain unexpected events if they do not believe that pursuing safety is of utmost importance within their workgroup.

6.3.2. Mindful organising and safety behaviours

Our understanding of safety at work has followed the mainstream organizational behaviour models that distinguish work related behaviour according to: In-role behaviour (task performance) and extra-role behaviour (contextual performance) (Katz & Khan, 1966). In-role safety behaviours are generally labelled “safety compliance” and refer the tasks and activities outlined by formal procedures and rules that employees are expected to follow to maintain minimum levels of safety (Neal et al., 2000). Extra-role safety behaviours are generally called “safety participation” and refer to a wider set of behaviours that may contribute to developing an environment that supports safety, such as participating in voluntary safety activities or helping coworkers with safety tasks (Neal & Griffin, 2006). High risk environments are facing more uncertainty and change than ever before, making it difficult to predict and formalize ideal behaviours through setting up procedures and rules (Griffin et al., 2007). It is therefore unsurprising that the available research shows that safety management systems that focus more on stimulating safety participation have better safety outcomes (Curcuruto & Griffin, 2016; Hofmann et al., 2003; Zacharatos et al., 2005) Thus, safety management approaches need to encourage both safety compliance (to ensure reliability in routine situations) and safety participation (to ensure that safety citizenship and initiative grow capacity for reliability in unpredictable situations) (Zohar, 2008).

Within the safety participation paradigm, individuals may also engage in safety citizenship behaviours (SCBs), which are prosocial, discretionary actions carried out by employees that are necessary for managing risk in safety critical industries (Curcuruto et al., 2019; Hofmann et al., 2003). These SCBs can have various typologies, in that they can be affiliative (prosocial, cooperative behaviours that solidify the relationship with others and the organization) or challenging (behaviours that enact organizational change and challenge the status quo through innovation, problem solving or idea generation) (Curcuruto & Griffin, 2018; Hofmann et al., 2003; Van Dyne et al., 1995). These behaviours can also be either people-targeted (aimed at improving the quality of work experiences of the performance of people) or organization targeted (aimed at improving the organization itself) (Laurent, Chmiel, & Hansez, 2020; Organ et al., 2006; Williams & Anderson, 1991). Another distinction made, is whether the SCB is either protection/prevention focused (aims to mitigate risks in order to avoid the potential negative consequences of these risks) or promotion focused (aims to enhance safety so as to increase positive outcomes for the organization) (Curcuruto et al., 2019; Van Dyne et al., 1995).

Mindful organising has been attributed to higher reliability and better safety outcomes in various studies (e.g. Bigley & Roberts, 2001; Dierynck et al., 2016; Madsen et al., 2006; Vogus & Sutcliffe, 2007) These studies all look at safety outcomes (such as number of medication errors). Of the limited quantitative studies that exist, there is only one study linking mindful organising to more general indicators of safety behaviour (Gracia et al., 2020). This study showed that empowering leadership created the context for mindful organising which in turn predicted individual safety compliance but did not predict general individual safety participation. No study to date has looked at the impact of team mindful organising on individual safety citizenship behaviours. This limits our understanding of which individual safety behaviours are stimulated by team mindful organising, helping to achieve better safety outcomes and higher reliability. The present research wanted to investigate the impact of mindful organising on a variety of safety behaviours on the individual level, within a context of a high group safety climate. In other words, we wanted to investigate whether mindful organising mediates the impact of a strong group safety climate on individual safety behaviour, and if so, which safety behaviours?

We posit that group safety climate creates the necessary psychosocial platform to create and sustain the five processes of mindful organising by reinforcing expectancy-value perceptions of safety priorities (Parker et al., 2010). Therefore, we believe that in a context where team members perceive that safety is a priority above other competing demands, mindful organising is likely to develop.

Mindful organising represents a set of safety proactivity principles and norms that help teams to anticipate and contain risks and unexpected events. Consistently engaging in these behaviours and norms are likely to encourage further individual safety proactivity, such as SCBs. Therefore, the present study examines whether a high safety climate in teams leads to higher mindful organising, and whether mindful organising in turn leads to SCBs such as helping, initiative and voice. Helping refers to behaviours that help others with safety related responsibilities; it is an affiliative, promotive, and people-targeted SCB (Curcuruto et al., 2019). Voice refers to raising safety concerns to others; it is a challenging, promotive, and people-targeted SCB (Curcuruto et al., 2019). Initiative refers to making changes to ways of working to make it safer; it is a challenging, promotive, and organization-targeted SCB. We posit that the norms established through collectively engaging in the behaviours required for the anticipation (preoccupation with error, reluctance to simplify, sensitivity to operations) and the containment (commitment to resilience and deference to expertise) processes of mindful organising will increase individual's propensity to engage in SCBs. This is because consistently engaging in team level proactivity towards safety enacted through mindful organising is likely to influence individuals to be more proactive in enhancing individual capacities for safety by raising safety concerns they see to their colleagues and leaders (voice), independently make changes to their ways of working to make it safer (initiative) as well as helping others with safety related issues (helping). We argue that although a high safety climate may set the foundation for encouraging individual SCBs such as voice, initiative and helping, it is through the influence of team mindful organising that these individual behaviours are likely to be enacted. Therefore, the following is hypothesized:

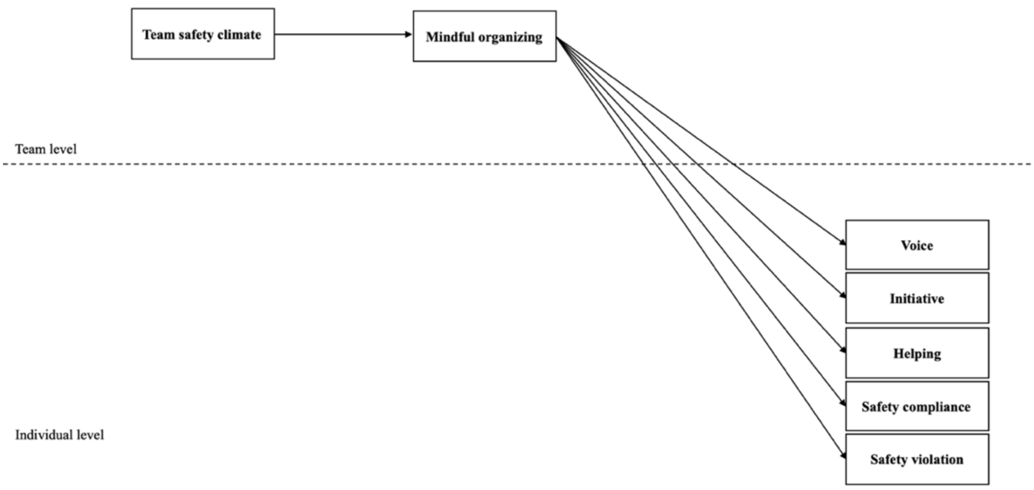
Hypothesis 1: Mindful organising mediates the relationship between group safety climate and voice(1a), initiative (1b), helping (1c) so that the relationship is positive and significant.

Engaging in team level mindful organising will then increase individual's propensity to adhere to general safety rules and procedures and discourage them going against these rules, especially for routine tasks. Thus, the present study wanted to examine whether mindful organising mediated the relationship between safety climate and safety compliance. We believe that the heightened attention to safety risks and possible errors and mishaps or "heedful interrelating" that comes from engaging in the processes of mindful organising (Weick et al., 1999), is likely to reduce slip-ups and lack of adherence to safety rules and procedures. Similarly, it is likely that teams with a high safety climate that engage in the five processes of mindful organising create a norm of a high commitment to safety and safety behaviours. It is highly unlikely that individuals working within units will actively go against formalised safety rules. Therefore, the following is hypothesized:

Hypothesis 2: Mindful organising mediates the relationship between group safety climate and safety compliance so that the relationship is positive and significant.

Hypothesis 3: Mindful organising mediates the relationship between group safety climate and safety violation, so that the relationship is negative and significant.

Figure 1. Study 1 model



6.3.3. Sample and Procedure

The data used in this research was collected within a sample of Russian-based chemical plant workers (N = 1112) comprising of 98 teams. Participation was voluntary and all workers were informed that the data would be used for scientific research and to gain insight into safety culture improvements in each plant. The average length of tenure was 4.7 years (SD = 9.58). Participants were employed in production (49%), chemical treatment (25%), packaging (22%) or maintenance (4%). Employees in the sample worked in various departments within the plant such as secondary production (42%), primary production (18%), filter making (17%), in the warehouse (14%), quality assurance (4%), engineering (3%) or other areas (2%). In terms of safety roles, 12% of respondents were either a team safety head or manager and majority of participants were ordinary workers (88%). The questionnaire was administered in Russian and the scales below were translated from English (the original versions) to Russian using the back-translation methods with two bilingual experts and industry personnel.

6.3.4. Measures

All of the following scales were measured using 5-point Likert scales, with 5 indicating the highest score in the dimension studied and 1 being the lowest score in the dimension studied.

6.3.4.1. Group safety climate

Group safety climate is the perceived level of importance given to safety at the group level. Group safety climate was measured using a 16-item scale (α = .94) taken from Zohar and Luria (2005). An example item is "My direct line manager frequently tells us about the hazards in our work".

6.3.4.2. Mindful organising

Mindful organising is a team's collective capability to anticipate and contain errors and unexpected events. Mindful organising was measured using a 9-item scale (α = .93) taken from Vogus and Sutcliffe (2007). An example item is "We talk about mistakes and ways to learn from them."

6.3.4.3. Safety citizenship behaviours

Safety citizenship behaviours are discretionary and prosocial activities essential for managing risk in safety critical industries (Curcuruto, Conchie & Griffin, 2019). For the present study, we analysed three SCBs, namely: voice, initiative and helping. Voice was measured using a 4-item scale (α = .91), an example item is "rate the extent to which you voluntarily raise safety concerns in planning sessions" Initiative was measured using a 4-item scale (α = .84), an example item is "rate the extent to which you voluntarily try to make policies and procedures safer". Helping was measured using a 6-item scale (α = .90), an example item is "rate the extent to which you voluntarily help teach safety procedures to new crew members".

6.3.4.4. Safety compliance

In order to analyse safety compliance, we measured whether individuals comply with the safety protocol of the chemical plant and whether individuals violate safety protocol. Both scales were taken from Hansez and Chmiel (2010). Although the compliance scale is a positive indicator of adhering to safety protocol and the violation scale is a negative indicator of adhering to safety protocol, conceptually we treated both scales as indicators of compliance. Safety compliance was measured using a 5-item scale (α = .81), an example item is "rate the extent to which you voluntarily use protection, even if it is hard to find." Safety violation was measured using a 5-item scale (α = .91) and is inversely scored, an example item is "rate the extent to which you neglect some safety rules when performing familiar or routine work."

6.3.5. Analyses

To test our proposed model, we ran a multilevel structural equation model (MSEM). Group safety climate and mindful organising were analysed on the team level and safety compliance, routine violation and the SCBs were analysed on the individual level.

First, confirmatory factor analyses (CFA) of the seven scales (group safety climate, mindful organising, voice, initiative, helping, safety compliance and safety violation) were carried out in order to gain evidence of the discriminant validity of these measures. A seven-factor model with all the items loading onto seven separate factors using individual level data was run with Mplus (Muthén & Muthén, 1998–2010). Thereafter, five alternative CFA models were conducted, and the fit of these models was compared with the seven-factor model. The alternative models are: (1) a model with all the items of the seven scales loading onto one single factor, (2) a six factor model with all items loading onto their corresponding factor but with group safety climate and mindful organising loading onto one single factor, (3) a five factor model with all items loading onto their corresponding factor and the three SCBs (helping, initiative and voice) loading onto one single factor, (4) a six factor model with all items loading onto their corresponding factor but with safety compliance and safety violation loading onto one single factor, (5) a four factor model with group safety climate and mindful organising loading onto their corresponding factor, the three SCBs (helping, initiative and voice) loading onto one single factor and the two compliance variables loading onto one single factor.

Model fit was evaluated by calculating the chi-squared statistic, the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI; Bentler, 1990) and the Tucker Lewis index (TLI; Tucker & Lewis, 1973). RMSEA values below .05 indicate good fit, values of between .08 and .05 show a reasonable error of approximation and values of .10 or more indicate poor fit, (Browne & Cudeck, 1993; Browne & Du Toit, 1992). For the CFI values, values above .90 are considered acceptable fit and values close to 1 indicate good fit (Hu & Bentler, 1999). TLI values near 1 indicate good fit, with the conventional cut off being .90 for acceptable fit (Tucker & Lewis, 1973). When comparing alternative models, we used the following criteria: (1) whether the differences between TLI and CFI values of the competing models were larger than .01 (Cheung & Rensvold, 2002; Widaman, 1985), and (2) whether the differences between RMSEA values were larger than .015 (Chen, Curran, Bollen, Kirby & Paxton, 2008). These criteria indicate whether there is a notable disparity between the models and when these differences in practical fit indices are detected, the model showing better fit will be selected. Complementarily, the difference in chi-squared statistics along with the difference in degrees of freedom was also used to check for statistically significant differences among competing models, using a $\chi 2$ table. If the difference is significant, the model with the smaller chi-square value is argued to have better fit to data (Schermelleh-Engel et al., 2003).

Second, to evaluate the within group agreement and between group discrimination for group safety climate and mindful organising, we calculated aggregation indices and ANOVA , respectively. Therefore, we calculated different aggregation indices (average deviation index (ADIs), Rwg values, intraclass correlation statistics), and ANOVAs.

Third, we ran a multilevel structural equation model to assess our proposed mediation model and the pathways between our variables. Monte Carlo (MC) confidence intervals were used for testing the significance of the indirect effects, as it is argued to be a more viable and robust method for calculating confidence intervals for complex and simple indirect effects when working with a multilevel model (Preacher & Selig, 2012).

6.3.6. Results

6.3.6.1. Confirmatory Factor Analysis

Table 1 shows the goodness of fit indices of the CFA with all seven variables included in the study loading onto seven separate factors, and four alternative models.

Table 1

CFA goodness of fit indices for the study model and alternative models.

Model	χ^2 *(df)*	***p***	**RMSEA**	**CFI**	**TLI**	**SRMR**
7-factor model: *the seven study variables loaded onto seven separate factors*	4167.47 (1106)	.000	.050	.966	.964	.039
Alternative model 1: *the seven study variables loaded onto a single factor*	28160.41 (1127)	.000	.147	.699	.686	.159
Alternative model 2: *six factor model with mindful organising and group safety climate loading onto the same single factor and initiative, helping, voice, safety compliance and safety violation each loading onto separate factors.*	7757.74 (1112)	.000	.073	.926	.922	.065

Alternative model 3: *five factor model with the SCBs (initiative, helping, voice) loading onto the same single factor and mindful organising, group safety climate, safety compliance and safety violation each loading onto separate factors*	4796.62 (1117)	.000	.054		.959	.957	.043
Alternative model 4: *five factor model with safety compliance and safety violation loading onto the same single factor and mindful organising, group safety climate, initiative, helping and voice each loading onto separate factors.*	6548.45 (1112)	.000	.066		.939	.936	.057

Alternative model 5: *four factor model with group safety climate and mindful organising loading onto their corresponding factor, the three SCBs (helping, initiative and voice) loading onto one single factor and the two compliance variables loading onto one single factor*	7005.23 (1121)	.000	.069		.934	.931	.060

The differences between the 7-factor model and the alternative model 1 (ΔRMSEA = .097, ΔCFI = .267, ΔTLI = .278), alternative model 2 (ΔRMSEA = .019, ΔCFI = .040, ΔTLI = .042), alternative model 4 (ΔRMSEA = .016, ΔCFI = .030, ΔTLI = .028) and alternative model 5 (ΔRMSEA = .019, ΔCFI = .036, ΔTLI = .034) were notable, indicating that the study model had a better fit to the data. However, the differences between the 7-factor model and alternative model 3 (where initiative, voice and helping loaded onto a single factor) were negligible (ΔRMSEA = 0.004 0, ΔCFI = .007, ΔTLI = .007). Therefore, we examined the difference in chi-square statistics of the 7-factor model and alternative model 3, and found that the difference between the chi-square statistics were statistically significant ($\Delta\chi^2 = 629.15$, $\Delta df = 11$, $p < .001$). Given that the 7-factor model has a smaller chi-square value, it is considered to have better fit to data. Thus, the evidence above supports the discriminant validity of the seven scales.

6.3.6.2. Aggregation Indices

The results of the within-team agreement and inter-rater reliability analyses for group safety climate and mindful organising provided adequate justification for aggregating the data to the team level. The ADI values were .66 (SD = .19) for group safety climate and .62 for (SD = .21) for mindful organising, both were below the .83 cut off indicated for 5-point Likert response scales (Burke & Dunlap, 2002). The $r_{wg(J)}$ values were .91 for group safety climate and .90 for mindful organising, both were above the .70 cut-off (Bliese, 2013). The ICC(1) values were .06 for both variables, thus above the recommended .05 cut-off (Bliese, 2000). ANOVA results for group safety climate (F (98,1013) = 1.78, $p < .001$) and mindful organising (F (98,1010) = 1.68, $p < .001$) indicated adequate between-team discrimination.

6.3.6.3. Descriptive statistics and correlations among study variables

Descriptive statistics and the correlations between the study variables can be found in Table 2.

Table 2

Descriptive Statistics and Correlations Among Study Variables

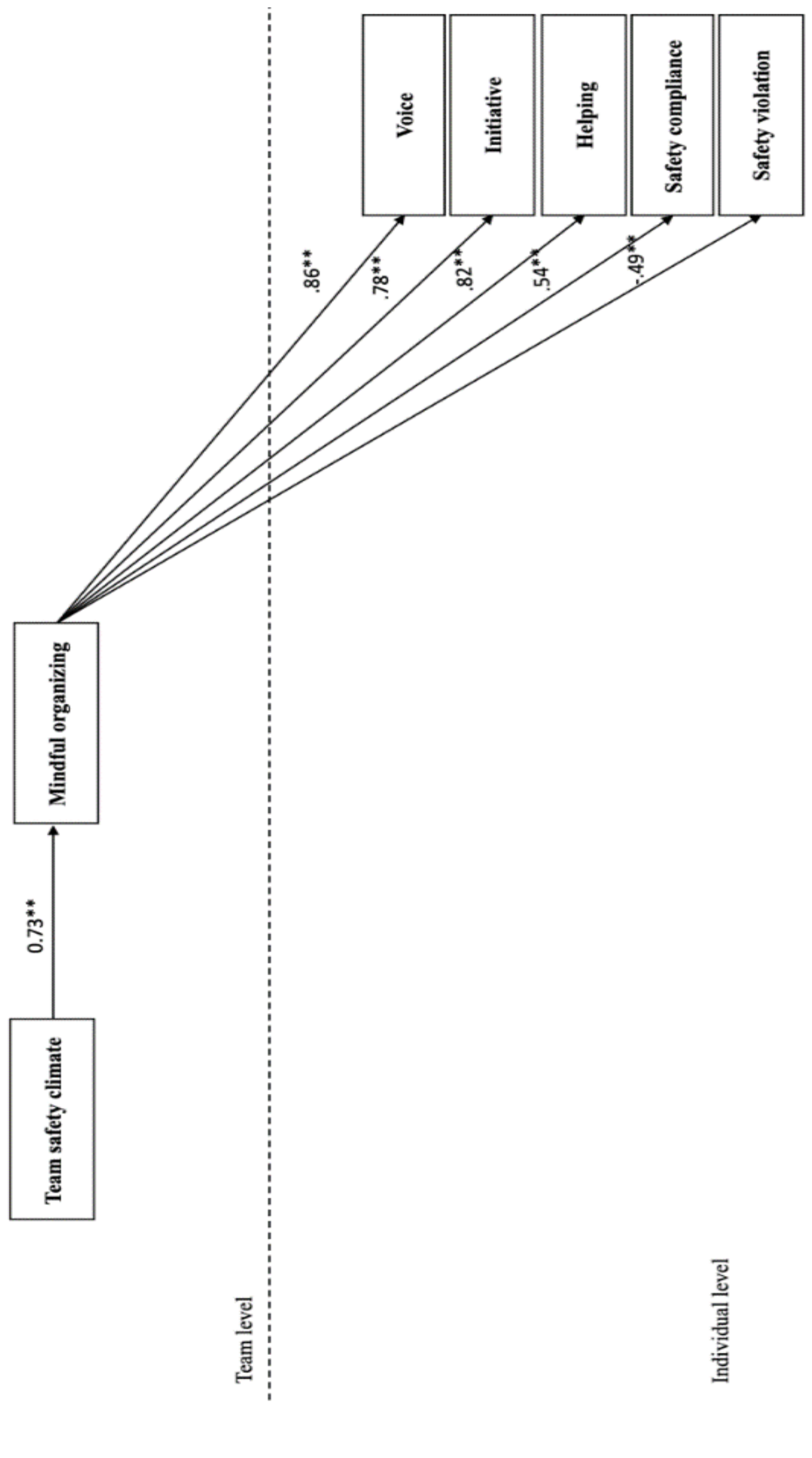
Variable	*M*	*SD*	1	2	3	4	5	6	7
1.Group safety climate	4.08	.76	--						
2. Mindful organising	3.97	.75	.64**	--					
3. Safety Compliance	4.35	.67	.41**	.44**	--				
4. Safety Violation	1.56	.78	-22**	-.24**	.47**	--			
5. Voice (SCB)	3.08	1.02	.31**	.44**	.43**	.12**	--		
6. Initiative (SCB)	3.09	.92	.31**	.44**	.40**	.11**	.80**	--	
7. Helping (SCB)	3.35	.98	.38**	.49**	.48**	.15**	.78**	.72**	--

Note. * p < .05, **p < .001

6.3.6.4. Multilevel SEM analysis

The results of the MSEM analysis indicated that the hypothesized multilevel mediation model showed a satisfactory fit (χ^2 =21.73, *df* = 15, p > .05; RMSEA = 0.02 ; CFI = 1.00; TLI = 1.00; SRMR-within = .01; SRMR-between = .06). All hypothesized pathways were significant (see Figure 2).

Figure 2. Unstandardized parameter estimates for the hypothesized model. $*p < .05$, $**p < .001$



The pathway from group safety climate to mindful organising was positive and statistically significant (b = .73, p < .001). In addition, the pathways from mindful organising to voice (b = .86, p < .001), initiative (b = .78, p < .001), helping (b = .824, p < .001), safety compliance (b = .54, p < .001) and safety violation (b = -.49, p < .001) were all statistically significant. Moreover, regarding the indirect effects (mediation effects), none of the 95% Monte Carlo (MC) confidence intervals (CI) include the zero value. Group safety climate had a positive statistically significant indirect effect on voice (IE = .63,, 95% MC CI = 0.40, 0.91), initiative (IE = .57,, 95% MC CI = 0.36, 0.82), helping (IE = .60, 95% MC CI = 0.40, 0.84) and safety compliance (IE = .40, 95% MC CI = 0.27, 0.53) through mindful organising. As expected the indirect between relationship of group safety climate on safety violation through mindful organising was negative and significant (IE = -0.36, 95% MC CI = -0.53, -0.21).

To further examine full vs partial mediation, we tested an alternative model that included the direct paths from group safety climate to the five outcomes. The extra paths were not statistically significant (p > .05) and the partial mediation model did not improve model fit (χ^2 =32.87, df = 10, p > .001; RMSEA = 0.05 ; CFI = 0.99; TLI = 0.98; SRMR-within = .01; SRMR-between = .05).

6.3.7. Conclusions

The results obtained were in line with the hypothesized model in that mindful organising fully mediated the relationship between group safety climate and all five individual safety behaviours (voice, initiative, helping, safety compliance and safety violation), so that the relationship was significant and positive for safety compliance and the SCBs (initiative, voice, helping) , and the relationship was negative and significant for safety violation. These results confirm hypotheses 1, 2 and 3.

6.4. STUDY 4: THE ROLE OF INDIVIDUAL CAPABILITY DRIVERS IN LINKING TEAM MINDFUL ORGANISING TO INDIVIDUAL SAFETY BEHAVIOURS

6.4.1. Mindful organising and role breadth self-efficacy

The model examined in study one looks at the contextual and social influences of a strong group safety climate and mindful organising on individual safety citizenship behaviours (SCBs), safety compliance and violation. Although this offers us an insightful framework of the multileveled factors at play that predict desirable safety behaviours, it does not take into account the means through which mindful organising affects individual behaviour. When we only take into account the contextual and social drivers of individual safety proactivity, we end up treating the individual as a passive agent within the system, wholly influenceable by the social expectations and desired behavioural models in their organization (Parker et al., 2010). There is a great body of research that analyses the individual as an active element of the system, able to initiate changes and drive improvement, development and resilience themselves (Curcuruto et al., 2016). This research stream shows that there are multiple psychological mechanisms that drive individual proactivity. Therefore, the next step of our research is to investigate how mindful organising affects certain cognitive-motivational states that could drive individual behaviour.

A prominent driver of proactive behaviour is an individual's perceived capability to achieve short term, proactive goals. In high risk contexts rife with unexpected events, it can be daunting to engage in safety citizenship behaviours such as initiating changes, voicing concerns or taking the lead in managing safety by helping or guiding others to be safer in the moment. Believing in one's own ability to be able to successfully carry out these daunting activities is likely to be a powerful motivator for engaging in these activities. Therefore, the present study wanted to examine whether individual capability drivers such as self-efficacy played a role in facilitating individual safety citizenship behaviours in a context where teams engage in mindful organising. In particular, we wanted to examine whether role breadth self-efficacy played an important role in mediating the relationship between team mindful organising and individual safety behaviours.

Role breadth self-efficacy refers to "employees perceived capability of carrying out a broader and more proactive, interpersonal and integrative set of work tasks and goals to do with safety beyond prescribed requirements" (Curcuruto & Griffin, 2016 p.121). An important distinction to make is that role-breath self-efficacy does not refer to an individual's capability, knowledge and skills to carry out important extra role behaviours and tasks. Rather, it refers to an individual's confidence to perform such tasks stemming from their own subjective judgement of their capability, knowledge and skills (Bandura, 2001). It encompasses how confident employees feel to analyse safety issues and propose solutions, come up with new methods to improve safety, help to facilitate safety goals in their team as well as discuss how to improve safety with others (Curcuruto et al., 2016). Role breadth self-efficacy has been shown to lead to individual proactivity in work performance (Griffin, Neal & Parker, 2007). It has also been associated with challenging behaviours to disrupt the status quo and suggest improvements (McAllister et al., 2007).

Engaging in the five processes of mindful organising boosts a team's ability to understand and diagnose the risks they face (through the anticipation processes) as well as enhances a team's ability to successfully navigate unexpected events and contain errors (through the containment processes) (Vogus, 2011). We believe that individuals that form part of a team that is able to collectively manage unexpected events and small errors effectively are likely to develop more confidence in their individual ability to fulfil their extra-role tasks to enhance safety. This increased role-breadth self-efficacy is likely to lead to higher proactivity to carry out safer practices in the organization such as engaging in helping, voice and initiative.

We posit that the anticipation processes of mindful organising (preoccupation with error, reluctance to simplify and sensitivity to operations) will lead to higher role breadth self-efficacy to voice safety concerns to others. Preoccupation with error entails teams continuously searching for, detecting and voicing concerns about potential errors and anomalies (Weick & Sutcliffe, 2007). Reluctance to simplify entails challenging assumptions and trying to uncover blind spots in operations through rich discussions about possible categories and labels (Schulman, 1993). Sensitivity to operations means teams make sure to be aware of the realities of operations on the front line and communicate these challenges and realities to one another and to leaders (Weick & Sutcliffe, 2015). These three actions and activities increase the range of situations that each individual team member becomes more self-assured to address and discuss, increasing their confidence to correctly identify, and voice, a wide range of safety issues. This increased role breadth self-efficacy is likely to motivate these team members to engage in voicing safety concerns to others on their own accord, over and above mindful organising and what is required by their formal job description. Therefore, the following is hypothesized:

Hypothesis 4: Role breadth self-efficacy mediates the relationship between mindful organising and voice so that the relationship is positive and significant.

We argue that the containment processes of mindful organising (commitment to resilience and deference to expertise) will lead to higher role breadth self-efficacy to engage in initiative (initiating changes to ensure safer practices) on an individual level. This is because commitment to resilience has to do with growing team capabilities to quickly recover from unexpected events so teams are can act swiftly and make changes to bounce back from errors (Weick & Sutcliffe, 2015). Deference to expertise has to do with knowing where the best expertise in the system are, and quickly acting to ensure that the best expertise are utilised to make decisions during unexpected events so that errors can be contained and stability can be achieved (Roberts et al., 1994). This often means that those that can see the most and are the closest to a potential problem are the ones with the best expertise in the matter (Weick & Sutcliffe, 2015). Engaging in this resilient action and deference to expertise on a team level is likely to increase an individual's confidence in their own ability to initiate changes in the moment to quickly act to ensure a safer workplace, this increased confidence in their capability to initiate these actions, will then lead to them engaging in initiating changes to increase safety. Therefore the following is hypothesized:

Hypothesis 5: Role breadth self-efficacy mediates the relationship between mindful organising and initiative so that the relationship is positive and significant.

Mindful organising creates a broader awareness of the work and knowledge of others in a team (through sensitivity to operations, commitment to resilience and deference to expertise) , this is likely to enhance each individual's understanding of which team members are likely to need support or help with safety protocol and practices. This, coupled with the knowledge and experience in managing safety that comes from engaging in mindful organising continuously as a team is likely to build individuals perceived confidence in successfully helping the less experienced to follow and achieve safety goals. The enhanced role breadth self-efficacy to engage in extra role helping will increase an individual's propensity to actually reach out to less experienced or knowledgeable colleagues to assist them with safety related matters. Therefore, the following is hypothesized:

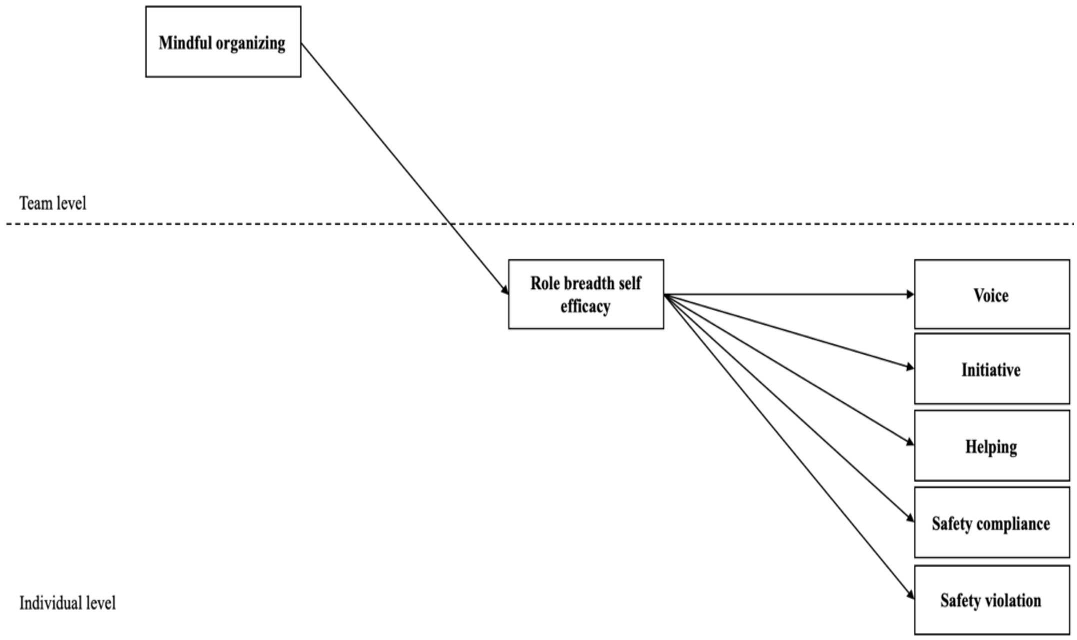
Hypothesis 6: Role breadth self-efficacy mediates the relationship between mindful organising and helping so that the relationship is positive and significant.

It is expected that the relationship between mindful organising and the SCBs (helping, voice and initiative) through role breadth self-efficacy will be stronger than for safety compliance and violation. We believe that mindful organising will have a significant positive impact on individuals' subjective judgement of whether they are capable of pursuing important safety tasks that do not form part of their formal roles, which will strongly predict SCBs, which are extra-role safety behaviours. Safety compliance and violation, on the other hand, are in-role behaviours and will not be as strongly influenced by an individual's confidence in their ability to perform activities above and beyond what is formally required of them. However, we wanted to do still argue that in a context where teams engage in mindful organising which sparks higher role breadth self-efficacy, that it will lead to higher compliance with safety rules and less violation of such rules. In a context where individuals have high role breadth self-efficacy from engaging in mindful organising, there is likely to be a high commitment to upholding safety procedures and rules. We therefore hypothesize the following:

Hypothesis 7: Role breadth self-efficacy mediates the relationship between mindful organising and safety compliance, so that the relationship is positive and significant.

Hypothesis 8: Role breadth self-efficacy mediates the relationship between mindful organising and safety violation, so that the relationship is negative and significant.

Figure 3. Study 2 model



6.4.2. Method

6.4.2.1. Sample and procedure

The data used in this research was collected within a sample of Ukraine-based chemical plant workers (N = 443) comprising of 50 teams. Participation was voluntary and all workers were informed that the data would be used for scientific research and to gain insight into safety culture improvements in each plant. Majority of participants (60%) had been working in the company for more than 10 years, 33% had been working in the company for 5 to 10 years, 3% had been working in the company for 2 to 5 years, 2% had been in the company for less than 5 years and 2% did not indicate their tenure in the company. Participants were employed in primary and secondary production (30%), the filter production workshop (12%), the warehousing department (15%), quality assurance department (13%), the engineering department (8%) and 22% came from other departments. The questionnaire was administered in Russian and the scales below were translated from English (the original versions) to Russian using the back-translation methods with two bilingual experts and industry personnel.

6.4.2.2. Measures

All scales were measured using 5-point likert scales, were 5 indicated the highest value and 1 indicated the lowest value in the respective measures. Given the negative wording of the scale for safety violation, it was reverse scored.

Mindful organising. Mindful organising is a team's collective capability to anticipate and contain errors and unexpected events. Mindful organising was measured using a 9-item scale ($\alpha = .94$) taken from Vogus and Sutcliffe (2007). An example item is "We talk about mistakes and ways to learn from them."

Role breadth self-efficacy. Role breadth self-efficacy is the confidence individuals have in their own ability to carry out a more participative and broader set of safety tasks beyond formalised role requirements. It was measured using a 5-item scale ($\alpha = .93$) taken from Curcuruto, Mearns and Mariani (2016). An example item is "Feeling confident in devising new methods to improve safety in my work area".

Safety citizenship. Safety citizenship behaviours (SCBs) are discretionary and prosocial activities essential for managing risk in safety critical industries (Curcuruto, Conchie & Griffin, 2019). For the present study, we analysed three SCBs, namely: voice, initiative and helping. Voice was measured using a 4-item scale (α = .92), an example item is "rate the extent to which you voluntarily raise safety concerns in planning sessions" Initiative was measured using a 4-item scale (α = .87), an example item is "rate the extent to which you voluntarily try to make policies and procedures safer". Helping was measured using a 6-item scale (α = .90), an example item is "rate the extent to which you voluntarily help teach safety procedures to new crew members".

Safety compliance. Safety compliance is the degree to which an individual complies with the safety protocol of the chemical plant. Safety Violation is the extent to which an individual violates safety protocol. Both scales were taken from Hansez and Chmiel (2010). Safety compliance was measured using a 5-item scale (α = .82), an example item is "rate the extent to which you voluntarily use protection, even if it is hard to find." Safety violation was measured using a 5-item scale (α = .94) and is inversely scored, an example item is "rate the extent to which you neglect some safety rules when performing familiar or routine work."

6.4.2.3. Analyses

To test our proposed model, we ran a multilevel structural equation model (MSEM). Mindful organising was analysed on the team level and role breath self-efficacy, safety compliance, safety violation and the SCBs were analysed on the individual level. First, confirmatory factor analyses (CFA) of the seven scales (mindful organising, role breath self-efficacy safety compliance, safety violation, voice, initiative, and helping) were carried out in order to gain evidence of the discriminant validity of these measures. A seven-factor model with all the items loading onto seven separate factors using individual level data was run with Mplus (Muthén & Muthén, 1998–2010). Thereafter, four alternative CFA models were conducted, and the fit of these models was compared with the seven-factor model. The alternative models are: (1) a one factor model with all the items of the seven scales loading onto one single factor, (2) a six factor model with mindful organising and role breath self-efficacy both loading onto the same single factor and all the other items loading onto their corresponding factors, (3) a five factor model with the three SCBs (voice, initiative, and helping) loading onto the same single factor and all the other items loading onto their corresponding factors, (4) a six factor model with safety compliance and safety violation both loading onto the same single factor and all the other items loading onto their corresponding factors and (5) a four factor model with the three SCBs (voice, initiative, and helping) loading onto the same single factor, safety compliance and violation loading on to the same factor and mindful organising and role breadth self-efficacy loading onto their corresponding factors. Model fit was evaluated by calculating the chi-square statistic, the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI; Bentler, 1990) and the Tucker Lewis index (TLI; Tucker & Lewis, 1973). RMSEA values below .05 indicate good fit, values of between .08 and .05 show a reasonable error of approximation and values of .10 or more indicate poor fit, (Browne & Cudeck, 1993; Browne & Du Toit, 1992). For the CFI values, values above .90 are considered acceptable fit and values close to 1 indicate good fit (Hu & Bentler, 1999). TLI values near 1 indicate good fit, with the conventional cut off being .90 for acceptable fit (Tucker & Lewis, 1973). When comparing alternative models, we used the following criteria: (1) whether the differences between TLI and CFI values of the competing models were larger than .01 (Cheung & Rensvold, 2002; Widaman, 1985), and (2) whether the differences between RMSEA values were larger than .015 (Chen, Curran, Bollen, Kirby & Paxton, 2008). These criteria indicate whether there is a notable disparity between the models and when these differences in practical fit indices are detected, the model showing better fit will be selected. Additionally, the difference in chi-square statistics along with the difference in degrees of freedom was also used as a criteria to check for statistically significant differences among competing models. If the difference is significant, the model with the smaller chi-square value is argued to have better fit to data (Schermelleh-Engel et al., 2003).

Second, the aggregation indices (average deviation indices (ADIs), Rwg values, intraclass correlation coefficient ICC(1)) and ANOVAs, were calculated for mindful organising to evaluate the within group agreement and between group discrimination, respectively.

Third, we ran a multilevel structural equation model to assess our proposed mediation model and the pathways between our variables. Monte Carlo (MC) confidence intervals were used for testing the significance of the indirect effects, as it is argued to be a more viable and robust method for calculating confidence intervals for complex and simple indirect effects when working with a multilevel model (Preacher and Selig, 2012).

6.4.3. Results

6.4.3.1. Confirmatory factor analysis

Table 3 shows the goodnes of fit indices of confirmatory factor analysis (CFA) carried out for alternative models. We examined the distintiviness of the seven study variables through a seven-factor model (with all seven variablesin the study loading onto seven separate factors), and compared the fit of this model with four alternative models.

Table 3

Goodnes of Fit Indices of Confirmatory Factor Analysis (CFA) for the Alternative Models

Model	χ^2 *(df)*	***p***	**RMSEA**	**CFI**	**TLI**	**SRMR**
Seven-factor model: *the seven study variables loading onto seven separate factors*	1226.57 (506)	.000	.057	.919	.910	.040
Alternative model 1: *the seven study variables loading onto a single factor*	4691.99 (527)	.000	.134	.531	.500	.136

Alternative model 2: *six factor model with mindful organising and role breath self-efficacy loading onto the same single factor and initiative, helping, voice, safety compliance and safety violation each loading onto separate factors.*	1938.84 (512)	.000	.079	.839	.824	.061
Alternative model 3: *five factor model with the SCBs (initiative, helping, voice) loading onto the same single factor and mindful organising, role breath self-efficacy, safety compliance and safety violation each loading onto separate factors.*	1380.53 (517)	.000	.061	.903	.894	.043

Alternative model 4: *five factor model with safety compliance and safety violation loading onto the same single factor and mindful organising, role breath self-efficacy, initiative, helping and voice each loading onto separate factors.*	1581.56 (512)	.000	.069	.879	.868	.084
Alternative model 5: *four factor model with the three SCBs (voice, initiative, and helping) loading onto the same single factor, safety compliance and violation loading on to the same factor and mindful organising and role breadth self-efficacy loading onto their corresponding factors*	1728.95 (521)	.000	.072	.864	.853	.085

The differences between the theorized seven-factor model and the alternative model 1 (ΔRMSEA = .07, ΔCFI = .39, ΔTLI = .41), alternative model 2 (ΔRMSEA = .02, ΔCFI = .08, ΔTLI = .09), and alternative model 4 (ΔRMSEA = .01, ΔCFI = .04, ΔTLI = .04) were notable, indicating that the seven-factor model had a better fit to the data. The differences between the theorized seven-factor model and alternative model 3 (where initiative, voice and helping loaded onto a single factor) were notable for the CFI and TLI values (ΔCFI = .02, ΔTLI = .02), however, there were no relevant differences in the RMSEA values (indicate here the value). Therefore, we examined the difference in chi-square values for the theorized seven-factor model and the alternative model 3, and we found a statistically significant difference ($\Delta\chi^2$ = 153.96, Δdf = 11, p < .001). Given that the theorized seven-factor model had a smaller chi-square value, we concluded that it was the best fitting model. Thus, the evidence above supported the discriminant validity of the seven scales.

6.4.3.2. Aggregation indices

The results of the within-team agreement and inter-rater reliability analyses for mindful organising provided adequate justification for aggregating the data to the team level. The average ADI value was .50 (SD = .19), which is below the .83 cut off for a 5-point Likert-type scale (Burke & Dunlap, 2002). The $r_{wg(J)}$ value was .94, above the .70 cut-off (Bliese, 2013). The ICC(1) value was .09, which is above the recommended .05 cut-off (Bliese, 2000). Additionally, ANOVA results for mindful organising (F (49,379) = 1.80, p < .05) indicated adequate between-team discrimination.

6.4.3.3. Descriptive statistics

Descriptive statistics and the correlations between the study variables can be found in Table 4.

Table 4

Descriptive statistics and correlations among study variables

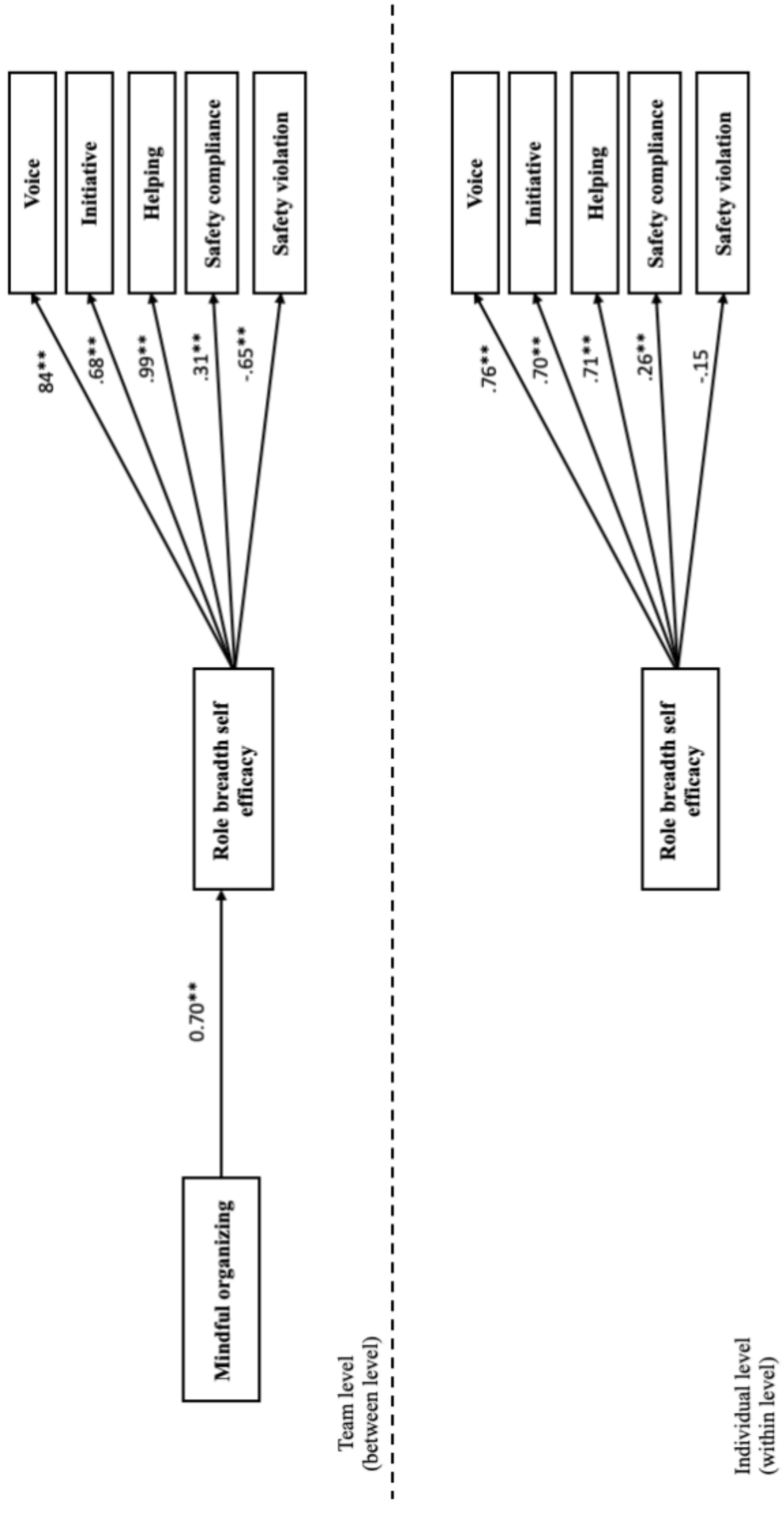
Variable	*Range*	*M*	*SD*	1	2	3	4	5	6
1. Mindful organising	1 - 5	4.01	.66	--					
2. Role breath self-efficacy	1 - 5	4.10	.70	.61**	--				
3. Safety Compliance	1 - 5	4.69	.48	.37**	.39**	--			
4. Safety Violation	1 - 5	1.36	.73	-.24**	-.20**	-.48**	--		
5. Voice (SCB)	1 - 5	3.36	.96	.54**	.59**	.27**	.10*	--	
6. Initiative (SCB)	1 - 5	3.29	.93	.50**	.55**	.26**	.04	.84**	--
7. Helping (SCB)	1 - 5	3.52	.96	.59**	.56**	.30**	.15*	.83**	.76**

Note. * p < .05, **p < .001

6.4.3.4. Multilevel analysis of the study model

The results of the MSEM analysis indicated that the hypothesized multilevel mediation model showed a satisfactory fit ($\chi^2 = 0.61$, df = 5, $p > .05$; RMSEA = 0.00 ; CFI = 1.00; TLI = 1.00; SRMR-within = .001; SRMR-between = .015). All hypothesized pathways were significant (see Figure 4).

Figure 4. Parameter estimates for the hypothesized model. $^{*}p < .05$, $^{**}p < .001$



Regarding the multilevel mediation, at the team level (between level), mindful organising had a positive statistically significant indirect effect (IE) on voice (IE = 0.84, $p < .001$, MC CI = 0.09, 2.14), initiative (IE = 0.68, $p < .001$, MC CI = 0.16, 1.18) helping (IE = 1.00, $p < .001$, MC CI = 0.20, 2.31) and safety compliance (IE = 0.31, $p < .001$, MC CI = 0.11, 0.55) through role breath self-efficacy. As expected the indirect between relationship from mindful organising to safety violation through role breath self-efficacy was negative and significant (IE = -0.65, p < .001 MC CI = -1.09, -0.17).

To further examine full vs partial mediation, we tested an alternative model that included the direct paths from mindful organising to the five outcomes. The extra paths were not statistically significant (p > .05). The partial mediation model was a complete model (with no degrees of freedom) that showed satisfactory fit ($\chi^2 = 0.45$, df = 0, p <.01; RMSEA = 0.00; CFI = 1.00; TLI = 1.00; SRMR-within = .000; SRMR-between = .006). However, the difference between the chi-square statistics provided by the hypothesized full mediation model and the partial mediation model was not statistically significant ($\Delta\chi^2 = 0.16$, $\Delta df = 5$, p > .05). Considering all together, and according to the parsimony principle, the full mediation model was selected against the alternative partial mediation model. These results confirmed that role breath self-efficacy fully mediated the relationship between mindful organising and SCBs and individual safety behaviours.

At the within (individual) level, role breadth self-efficacy showed a positive and significant relationship with voice (b = .76, $p < .001$), initiative (b = .70, $p < .001$), helping (b = .71, $p < .001$) and safety compliance (b = .26,

$p < .001$). However, at the individual level, role breadth self-efficacy was not related to safety violation (b = -.15, $p > .05$).

6.4.4. Conclusions

The results obtained in study two confirmed the hypothesized model in that role breadth self-efficacy fully mediated the relationship between mindful organising and all five individual safety behaviours (voice, initiative, helping, safety compliance and safety violation,) so that the mediated effect was significant and positive for the SCBs (voice, initiative, helping) and safety compliance and the mediated effect was negative and significant for safety violation.

6.5. DISCUSSION

Understanding safe systems from a human behaviour perspective is a major feat, not only because human beings are fallible and somewhat unpredictable, but because human behaviour is so complex and multifaceted that we cannot begin to measure every element at play. What we can do, is create models that synthesize and measure some of the major factors and conditions known in research on safer systems and see how these major factors relate to one another and try to understand why. That is what we tried to achieve in this study. It is argued that engaging in mindful organising underpins the success of highly reliable and resilient organizations, however, as it stands the applicability and usefulness of mindful organising in safety management theory and practice is limited. This is largely because mindful organising studies have been criticised as being too narrow in focus, not socially embedded enough and one-dimensional in their level of analysis (Martínez-Córcoles & Vogus, 2020). The present research set out to expand our understanding of mindful organising's nomological network and in doing so, position mindful organising within other important contextual factors and individual behaviours to do with safety.

We were interested in examining how mindful organising may be affected by organizational features like safety climate and how mindful organising may influence individual self-efficacy and safety behaviours, with a special focus on discretional safety actions like safety citizenship behaviours. Therefore, we wanted to answer the following research questions: Does mindful organising mediate the relationship between group safety climate and individual safety behaviours? If so, which individual safety behaviours? Do individual capability drivers (such as self-efficacy) act as underlying mechanisms through which team mindful organising influences individual safety behaviours? The results shed light on some multilevel factors that may be important for creating safer workplaces in high risk environments.

The first study results show that when a work group perceives their team members and supervisor prioritise safety over other demands, this will lead to team members collectively trying to commit to anticipating errors and unexpected events, and recovering from them, through the five processes of mindful organising. Engaging in mindful organising leads to extra-role safety behaviours such as helping others with safety related tasks and issues, initiating changes in ways of working to make them safer as well as voicing safety concerns and issues to others. Engaging in mindful organising in a team where safety is perceived to be a major priority also increases compliance to safety rules and procedures and leads to less violation of these rules and procedures. Further enquiry into the link between mindful organising and individual safety behaviours in Study 4 showed that mindful organising increases confidence in the ability of workers to carry out a broader range of proactive, interpersonal and integrative tasks to do with safety, over and above what is formally required of them. This increased confidence has a significant influence on team members carrying out SCBs as well as complying to safety rules and not violating these rules. When team members feel that they are going be successful in reaching their goals if they engage in activities and tasks that uphold safety beyond what is formally required of them, it will act as a strong motivator to actually carry out these tasks.

6.5.1. Theoretical and practical contributions

The present research attempts to position mindful organising within the broader, more mainstream safety literature. Previous studies speculate that there could be a reciprocal relationship between mindful organising and safety climate. Our research findings show that when teams perceive that safety is prioritised by their supervisor and team members, mindful organising is stimulated and acts as collective regulatory mechanism which translates the perceived group safety priorities to team members safety behaviours, sustaining not only compliance with prescribed safety standards but also team members engagement in extra role behaviours (voice, initiative and helping) that are not expected by formal job descriptions or the safety systems in place. This shows us that a high safety climate could be an important driver in creating and sustaining mindful organising, which appears to need constant reinforcement as it is enacted and re-enacted by those on the front-line (Vogus & Suctliffe, 2012). Although we did not test the impact of mindful organising on safety climate, we believe that it is more likely that a strong sense for prioritising safety above other demands will be an important prerequisite of mindful organising rather than the other way around. We speculate that teams engaging in mindful organising could strengthen and solidify a high group safety climate, but mindful organising is unlikely to develop if there is not a strong safety climate to begin with. This is because the five processes of mindful organising require ongoing attention, effort and commitment toward anticipating and containing error, which requires continuously choosing the action to ensure safer practices and minimising error over any other action to pursue other goals (efficiency and speed). Without the perception that safety is prioritised, rewarded and expected above competing demands, we believe that mindful organising would be stifled.

Regarding outcomes of mindful organising, the present research shows that mindful organising increases team members' confidence in their ability to perform a wide range of safety related tasks leading to higher safety adherence and extra-role safety behaviours. This shows us that the magic of mindful organising in enhancing reliability and resilience in organizations may also come from its impact on team members' self-efficacy in their safety roles leading to the increase of team members' SCBs and higher compliance to safety rules. Individuals who may not originally have the self-efficacy to engage in a wide range of extra role tasks and actions to do with enhancing safety, through being in a team that engages in mindful organising will start to grow their confidence in performing these tasks.

Through engaging in the anticipation processes of mindful organising (preoccupation with error, reluctance to simplify and sensitivity to operations), the range of situations that team members becomes more self-assured to address and discuss is increased, growing their confidence to correctly identify, and voice, a wide range of safety issues. This, in turn, makes them more likely to perform the SCB of voicing safety concerns on their own. Furthermore, engaging in the containment processes of mindful organising boosts an individual's confidence in their own ability to initiate changes in the moment to quickly act to ensure a safer workplace. This increased confidence in their capability to initiate these actions, will then lead to them engaging in initiating changes to increase safety. The processes of sensitivity to operations and deference to expertise will lead team members to identify colleagues that may need support or assistance with safety protocol and practices. This, coupled with knowledge and experience of how to manage safety that comes from engaging in mindful organising, is likely to build team members' perceived confidence in successfully helping less experienced colleagues to achieve safety goals. This belief in their ability to mentor or assist others is likely to lead these team members to reach out to their colleagues that need help with safety related issues when the situation arises.

The present findings added to the growing empirical evidence that mindful organising is in fact a shared, team construct as the aggregation indices in both studies for mindful organising showed adequate within team agreement and between team discrimination. The findings of the two studies also expand our current understanding about the interplay between group normative influences (safety climate), mindful organising, individual capability perceptions as well as extra role and in-role safety behaviours. We see that group safety climate and mindful organising are important for creating the context for increasing key safety behaviours. This insight broadens our understanding about how social norms and group behaviours influence individual confidence and safety proactivity and adherence.

Practically, leaders in high-risk organizations face a complex and multifaceted challenge when it comes to managing safety, therefore it is essential that leaders in this setting balance their focus across individual, team and organizational levels (Curcuruto & Griffin, 2016); Griffin & Curcuruto, 2016). The findings from this study offer leaders and practitioners in safety-critical contexts with some insight into which factors are important to focus on when attempting to increase individual safety citizenship behaviours and adherence to safety rules and procedures (which have shown to directly result in better safety outcomes) (Christian et al., 2009; Curcuruto et al., 2015). It shows that on an organizational level, leaders must ensure that they put into practice policies and procedures that highlight the importance of vigilance and caution above sometimes competing demands for efficiency and high performance. Thereafter, they should measure and ensure that lower level leaders are enacting these policies and processes and that this priority of safety above other demands is felt and practiced on a team level so that they may have strong group safety climates. Along with this, leaders could train workers and lower level leaders on the principles of mindful organising, knowing that the strong group safety climates will provide the context to enhance and sustain these team level processes. From this, team members role breath self-efficacy, safety citizenship and higher adherence to safety will be stimulated.

6.5.2. Limitations and implications for future research

Although this study offers valuable advancement of our current understanding of mindful organising and safety proactivity on various levels of analysis, the present study is not without its limitations. Firstly, the study was conducted in samples of chemical plant workers, which is a unique organizational context and therefore the study findings should be applied to other high risk settings with caution. That being said, these chemical plants are high-risk settings that face many of the same challenges as other high risk settings (small errors leading to accidents and unexpected events leading to failures in the system), meaning the lessons in safety behaviour models may still be useful for other industries with similar challenges. Future research should build on this model in other high risk environments to show the replicability of the study and test the generalisability of the study findings. Another major drawback of the present study is that it relies on self-report measures of behaviour. This opens up the possibility of inaccurate responses due to social desirability bias as workers operating in safety-critical units may be less inclined to respond honestly to questions about safety as they know that they ought to be taking safety seriously. We did however, ensure anonymity and confidentiality and gave employees an opportunity to withdraw their responses at any time. Future research should consider including other more objective indicators of safety behaviour and compliance such as peer and supervisor ratings of safety citizenship and compliance or incident reports. Another limitation of our study is that our measure of mindful organising is a nine item, one-dimensional scale that does not comprehensively measure the five processes of mindful organising, this limits our enquiry into which factors of mindful organising may more strongly effect various individual behaviours. However, the nine item measure does encompass all five processes of mindful organising and has been successfully validated in various contexts (e.g. Renecle et al., 2020; Vogus & Sutcliffe, 2007). Future research should consider validating a broader measure of mindful organising that allows for more granular measurement of mindful organising to more clearly see how the five factors relate to various safety behaviours.

6.6. CONCLUSIONS

The present study showed how a high group safety climate and team level mindful organising can enhance capability drivers of safer behaviours in a chemical plant setting. The study findings offer a multifaceted, multileveled safety behaviour model that enhances our current understanding of mindful organising as a construct and the multilevel factors affecting safety proactivity. Although much work still needs to be done before mindful organising can be theoretically and practically relevant within safety management research and practice, this study offers an interesting insight into how mindful organising may lead to higher reliability and under which conditions.

CHAPTER VII: GENERAL DISCUSSION

7.1. INTRODUCTION

The present chapter will integrate the research findings of the four studies within this thesis. From this, we will highlight and discuss the main insights gained from this research and how the findings broaden the current understanding of mindful organising, rectifying and clarifying some of the shortcomings and confusions in the literature. Therefore, this section has four main parts. First, we revisit the main objectives of this research, the research questions we hoped to answer and summarize the main findings of each of the four studies included in this thesis. Then, we discuss and outline the major theoretical contributions of our research. Next, we present the main practical implications that can be derived from our research findings. Finally, we will discuss the general limitations of our four studies and the directions for future research in light of our findings.

7.2. STUDY OBJECTIVES AND MAIN FINDINGS

We became interested in the model of mindful organising as it represents a team-based collective capability that allows workers within high-risk organizations to better manage errors and unexpected events that could lead to disasters. After reviewing the extant literature on this topic, we discovered that mindful organising has shown to lead to better objective safety outcomes in qualitative and quantitative research in different high-risk environments (e.g. Dierynck et al., 2016). However, despite the promising outcomes shown in most of the research into mindful organising, there are major gaps in our understanding of mindful organising as a concept. Given that majority of the studies done on mindful organising have been qualitative in nature (Martínez-Córcoles & Vogus, 2020; Sutcliffe et al., 2016), we do not know much about the nature and direction of mindful organising's relationship with other important antecedent and outcome variables. It has become clear to us that mindful organising's utility and applicability in research and practice is stunted as the current literature does not tell us much about the factors that are important for creating and sustaining mindful organising in organizations, beyond a handful of studies showing the importance of leader behaviour and specific organizational practices such as training and socialisation (Sutcliffe et al., 2016). Of particular relevance is the limited understanding of which social forces are important for sustaining mindful organising, making it difficult to socially embed in practice (Martínez-Córcoles & Vogus, 2020). Current research also does not investigate the impact mindful organising may have on individual motivational states and safety behaviours, which could be a vital mechanism through which high reliability and better objective safety outcomes is achieved. Examining these relationships also offers a more holistic and generalisable understanding of the impact of mindful organising on individual psychological and behavioural outcomes, rather than focusing on sector specific outcome variables. Another point of contention in this literature is that research is too narrow in its level of analysis (Martínez-Córcoles & Vogus, 2020), with few studies examining the how mindful organising may relate to individual variables. Conceptually, it has been unclear how mindful organising emerges in teams as well as how it differs from other team-related variables. We concluded that mindful organising has the potential to theoretically and practically change the way leaders and scholars understand team-based safety management. However, our current conceptualisation and understanding of this construct are far too limited for mindful organising to be easily integrated into mainstream safety management systems and research.

Our research wanted to help fill these major gaps and conceptual ambiguities in the mindful organising literature through four main aims. First, we wanted to statistically show that mindful organising is a distinct variable from constructs that may be conceptually similar by analysing their factor structures as well as testing whether mindful organising affects changes in individual safety behaviours over and above other important group safety variables. Second, we wanted to expand our understanding of the team level climate and communication conditions which may be important for mindful organising to develop, as mindful organising is not an enduring property within organizations that, once established, will continue to be practiced by teams (Vogus & Sutcliffe, 2013). Rather, it needs to be enacted and re-enacted by team members working together, which makes social forces that reinforce the re-enactment of mindful organising highly relevant to study in terms of being able to sustain mindful organising in practice. Third, we wanted to investigate the impact of mindful organising on individual safety behaviours and attitudes, while examining motivational and affective mechanisms that may act as mediators of these relationships. This allows gives us a deeper understanding of how mindful organising may be shaping the motivations and actions of team members, and how these may in fact contribute to better safety management. Lastly, we wanted to add to the small but growing body of quantitative mindful organising literature using multi-level analyses, to help strengthen the methodological validity of mindful organising as a concept.

To reach the abovementioned objectives, we carried out four studies with different samples belonging to two nuclear power plants and two chemical plants across three countries: Spain, Russia and Ukraine. We summarize the main research questions and findings within each of our studies below, not going into too much detail as the detailed discussion of each study's findings have already been presented in the previous chapters.

We started our research by attempting to clarify the concept of mindful organising as there were ambiguities around whether mindful organising is distinct from safety culture and climate (e.g. Vogus & Sutcliffe, 2007) and team learning (Sutcliffe et al., 2016). This led us to ask the question: is mindful organising a distinct construct from other important team safety variables? We attempted to answer this question in Study 1 where we adapted to Spanish and validated a mindful organising measure and provided evidence of internal factor structure validity, reliability of the scores, convergent validity and discriminant validity with related variables as well as incremental validity in the association with workplace safety outcomes (safety compliance and safety participation) above and beyond other team-related variables. In this study, we showed that the widely used mindful organising scale (by Vogus & Sutcliffe, 2007) does measure one underlying construct, and it does so reliably. The findings confirmed that mindful organising is positively related to team safety climate, organizational safety culture, and team learning, but these variables are distinct from one another when looking at their factor structure. We were also able to provide evidence that mindful organising affects safety behaviours (participation and compliance) over and above team safety climate, organizational safety culture, and team learning. This shows empirically that engaging in mindful organising is a distinct contributor to safer actions as it helps employees to engage in safety behaviours over and above team safety climate, organizational safety culture, and team learning.

After clarifying mindful organising as a distinct construct from related team variables and testing the psychometric properties of our mindful organising measure, we wanted to expand our understanding of the needed team level communication conditions and climate for mindful organising to be created and sustained in Study 2. This was following speculations in the literature that conversations were the main driver of mindful organising (Sutcliffe et al., 2016) and that despite mindful organising being created and maintained through communication channels, there is hardly any enquiry into the communication conditions that lead to higher mindful organising or may stifle mindful organising (Ford, 2018). This led us to ask our second research question: which team level participatory communication conditions are important for mindful organising to develop? In Study 2, we draw on literature about psychological safety and voice and hypothesized a model where two participatory communication conditions interact to predict mindful organising. We found that perceived safety for upward dissent significantly moderated the relationship between participation climate and mindful organising. This showed for mindful organising to develop, teams not only needed to perceive that their participation (in sharing ideas and suggestions) within the organization was valued, but they also needed to feel safe to voice their concerns and disagreements with their superiors without fear of backlash. This perceived safety to disagree with supervisors turned out to be critically important, as our findings showed that without it, the relationship between a participation climate and mindful organising became non-significant. These results are promising since the data are longitudinal, showing that the interaction of perceived safety for upward dissent and participation climate at time one leads to mindful organising at time two, giving some evidence of a possible dynamic relationship between these variables.

Study 2 also attempted to investigate the relationship between mindful organising and team's subjective experience at work by investigating whether mindful organising has a positive impact on job satisfaction given the controversy around the relationship between mindful organising and employees affective responses at work (e.g. Rerup, 2006; Vogus et al., 2014). It has been argued that mindful organising is particularly draining for employees operating in high-risk environments with few adverse events, negatively impacting wellbeing (Vogus et al., 2014). If this is true, it suggests that mindful organising may not be sustainable in high risk environments that only sporadically experience adverse events, as employee's wellbeing would suffer and they would not want to remain in their current, taxing positions. However, mindful organising has been observed in various case studies in HROs where employees engage in demanding, risky work but do not necessarily experience constant, ongoing adverse events (e.g. nuclear power plants) and these teams manage to sustain mindful organising as an ongoing practice. This led us to ask the following question in Study 2: what impact does mindful organising have on team's subjective experience at work and team members' propensity to leave their organization? We therefore tested (within our model) the impact of mindful organising on individual turnover intention, with team job satisfaction mediating the relationship. The results of the pathway between mindful organising and team job satisfaction showed a strong positive and significant relationship. Team job satisfaction mediated the relationship between mindful organising and turnover intention, showing that through increasing a team's job satisfaction, mindful organising resulted in lower turnover intentions. This suggests that in a nuclear power plant, it is far better for team's satisfaction at work to engage in mindful organising than to not engage in mindful organising, even though being collectively mindful can be taxing. This suggests that mindful organising offers teams much needed resources to cope with the demands of their working environment, even if there are not continuous adverse events, leading to higher satisfaction and therefore, an increased desire to stay in their organization. These results provide evidence of the sustainability of mindful organising as it not only improves reliable and safe performance, but it also positively impacts job satisfaction and commitment.

The holistic model in Study 2 also showed us the critical importance of teams feeling safe to disagree with supervisors. The findings showed that perceived safety for upward dissent moderated the negative indirect effect of participation climate on turnover intention through mindful organising and job satisfaction. This means teams feeling safe to disagree with supervisors facilitated the relationships between our study variables, and without it, a high participation climate would not lead to higher mindful organising, stifling team job satisfaction resulting in higher turnover intention for team members.

Study 1 showed us that mindful organising is positively related to team safety climate and organizational safety culture but it conceptually distinct from these variables. Team safety climate refers to the perceived priority a team or organization give to safety above other competing demands. The nature and direction of the relationship between mindful organising and safety climate are unclear. It is speculated that teams engaging in mindful organising may enhance the team's safety climate (Sutcliffe et al., 2016), but in Study 3, we wanted to ask: Can team safety climate aid in fostering mindful organising? Team safety climate is a well understood, implemented and measured concept in organizations. Understanding the impact of team safety climate on mindful organising could help scholars and practitioners with enhancing this collective team capability into organizations. This is because focusing on team safety climate could help to sustain and "socially embed" mindful organising in practice. Study 3 also wanted to examine the impact mindful organising may have on individual safety behaviours, as these individual behaviours may be contributing to the higher safety and reliability seen in organizations that have high mindful organising in their teams. This led us to ask the question: Does mindful organising increase individual in-role and extra-role safety behaviours?

To answer these questions, we tested a holistic mediation model which examined whether team mindful organising mediated the relationship between team safety climate and various individual safety behaviours. Our research findings confirmed this mediation model. This not only showed that team safety climate is an important prerequisite for mindful organising (with a strong positive and significant pathways between these two variables), but mindful organising did lead to higher in-role and extra-role safety behaviours. In other words, the results show that when teams perceive that safety is prioritised above all else (high safety climate), mindful organising is stimulated and increases team members' propensity to not only comply with prescribed safety standards but also to engage in extra-role safety behaviours (helping, voice and initiative) that are not expected of them by the formal rules and procedures.

After confirming that mindful organising does stimulate individual safety compliance and safety citizenship behaviours, we wanted to further examine the possible motivational drivers that could be affecting these relationships in Study 4. We were particularly interested in the impact that mindful organising may have on individual role breadth self-efficacy. We speculated that the increased propensity of individuals belonging to teams that organise mindfully to engage in extra-role safety behaviours came from mindful organising increasing their self-efficacy to do so. In other words, individuals that engaged in the five processes of mindful organising in their team, feel more confident in their ability to engage in safety-enhancing tasks beyond their formal job description. To our knowledge, no study has looked at how mindful organising affects individual capability perceptions. This is despite the fact that it could explain some of the important individual motivation and behaviour changes that come about from mindful organising, aiding in the higher safety and reliability seen in various studies. This led us to ask the question: do capability motivational drivers mediate the relationship between mindful organising and individual safety behaviours? To answer this question, we ran a multilevel mediation model where role breadth self-efficacy (operationalised at the individual level) mediated the relationship between team mindful organising and safety citizenship behaviours and safety compliance (operationalised at the individual level). This mediation model was confirmed and the pathways showed that team mindful organising has a positive statistically significant impact on team members role breadth self-efficacy, and this role breadth self-efficacy positively predicted team members in-role and extra-role safety behaviours. These findings suggest that being in a team that engages in mindful organising helps individuals who may not originally have the self-efficacy to engage in a wide range of extra-role tasks and actions to do with safety, grow their confidence in performing these tasks. This new-found confidence leads to team members going above and beyond what is required of them in the pursuit of safer practices.

In summary, the insight gained from the four studies conducted allowed us to significantly extend mindful organising's nomological network. In doing so, we managed to reach all three of our research objectives. First, by empirically distinguishing mindful organising from related team variables. Second, by uncovering three team level climates and norms to do with safety and communication that are important for fostering mindful organising. Third, by showing how mindful organising impacts team satisfaction, self-efficacy and in-role and extra-role safety behaviours.

7.3. THEORETICAL IMPLICATIONS

In this section, we integrate how the findings of our four studies help to move mindful organising research further by filling important research gaps and clarifying some inconsistencies and uncertainty within the literature.

Taken together, the four studies conducted within this thesis helped to significantly expand our understanding of mindful organising. We were able to show that mindful organising can be reliably measured within various teams in four different high-risk organizations (two nuclear power plants in Spain, one chemical plant in Russia and one chemical plant in Ukraine) while maintaining a unidimensional factor structure, high internal consistency and adequate aggregation indices across all four samples. This helps to back up and solidify the limited and mostly qualitative conceptual foundation of mindful organising (Martínez-Córcoles & Vogus, 2020; Sutcliffe et al., 2016) by showing that it is a concept that has cross-cultural relevance in a more traditional HRO setting (nuclear power plant) and in a non-traditional HRO setting (a chemical plant). This also adds to the limited empirical evidence that shows that mindful organising is in fact a team level emergent phenomenon and should be measured, analysed and monitored at the group level.

Through this research, we were also able to clarify conceptual ambiguities within the current literature around the uniqueness of mindful organising and how it may relate to other similar team constructs. Mindful organising has been met with scepticism as some of the concepts within mindful organising show similarities to variables such as team transactive memory systems, team situational awareness, team learning and team safety climate. This made some authors question whether mindful organising is a unique concept and not just an amalgamation of various concepts that already exist in the literature. Therefore, in Study 1, we conceptually explored the similarities between mindful organising and other constructs that may appear to be similar such as organizational mindfulness, team situational awareness and team transactive memory systems. We then theoretically showed the key differences between mindful organising and these variables. In addition, we argued for and statistically showed the uniqueness of mindful organising when compared with team safety climate, organizational safety culture and team learning. From this, we were able to prove that mindful organising is not only distinct in its factor structure from these other team safety variables, but it also explains unique variance in safety participation and compliance over and above these concepts. Based on this evidence we attempt to show that the five processes of mindful organising facilitate rich pathways and team dynamics that lead to a present and future mindful orientation towards safety (including a sustained interest in identifying potential errors, a shared reluctance to simplify interpretations, sensitivity to operations, showing resilience in the face of difficulties and deferring decision-making power to those with the best expertise). These five critical processes are unique and they strengthen a team's ability to consistently ensure safe performance in a complex socio-technical context.

The present research also helps to position mindful organising within the broader, more mainstream safety literature by showing how it relates to other important safety variables such as team safety climate and individual extra-role safety behaviours. Mindful organising has been mentioned in reviews of the organizational, team and individual factors that enhance proactivity towards safety (eg. Curcuruto & Griffin, 2016). Apart from these speculations, there have not been empirical investigations into how mindful organising may relate to individual safety proactivity. Other than our investigation of the differences between mindful organising and safety climate in Study 1, the nature of the relationship between mindful organising and team safety climate was still unclear. We found that mindful organising acts as a collective regulatory mechanism which translates the perceived group safety priorities to the individual level, sustaining not only compliance with prescribed safety standards but also team members' engagement in extra-role behaviours (helping, voice and initiative) that are not expected by formal job descriptions or the safety systems in place. This finding helps to position mindful organising more clearly within the mainstream safety literature, adding to conceptual ambiguities which have kept mindful organising as a novel concept outside of the major frameworks and conceptual maps of the contextual, team and individual factors to do with safety.

The present research also confirmed that mindful organising is valuable in high risk organizations as it showed significant positive effects on individual performance and affective outcomes. This is one of the biggest contributions we make to mindful organising literature as we not only gained valuable insight into the impact of mindful organising on individual attitudinal and safety behaviour outcomes, but we also managed to shed light on some of the affective and motivational drivers that are important in facilitating the relationship between mindful organising and these individual outcomes.

Currently, mindful organising literature positions it as a team level capability that has shown in specific environments, especially in health care, to lead to better objective safety outcomes (e.g. Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007; Oliver et al., 2019). This leaves us with a very sector-specific and in most cases department-specific understanding of the value of mindful organising. It also leaves us with little to no insight into the possible individual behaviours that play a role in mindful organising leading to better objective safety indicators (such as fewer errors or accidents). This stunts our theoretical understanding of how mindful organising affects individual performance and it keeps mindful organising's applicability very narrowly in the medical sector, where the vast majority of new studies are done. Our research shed some light on the impact of mindful organising on individuals' self-efficacy and propensity to engage in extra-role and in-role safety behaviours. The in-role and extra-role safety behaviours studied can be widely observed in various high-risk industries. We found that mindful organising positively impacts on team mebers' confidence in their ability to perform various safety behaviours outside of what is required of them, this increased self-efficacy leads to higher instances of initiating changes to make work safer, helping others to operate more safely and voicing safety concerns to others. This increased self-efficacy also lead to higher compliance with formalised safety rules and procedures. These findings show that the possible benefits of mindful organising are likely to come, in part, from how it affects team members' confidence to go above and beyond what is required of them, leading to higher individual safety proactivity and compliance.

There has been hardly any research into the impact of mindful organising on workers affective responses to their work environment. The only study that considered the impact of mindful organising on worker's affective responses at work used a sample of nurses and concluded that engaging in the five processes of mindful organising is somewhat strenuous and taxing, eventually draining workers well-being. However, if workers are operating in an environment with continuous adverse events then mindful organising is particularly helpful and can positively impact wellbeing. This led to the controversy around the sustainability of mindful organising in teams and environments that do not continuously experience adverse events. We showed that in high-risk settings outside of the medical sector, mindful organising had a positive impact on workers subjective experience at work. Mindful organising had a high positive statistically significant relationship with team job satisfaction, which in turn made team members more likely to want to stay in their current job. Although the workers within our sample operate in environments that face many safety risks, these environments do not face consistently high adverse events. This provides contrary evidence to the claim that mindful organising is taxing and depletes workers resources, making them have a less positive experience at work in environments that are not consistently experiencing adversity. We posit that mindful organising gives teams' resources to cope in all high-risk environments, regardless of the frequency of adverse events.

The present research also helped to uncover team conditions that are needed to support the enactment of mindful organising. Currently, we have a very limited understanding of the factors that are needed to create and sustain mindful organising (Sutcliffe et al., 2016), making mindful organising difficult to sustain in practice (Martínez-Córcoles & Vogus, 2020). We uncovered certain conditions that are not only important for fostering mindful organising but are also essential for facilitating the relationships between mindful organising and positive individual attitudinal and behavioural outcomes. More specifically, in high-risk industries such as nuclear power plants and chemical plants, three factors were found to be essential for mindful organising to develop: a climate for participation, perceived psychological safety for upward dissent and a high team safety climate. We showed that teams need to feel safe from threat or embarrassment to disagree with management and express challenging opinions for a general participatory climate to lead to mindful organising. This perceived safety for upward dissent was a necessary precondition for the positive effects of mindful organising on satisfaction and turnover to be seen. This shows that mindful organising is largely dependent on team members perceiving a "no blame", safe environment within their teams to express their views, even if these views are challenging. Of particular relevance here is the role of supervisors in cultivating a climate in the team that makes team members feel as if they can be open and honest about what may be bothering them or what they do not agree with. This provides us with clues to a very specific factor that could help with mindful organising. We also showed that a high safety climate could be an important driver in creating and sustaining the fragile construct of mindful organising. The five processes of mindful organising require ongoing attention, effort and commitment toward anticipating and containing errors. This requires continuously choosing the action to ensure safer practices and minimisation of errors over any other action to pursue other goals (such as goals to do with efficiency and speed). Without the perception that safety is prioritised, rewarded and expected above competing demands, we believe that mindful organising would be stifled. We also found that this safety climate was a necessary precondition for mindful organising to lead to desired team members' in-role and extra-role safety behaviours.

7.4. PRACTICAL IMPLICATIONS

Practically, this research gives leaders and decision-makers in high-risk organizations tools and guidance for measuring and analysing mindful organising quantitatively. The studies within this thesis also offer leaders and decision-makers insight into the conditions needed for creating and sustaining mindful organising in their organizations. Our studies also show that if leaders and managers are able to create and sustain mindful organising, this will lead to better attitudinal outcomes and encourage favourable safety behaviour. This is in their interest as these safety behaviours have shown to be the main and direct antecedents of better safety outcomes (Curcuruto & Griffin, 2016).

Firstly, our research yielded a fully validated Spanish mindful organising questionnaire to be used in organizations within the numerous Spanish speaking countries around the world to measure the levels of mindful organising in their teams. We also showed how to aggregate mindful organising scores to a team level for better and more accurate analysis of this construct.

Secondly, our research showed leaders in chemical and nuclear power plants, that when teams are able to engage in mindful organising, it leads to numerous benefits for the organization such as higher job satisfaction, lower turnover intention, higher role breadth self-efficacy, as well as higher in-role and extra-role safety behaviours. If leaders and decision-makers in these organizations want to reap the benefits of mindful organising, they will need to create the right conditions for mindful organising in their teams. They can start creating the right conditions for mindful organising by following three practical steps. Firstly, they need to ensure that they put into place practices that make workers feel that the organization wants them to be actively involved in everyday operations and values their comments, suggestions and opinions. Second, leaders need to ensure that team leaders or direct supervisors of teams do not blame or embarrass team members for expressing challenging views. Team members honestly expressing when they do not agree with management should be encouraged on all levels. Third, leaders should ensure that the organizational policies and practices prioritize safety above competing demands (such as efficiency or costs), and that team leaders and supervisors of teams are enacting these policies on a practical level and ensuring that team members know that their number one priority is safety, even if it means being less efficient.

7.4. LIMITATIONS

Although the present research has much theoretical and practical value, it is not without its limitations. The main limitations, common to all studies are described below. The specific limitations of each study are described in detail in each study's corresponding chapter.

One of the biggest limitations of the present research is that all four studies use self-report questionnaires as the main form of data. In addition, in all studies, participants were told that the questionnaire was concerned with safety and that the results may be shared with leadership to measure the levels of safety culture within the nuclear power plants and chemical plants. This introduces the possibility of error in the answers from respondents, as participants may have artificially inflated their responses on safety dimensions due to social desirability bias. However, we did try to control for this by ensuring strict confidentiality with the handling of responses and keeping biographical data to a minimum so that participants would not feel as if they could be recognized. Future studies could incorporate other means of measuring the study variables to introduce less subjectivity, such as observational data, or supervisor-rated data.

Another major limitation of our studies is that most of our studies was cross-sectional in their design. Except for the relationship between our predictor variables and mindful organising in Study 2, all other relationships studied used data collected at the same time. This means that we were unable to assess the relationships between our variables over time and couldn't ascertain the possible predictive power of mindful organising on our outcome variables or the dynamic relationship between our antecedent variables and mindful organising over time. Future studies should model the relationships between mindful organising and antecedent and outcome variables over time to better understand the dynamic nature and strength of these relationships.

Our research is also done in very highly standardized environments (chemical and nuclear power plants), which makes the generalizability of our study findings to less standardized and rigid environments questionable. That being said, these highly standardised environments are still high-risk settings that face many of the same challenges as other high risk settings (small errors leading to accidents and unexpected events leading to failures in the system), meaning the lessons in safety behaviour models may still be useful for other industries with similar challenges. Future research should build on this model in other high-risk environments to show the replicability of the study and test the generalisability of the study findings.

One of the biggest limitations of our study is one of the biggest limitations of much of the empirical research on mindful organising, that the measure we use is a nine-item, one-dimensional scale that does not comprehensively measure the five processes of mindful organising. This limits our enquiry into which mindful organising processes may more strongly affect various individual behaviours. However, the nine-item measure does encompass all five processes of mindful organising is the most widely used and has been successfully validated in various contexts other than our study (e.g. Ausserhofer et al. 2013; Vogus & Sutcliffe, 2007). Future research should consider validating a broader measure of mindful organising that allows for more granular measurement of mindful organising to more clearly see how the five factors relate to various safety behaviours.

CHAPTER VIII:
CONCLUSIONS

8. CONCLUSIONS

Here we present the most prominent conclusions that can be made from the present thesis.

1. Mindful organising is a team level, emergent phenomenon that is conceptually and operationally distinct from other variables that may seem similar such as team safety climate, organizational safety culture, and team learning (Study 1).
2. When teams perceive that they can safely express challenging views to their supervisors without fear of backlash and that their organizations value their opinions, suggestions and comments, mindful organising is likely to develop over time (Study 2). Mindful organising will then lead to higher job satisfaction in teams which will lower team members' intention to leave the organization.
3. When teams perceive that safety is prioritised above all else (high team safety climate), mindful organising is stimulated, which enhances team members within the team's propensity to not only comply with prescribed safety standards but also to engage in extra-role safety behaviours (helping, voice and initiative) that are not expected of them by the formal rules and procedures (Study 3).
4. Mindful organising has a positive impact on team members' confidence in their ability to perform safety-enhancing actions that do not form part of what is formally required of them (role breadth self-efficacy). This increased confidence leads to engage in initiating changes to make work safer, helping others to operate more safely and voicing safety concerns to others. This increased confidence also

leads to higher compliance with formalised safety rules and procedures (Study 4).

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