Safety Climate in Organizations:

New Challenges and Frontiers for Theory, Research and Practice

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1 Introduction

The organizational context is a critical and pervasive influence on safety outcomes such as accidents and injuries. Reviews of major accidents consistently identify the attributes of organizational management that contribute either directly or indirectly to incidents. At the individual level of safety, meta-analyses indicate that the organizational context shapes the motivation to work safely and the type of safe or unsafe behaviors that are enacted.

In this chapter we present the construct of safety climate as a critically important aspect of the organizational context that influences myriad safety outcomes. Safety climate is widely defined as the "shared perceptions with regard to safety policies, procedures and practices" in an organization (Zohar, 2011, p. 143).

Shared perceptions about the value and meaning of safety have been shown to influence safety across a range of industries that deal with individual and environmental hazards. Substantial research has shown that safety climate improves safety outcomes in healthcare, manufacturing, mining, transport, and energy production.

We explore the implications of shared perceptions of safety definition and develop and expanded view of the nature and impact of safety climate in organizations. We define safety climate in terms of a *perceptual*, *collective and multidimensional* phenomena in organizations to exercise a *subjective-normative influence* on individual and group behaviors through *sense-making* processes. Ultimately, this process influences organizational outcomes of safety as well as other aspects of organizational functioning such as productivity.

The review is divided into four main sections. The first section reviews the nature of safety climate as an entity in organisations and we outline how shared perceptions across multiple dimensions of the organisation constitute safety climate. We also review safety climate as an entity at different levels of analysis including team, organisation, industry, and

national levels. Second, we review how safety climate influences individual processes in terms of cognitive sense making, motivation, and behaviour. Third, we review the impact of these processes on organisation level outcomes of safety and productivity. Finally, we integrate these different areas into a dynamic system to explore how safety climate might develop and change over time. Throughout these four sections we review existing research and theory and identify practical implications for the management of safety at both an organisational and an individual level. Figure 1 outlines the content of the first three parts of the review.

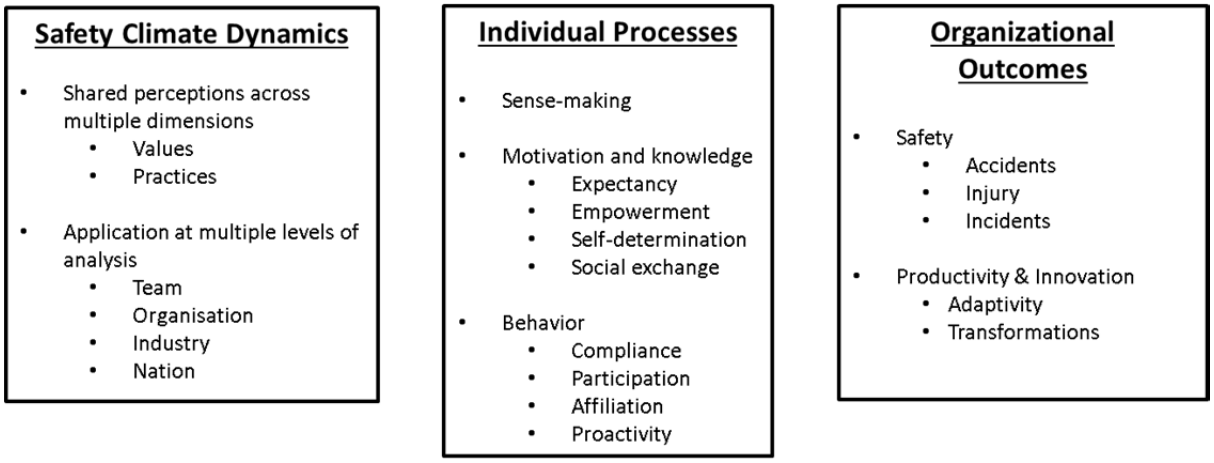

Figure 1

Review structure: safety climate, individual processes, and organizational outcomes

2 Nature of safety climate

In this section we review the key features of safety climate and explore implications of the construct for managing safety in organizations. The next section reviews the features of safety climate that constitute it as a distinct organizational entity and conceptual topic in the field of OB and I/O Psychology.

2.1 Collective perceptions

Zohar (1980, p. 101) defined safety climate as "the molar and unified set of cognitions [held by workers] regarding the safety aspects of their organization". This influential definition positioned safety climate as a specific form of organizational climate based on individuals' evaluation of their experiences of safety in the work environment. Another perspective describes safety climate is an "experientially based description of what people see and report happening in the real organizational situation" (Ostroff, Kinicki, & Tamkins, 2003, p. 566).

The range of perceptions that might constitute safety climate is wide (Christian, Bradley, Wallace, Burke, & Spears, 2009), In addition, it is important to differentiate safety climate perceptions other types of safety related constructs such as risk appraisal and attitudes toward safety (Huang, Ho, Smith, Chen, & Mith, 2006).

First, safety climate is based on ***shared perceptions*** of the context. This highlights that climate is a collective property of groups but derived from perceptions of single individuals and differs from other individual constructs such as personal attitudes toward safety.

Safety climate perceptions are characterized by being intrinsically *descriptive* and *cognitive* in their nature with reference to observable features of organizational safety as they are experienced by employees in their daily interactions (Guldenmund, 2000; Zohar & Luria, 2005). In contrast, safety attitudes such as fatalism, personal responsibility for safety, and scepticism can be characterized as intrinsically *evaluative* and *affective* in their nature (Mearns, Flin, Gordon, & Fleming, 1998).

Griffin and Neal (2000) identified three general domains of safety management in the organizations: general policies, formal procedure systems, and work practices relating to safety promotion in the workplace. Through experience of these aspects of the organization

during daily interactions, employees develop a unified perception of the priority of safety in the overall workplace (Zohar, 2008).

2.1.1 Differentiating safety climate from general climate and psychological climate

Safety climate can be differentiated from the construct of general organizational climate because of the focus on the safety domain. In the broader literature of applied psychology and organizational psychology, general organizational climate refers to the shared perceptions among employees concerning the procedures, practices and kinds of behaviors that get rewarded and supported with regard to a specific strategic focus (Schneider, 1990). When the strategic focus involves performance of high-risk operations, the resultant shared perceptions define safety climate (Zohar, 1980; 2010). From this perspective, safety climate is a specific form of organizational climate, which describes individual perceptions of the value of safety in the work environment (Neal, Griffin, & Hart, 2000)

The shared nature of safety climate differentiates from the notion of psychological climate (Neal & Griffin, 2004). Whereas psychological climate refers to individual perceptions of the work environment (James & James 1989), safety climate emerges only when then these perceptions are shared by individuals within a work group or organisation. More specifically, safety climate refers to the shared perceptions among members of an organization with regard to safety policies, procedures, and practices (Griffin & Neal, 2000). In other words, safety climate can be viewed as a shared and overall perception about the underlying values, beliefs, and principles that operate in relation to safety within their organization. These perceptions serve as a collective frame of reference for employees that provides cues about expected behaviour and outcome contingencies related to safety (Guldenmund, 2010; Neale & Griffin, 2006; Schneider, 1997; Zohar, 2010).

2.1.2 Differentiating safety climate from safety culture

Safety climate is based on perceptions shared by individual in the work context. In contrast, safety culture refers to the underlying assumptions and values that guide behaviour in organizations. A key difference, therefore, is the greater accessibility of safety climate perceptions to conscious evaluation compared to the more implicit processes of safety culture. In this way, safety climate might be regarded as the surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time (Flin, Mearns, O'Connor & Bryden, 2000). Safety climate measures provide a snapshot of the state of safety providing an indicator of the underlying safety culture of a work group, plant or organisation.

Despite these conceptual differences, much research and practice conflates the meaning of the two constructs. For example, numerous studies of safety culture use survey instruments that are more accurately defined as measures of safety climate. There are some advantages to developing a fine-grained distinction between climate and culture in specific domains (Day, Griffin, & Louw, 2014). However, both constructs emphasize the way safety is valued in the organization and explore the processes through which the meaning attached to safety influences safety outcomes in the organization. Therefore, our review focuses on safety climate as defined above. We emphasize that much of the research in safety culture overlaps with safety culture research and shares substantially similar goals.

2.2 Multifaceted features of safety climate

A major conceptual challenge for safety climate research has been convergence in the definition of its constituent elements (Christian, Bradley, Wallace, Burke, & Spears, 2009; Clarke, 2006; 2010; Neal & Griffin, 2004; Zohar, 2010). This diversity of dimensions reflects the second aspect of our definitions which describes safety climate as multifaceted because it is *multidimensional and applies across multiple levels of analysis.* In this section we review

the scope of this diversity in two ways. First, we review the various dimensions of safety climate that have been proposed. We then review the application of safety across multiple levels of analysis.

2.2.1 The multidimensional nature of safety climate

Since (Zohar, 1980) was published 35 years ago, both theory and research have advanced, but a comprehensive theory and a unanimously preferred measurement approach to safety climate are still lacking (Guldenmund, 2000; Wu, Liu, & Lu, 2007; Zohar, 2010).

Much of the subsequent scientific research on safety climate has focused on assessing empirical models rather than developing theoretical frameworks. Empirical issues include assessing the dimensionality of safety climate including the factorial structure of measurement scales and their predictive validity with regard to a variety of safety outcomes (Clarke, 2006). Previous literature reviews have identified more than fifty different variables or conceptual themes that have been included in safety climate questionnaires (Flin et al., 2000; Guldenmund, 2000).

An meta-analysis by Clarke (2006) examining twenty-two empirical studies showed at least three trends in safety climate research reflecting the conceptual confusion between *perceptual* and *attitudinal* approaches to safety research (Guldenmund, 2000), resulting in a variety of *mixed models* that conflated perceptions and attitudes. In addition, various studies also included constructs such as dispositions, beliefs, risk-perceptions, work stressors as elements of safety climate. As a consequence of this lack of conceptual clarity, it was difficult to ascertain a clear link between safety climate and safety outcomes. Aggregation across psychological constructs and overlap between safety and non-safety variables meant that key relationships were diluted (Wallance, Popp, & Mandore, 2006). Clarke's meta-analysis (2006) showed that more clearly defined perceptual approaches safety climate tended to report stronger predictive power for outcomes such as occupational accidents.

Despite the diversity of dimensions described in literature, the various definitions and measures show some commonality that suggest core conceptual themes (Flin et al., 2000, Guldenmund, 2000). Key themes that have been identified include the perceptions of managerial commitment for safety, safety systems and procedures, and training and competence systems related to working safely.

Adopting a *perceptual* approach to the study of organizational climate, Neal, Griffin and Hart (2000) discussed and empirically tested a multidimensional model of safety climate focusing on a limited set of organizational dimensions when conceptualizing and measuring organizational safety climate across different industrial sectors (Neal, Griffin, & Hart, 2000). These include *management values* (i.e., the extent to which management places a high priority on safety), *safety communication* (i.e., the extent to which there is an open exchange of information regarding safety), *safety training* (i.e., the extent to which training is accessible, relevant, and comprehensive), *and safety systems* (i.e., the extent to which safety procedures are perceived to be effective in preventing accidents).

2.2.1.1 Relative priority

The following scientific debate on safety climate's attributes has driven researchers to further specify this construct in relation to the broader and more complex organizational environment in term of relative priority. In this second perspective, safety climate reflects the shared perceptions that have employees of the relative importance granted to safety issues in their organization (Zohar, 2000). These perceptions serve as a frame of reference and provide psychological guidance for choosing adaptive and appropriate workplace behaviors (Neal & Griffin, 2004). However, at any development stage of the life of a company, this shared perception of safety values and priorities in the workplace might be affected by both internal characteristics of the organizations (i.e. department policies; supervision; team-working

processes) (Zohar & Luria, 2005; 2010), and by exogenous features related to the external environment (i.e. industrial regulations; national cultures) (Mearns & Yule, 2009).

Overall, these reflections have lead scholars and researchers to a more complex and detailed analysis of safety climate in term of multilevel construct and phenomenon of contemporaneous organizations (Zohar, 2014; 2010).

2.2.2 The multilevel nature of safety climate

Safety climate is a collective construct that has been applied to a variety of aggregate structures. This section reviews different levels of analysis at which safety climate might operate. The level of conceptualization and analysis of safety climate is a continuing debate among climate researchers as climate can be investigated at different levels of the organization (Kozlowski & Klein, 2000; Rousseau, 1985).

Psychological safety climate reflects individual perceptions of safety policies, procedures, and practices in the workplace (Christian et al., 2009). These non-aggregated perceptions of the work environment (Clarke, 2010) differ from safety climate at the group or organizational level, which represent collective perceptions of workplace safety. Although safety climate has traditionally been conceptualized and operationalized at the organizational level (e.g. Zohar, 1980), there is growing evidence for the informative and predictive nature of safety climate at various levels of aggregation.

Safety climate has most commonly been viewed as an organizational level construct. A number of studies explore safety climate as a team or group-level construct. However, even when safety climate is studied empirically at the group level, the theorizing around the nature of climate is often oriented toward the organizational level.

Below we explore implications of safety climate at the national and industry level of analysis. These two levels are considered less frequently in the literature but raise increasingly important issues for organizations operating in hazardous environments. We

consider the issue of national culture at some length because this is an important are for future development.

2.2.2.1 Industry level

As noted by Zohar (2014), there have been two primary approaches to the measurement of safety climate. A first approach has favoured the development of universal or general measures of organizational safety climate for use regardless of the specific organizational context (e.g., Neal et al., 2000; Griffin & Neal, 2000). A second approach has been to develop industry - and sometimes organization-specific measures of safety climate adapted to the unique features of the industrial context (Dedobbeleer & Beland, 1991; Singer, Meterko, Baker, Gaba, Falwell, & Rosen, 2007). While the former approach necessitates the development and validation of climate measures in each new context, the latter offers the possibility of accruing knowledge regarding the antecedents and consequences of safety climate across multiple contexts, languages, and cultures (Mearns, Whitaker, & Flin, 2001). In order to do so, however, there must first be ample evidence that the meaning and measurement of safety climate is equivalent across these disparate contexts (Zohar, 2014).

Concepts, methods, and tools to better manage risk and safety are sorely needed. This point appears to be absolutely salient for future research avenues on safety climate, in response to the continuing array of catastrophes in high-risk industries, such as oil and gas, nuclear power generation, aviation, railways, medicine (Grote, 2007). Over the years various industries have led the way to improved safety management, with other industries following them, but often also reinventing practices that were well established elsewhere or adopting practices that did not fit their new context (Mearns & Yule, 2009).

In the light of these reflections, it appears relevant that further research will discuss both effective ways to foster our knowledge of generalizability of safety climate models with a cross-industry approach on opportunities and limits of generalizing concepts and methods

in the investigation of safety climate phenomena. Aspects such as the coexistence of different professional sub-cultures in risk management, department interactions, investigation systems, socio-technically based risk assessment, and organizational and regulatory structures are all aspects whose effects may vary in a significant way across different industries (Grote, 2007). Therefore, further research on safety climate needs to address how the interplay between industry-specific features, managerial orientations and operational safety systems by organizations might univocally interact to eventually determine the way in which safety climate develops over time (Zohar, 2014).

2.2.2.2 National culture

Cultural differences in perceptions of risk as well as broad social and economic conditions provide a basis for exploring national differences in safety culture. Considering the features of the contemporary economy, the management of organizational safety in international and culturally diverse organizations is a concern for many high-risk industries (Reader, Noort, Shorrock, & Kirwan, 2015). Although there is evidence that safety climate may generalize across organisations (e.g., Mearns et al., 2001), and industries (e.g., Hahn & Murphy, 2008), there has been limited attention given to generalization across national cultures (Zohar, 2014). Most published studies have been conducted western countries and especially in Anglo English-speaking countries such the US, UK, Australia, and Canada (Barbaranelli, Petitta, & Probst, 2015). Notable exceptions such the study by Bahari and Clarke (2013) also highlight the limited information about safety climate in different national context. Therefore, comparative studies are certainly needed to understand how well established the meanings of safety climate might transfer to different national and cultural contexts (Zohar, 2014).

However, beyond the question of internal validity in different national and cultural contexts (Hsu, Lee, Wu, & Takano, 2008), there is a more urgent need to understand how

well the assumptions and measures safety climate apply across global organisations. This is particularly true if we consider that - at a broader level - recent reviews of the link between national cultures and organizational safety suggest that there are few consistent predictors of risk taking behaviour and safety performance across cultures (Mearns & Yule, 2009). As argued by Reader and collaborators (2015), there are at least three distinct macro-factors that highlight a need for researchers and practitioners to further investigate and understand safety climate from a more global vision

First, the number and reach multi-national corporations in the current economy means that many large organisations have operations that span multiple countries and continents, including both highly industrialized and developing countries (Mearns & Yule, 2009). The need to understand personal and process safety from a global perspective is therefore increasingly important. For example, cross-national differences might be especially salient for organisations who appoint managers from western backgrounds to positions in non-western environments. Implications for well-established safety climate dimensions like safety managerial commitment and safety leadership (Flin et al., 2000; Griffin & Talati, 2014) across varied multinational contexts are not well understood. In addition, Mearns and Yule (2009) suggested that relationships between perceived management commitment to safety and compliance versus risk taking behaviours might vary across cultures. Future research undertaken should investigate whether differences in cultural values between the workforce and management has an impact on how safety management and supervision behaviours are construed and their influence employee safety performance in high-hazard domains.

Second, national cultures can vary greatly in their support for legislation and regulation systems that preserve, maintain and improve safety in work and organizational setting. Existing research indicates that variations in national safety regulation practices have an impact safety outcomes (Mearns & Yule, 2009). Differences in regulation can be reflected

in job stability, access to safety training, and the nature of safety procedures (Vincent, 2011). For example, globalized industries and organizations operate across different regulatory environments, and must manage different standards for managing and learning from risk (Colakoglu, Lepak, & Hong, 2006). A single organization can be required to work to different safety standards depending on the location of operations, which potentially creates confusion and uncertainty around practices such as safety inspections (Harzing, 2006).

Third, safety-critical work is often performed by multicultural and co-located teams (Manzey & Marold, 2009). Although this diversity can be positive by bringing together different perspectives on safety (Reader et al., 2015), it also presents a challenge for safety management (Kouabenan, 2009). Different cultural values, beliefs and social representations (Cavazza & Serpe, 2009) about the way individuals contribute to safety may also strongly affect the influence of safety climate on more discretional forms of safety behaviors. For example, structured forms of workforce participation and involvement in safety management systems might be more easily accepted and used within a low power distance culture (low hierarchy and equal power distribution), but be perceived as less appropriate in a high power distance culture (strong hierarchy and unequal power distribution) (Hofstede, 1983). Moreover, some national cultural traits (e.g., for challenging authority) might influence safety-related beliefs of team members (e.g., on the acceptability of highlighting a supervisor's mistake; giving and receiving feedback and support for safety), and generally coordination on safety activities may not be optimal (e.g., expectations and behaviors for speaking up and/or supporting other's safety) (Reader et al., 2015).

Overall, a stronger focus on the cross-cultural implications of safety climate will help to understand how key elements such as managerial safety commitment might vary across national contexts. It will also provide insights into the way national systems such as

legislations frameworks and cultural systems such as values might moderate the link between safety climate and outcomes.

3 Individual processes

We next consider the individual processes through which safety climate influences safety outcomes. Our definition indicates that safety climate exerts a *subjective-normative* influence on individual and group behaviour through sense-making and motivational mechanisms (Zohar, 2010). In other words, employees perceive and interpret the organization context and act according to their interpretations (Campbell, Dunnette, Lawler, & Weick, 1970; Carr, Schmidt, Ford, & DeShon, 2003). We first situate safety climate in relation to sensemaking then review various theoretical perspective applied to safety motivation. We conclude with a review of the many forms of motivated safety behaviors that contribute to overall safety.

3.1 Sensemaking

Sensemaking processes help to explains how safety climate is formed over time as a collective phenomenon that goes beyond the mere individual perception of organizational values and priorities (Gonzalez-Roma, Peiro, & Tordera, 2002; Zohar, 2010). In general, organizational sense-making, refers to ongoing interpretative processes in which individuals who are facing complex and ambiguous work situations engage in social interactions to better understand their environment and reduce uncertainty related to organizational goals, norms, and priorities (Louis, 1980; Weick, 1995). Through repeated social interactions, individuals infer organizational priorities and the corresponding behaviours to be rewarded or sanctioned. Sense-making is a primary means through which organizational events and social information are transformed into a collective experience organizational or team climates (Ostroff et al., 2003).

Through sense-making mechanisms, safety climate provides a shared interpretation framework which affects motivations and behaviors by individuals (Beus, Jarrett, Bergman, Mindy, & Payne, 2012). This process is important for safety were interactions are embedded in a complex net of competing organizational goals (speed/productivity vs. safety), time frames, (short vs. long-term goals), and contradictory messages (enacted vs declared policies) (Zohar, 2002; 2003). For instance, strong tendencies for short-term maximization of productive instances (melioration bias) results in on-going dilemma for managers and supervisors, which might lead employees to cope with a multitude of actual policies and practices, often inconsistent with the declared ones (Zohar, 2008). From this perspective, managers and supervisor's daily actions and informal interactions provide the most reliable information concerning utilities and priorities at the workplace (Luria, Zohar, & Erev, 2008) which will constitute the basic elements of safety climate through the construction of a shared framework to use as reference to assure safety instances balancing different goals (Griffin & Talati, 2014). For example, Luria and Rafaeli (2008) showed that colleagues from the same team unit may work as analogous sense-making referent in forming group consensus (Zohar & Luria, 2005), complementing supervisors' functions in creating a common perception of safety climate in a collective process of making sense of the environment, across different situation and circumstances.

3.2 Motivation

Internal psychological states are typically proposed as precursors to effort and behavior (Griffin & Neal, 2000). Understanding what motivates employees to work safely is a crucial for tackling unsafe behavior and increasing employees' participation in safety activities at work (Conchie, 2013). Safety motivation reflects "an individual's willingness to exert effort to enact safety behaviors and the valence associated with those behaviors" (Neal & Griffin, 2006, p. 947). As a psychological process that directs, energizes and sustains

action (Latham & Pinder, 2005; Scott et al., 2014), safety motivation has been conceptualized to determine safe behavior in the workplace across a different range of industrial and organizational contexts (e.g., Clarke; 2010; Griffin & Neal, 2000; Neal & Griffin, 2004).

Griffin and Neal (2000) proposed that safety motivation is proximal determinant of employee safety behaviors and that distal factors such as safety climate have an indirect effect on safety behaviors by influencing employees' safety motivation. Subsequent research has consistently supported these conceptual assumptions (Christian et al., 2009; Clarke, 2010; 2006; Neal & Griffin, 2006). However, a variety of theoretical perspectives underpin the concept of motivation in safety research (Scott, Fleming, & Kelloway, 2014). Below we review the theoretical foundations and empirical bases for different approaches to motivation as an outcome of safety climate and a determinant of safety behavior.

3.2.1 Safety motivation and normative influence by safety climate

The subjective meaning of safety is commonly identified to underlie safety motivation (Conchie, 2013; Curcuruto, Guglielmi, & Mariani, 2013; Scott et al., 2014). As noted by Zohar (2010), maintaining high levels of safety motivation presents a paradox to practitioners and researchers alike because, contrary to the assumption that self-preservation overrides other motives (Maslow, 1970), careless behavior prevails during many routine jobs. There is a consensus among scholars that safety climate affects worker motivation through normative influence mechanisms (Tesluk & Quigley, 2004; Zohar, 2010). As a shared perception of *factual* managerial priorities in the organization (Griffin & Neal, 2000), safety climate informs the workforce about the *normative value* of safety in relation to other aspects of the organization (Cavazza & Serpe, 2009). A positive and consistent organizational safety climate reinforces expectancy-value perceptions of safe (Parker, Bindl & Strauss, 2010; Vroom, 1964). Individuals enact safety behaviors which are perceived to be rewarded and valued in the organization (Zohar, 2010).

3.2.2 Safety motivation and self-determination perspectives

In recent years, an expanded view of safety motivation has been developed through the principles of self-determination theory (SDT) (Scott et al., 2014). This theory builds on the distinction between intrinsic and extrinsic types of motivation at work (Deci & Ryan, 2002). According to SDT, extrinsic motivation explains work behavior in terms of its expected instrumental value for obtaining tangible rewards or avoiding undesired outcomes (Gagnė & Deci, 2005). In contrast, intrinsic motivation involves engaging in a work behavior because it is personally rewarding; performing an activity for its own sake rather than the desire for some external reward.

In safety climate research, it can be argued that because the target of climate perceptions concerns rewarded role behavior, it follows that the main safety climate-behavior relationship should be explained in terms of motivation for safety externally directed (Zohar, Huang, Lee, & Robertson, 2015). However, the distinction between the two types of motivations adds further complexity to this argument. Many safety events (e.g., near-misses or accidents) are low-likelihood with delayed and unsure negative outcomes. Individuals might choose an unsafe behavior such as working faster if the subjective expected utility of unsafe behavior exceeds that of safe behavior, resulting in greater extrinsic motivation for engaging in safety shortcuts or workarounds (Zohar & Erev, 2007). Safety climate, as a contextual variable indicative of the extent to which employees expect safety behavior to result in short-term and more probable positive outcomes (e.g. supervisory recognition and/or approval), constitutes, therefore, a key antecedent for extrinsic safety motivation. Under high safety climate, the level of such motivation can be expected to exceed that associated with safety's competing demands, surpassing the effects of socio-cognitive behavioral bias accountable for the underweight of the benefits associable with safe conducts in the workplace (i.e. recency bias; melioration bias) (Zohar & Erev, 2007).

On the other hand, SDT suggests the increasing internalization of externally-regulated behavior. Therefore it might be argued that safety climate endangers identification - or integration-based extrinsic motivation (Zohar et al., 2015; Ryan & Deci, 2000). A further consideration is that many safety behaviors involve rule compliance, offering limited potential for autonomy or interest (Parker, Axtell, & Turner, 2001). We discuss the motivational implications of different forms of safety behavior in more detail below.

3.2.3 Safety motivation and psychological empowerment

Safety climate might also motivate safety behavior through feelings of empowerment, psychological ownership, personal engagement and passion for meeting challenging work goals (Curcuruto & Griffin, in press; Parker, Turner, & Griffin, 2003; Zohar, 2008). For example, highly engaged employees experience a sense of personal significance and pride (Schaufeli, Bakker, & Salanova, 2006). A recent literature review concluded that because engaged employees find their work psychologically meaningful and self-relevant (Spreitzer, 1995; 1996), they feel as though work objectives or processes have become part of, or are an extension of, themselves (Pierce, Kostova, & Dirks, 2003). Consequently, they are more intrinsically motivated to protect their work from harm as an expression of the intrinsic tendency for self-protective behavior (Greenglass, 2002). In other words, when work becomes a psychologically meaningful activity, turning into an extension of one's self, safety behavior becomes an intrinsically motivated investment in self-protective behavior when performing high-risk jobs (Zohar, Huang, Lee, & Robertson, 2014).

Given this line of argument, it follows that work environments whose contextual attributes have been shown to promote employee engagement in conjunction with exposure to routine physical risks can offer an opportunity to stimulate intrinsic motivation on safety behavior. Literature reviews of job design (Parker, 2014) have identified a number of work-related attributes promoting such engagement (Macey & Schneider, 2008; Simpson, 2009).

These attributes include task autonomy, challenge and variety (Gagne & Deci, 2005), task meaningfulness (Kahn, 1990), job control (Parker, William, & Turner, 2006) and employee empowerment (Carless, 2004).

3.2.4 Safety motivation and social-exchange theories

Another complementary approach linking safety climate to safety motivation involves *social-exchange* theory and social reciprocation principles (Mearns & Reader, 2008). Social exchange theory (Blau, 1960) proposes that when individuals (or other social agents like organizations) provide valued services, others typically respond with a certain level of obligation in response to and exchange for these services. The social exchange perspective (Eisenberger, Fasolo, P., & Davis-LaMastro, 1990) suggests the perception of employer support and investment generates an implied obligation in employees that results in positive reciprocity favoring the organization (Dejoy, 2005). Thus, when organizations provide services which are perceived as discretionary, this could inspire reciprocating behavior in the form of employee compliance with organizational policies, rules and expectations.

A strong positive safety climate, in which employees perceive that safety is prioritized and that managers are committed to their safety is likely to increase employees' feelings of commitment and satisfaction with the organization, and so influence their behavior – an effect that has been described as a 'positive spillover' (Morrow & Crum, 1998, p. 130). Similarly, Hofmann and Morgeson (1999) argued that individuals who perceive that their organizations are supportive of their health and safety, may feel obligated to reciprocate these attentions with higher involvement in safety behaviors (Parker et al., 2001). Therefore, perceptions of managerial commitment and organizational investment in programs promoting health and safety of the workforce might be reciprocated by employees through an active personal commitment toward compliance with organizational safety rules and procedures and

participation in discretional programs supporting safety in the organization (Clarke, 2010; Mearn, Hope, Ford, & Tetrick, 2010).

Similarly, other authors have extended this focus of social-exchange mechanism including the influence of *organizational support* for safety by supervisors, co-worker and management and their impacts on individual engagement toward safety in terms of social reciprocity (Tucker, Chmiel, Turner, Hershcovis, & Stride, 2008). In other words, various social agents such as managers, supervisors, and colleagues, become the expression of the general support and care by the organization for the quality and well-being of the work experience (Brondino, De Silva & Pasini, 2012). For example, studies have highlighted how supportive and participative managerial styles in organizations and workgroups are linked to a greater safety commitment by employees (Curcuruto et al., 2013; DeJoy, Lindsay, Vandenbergh, & Wilson, 2010; Tucker at al., 2008).

3.3 Safety behaviors

We next review the link between safety climate and specific safety behaviors such as compliance and proactivity. Injury and near miss outcomes will be reviewed here at the individual level.Employee safety behaviors play an important role in maintaining a safe work environment and have been previously shown to be associated with workplace injuries (Clarke, 2006; Christian et al., 2009; Neal & Griffin, 2006).

Safety behaviors by individuals are frequently conceptualized as criteria of the overall safety performance by organizations, as they provide researchers with a measurable outcome, which is more proximally related to psychological factors than accidents or injuries (Christian et al., 2009). Moreover, safety performance behaviors tend to be predicted with greater accuracy than more distal outcomes, which often have a low base rate and skewed distributions (cf. Zohar, 2000; 2002). Similar to job performance in general, safety performance behaviors can be scaled by the frequency with which employees engage in the

behaviors and are distinguishable in terms of their antecedents and covariation with safety outcomes (Burke, Sarpy, Tesluk, & Smith-Crowe, 2002). Moreover, a recent meta-analysis by Clarke (2013) containing 32 adult-aged working samples revealed that higher levels of safety behavior is associated with fewer occupational injuries (average rs with occupational injuries =−.21, both with N = 229 reliability-corrected meta-analytic correlations).

3.3.1 The distinction between compliance and participation

Several conceptual models of safety behavior have been advanced. A first model of safety performance outlined by Burke, Sarpy, Tesluck and Smith-Crowe (2002) - defined as "actions or behaviors that individuals exhibit in almost all jobs to promote the health and safety of workers, clients, the public, and the environment" (p. 432) - includes four factors: (a) using personal protective equipment, (b) engaging in work practice to reduce risk, (c) communication of hazards and accidents, and (d) exercising employee rights and responsibilities. However, since the beginning of 2000's, a more refined conceptual distinction emerged in safety climate literature, between safety "compliance" and safety "participation," with the former referring to "generally mandated" safety behaviors and the latter referring to safety behaviors that are "frequently voluntary" (Neal et al., 2000, p. 101). This distinction is similar to that between task and contextual performance in the job performance literature (e.g., Borman & Motowidlo, 1993). From this perspective, safety compliance behaviors are the core of safety activities that are required by the formal work procedures in order to maintain a minimum level of safety (Griffin & Neal, 2000; Neal & Griffin, 2002). Examples of safety compliance behaviors include following safety rules and procedures, and complying with occupational safety regulations. Alternatively, safety participation describes behaviors that might not directly contribute to an individual's personal safety but that do help to develop an environment that supports safety (Neal & Griffin, 2006, p. 947). These behaviors include activities such as participating in voluntary safety activities,

helping coworkers with safety-related issues, and attending safety meetings (Neal & Griffin, 2002).

3.3.2 The distinction between affiliation and proactivity

In safety literature, the concept of safety participation is also frequently used interchangeably with the notion of organizational safety citizenship (Conchie, 2013; Zohar et al., 2015) which includes a broad range of extra-role behaviors, including *affiliative oriented* citizenship, like helping and stewardship behaviors (Curcuruto, Mariani, Conchie, & Violante, in press), civic virtue acts (i.e. keeping informed about safety issues) (Hofmann, Morgeson, & Gerras, 2003), active caring for safety (i.e. housekeeping; risk reporting; whistleblowing actions) (Geller, Roberts, & Gilmore, 1996), and *change-oriented* citizenship (or safety proactivity), like *safety initiative* (i.e. initiating safety-related changes) (Hofmann et al., 2003; Simard & Marchand, 1995) and *safety voice* (i.e. raising safety related concerns; providing suggestions for improvement) (Curcuruto, Guglielmi, & Mariani, 2014, in press; Tucker et al., 2008).

4 Organizational outcomes

In addition to the numerous studies devoted to the measurement of safety climate and identifying its components, a significant amount of research has focused on the nomological consequences of safety climate, with a strong focus on safety performance and safety outcomes. In the next subsections, we will briefly review the most relevant studies that link safety climate to individual and aggregate outcomes. We will start to overview individual processes; then we will examine aggregate organizational outcomes.

4.1.1 Predictive validity issues

Recent meta-analytical studies show that safety climate offers robust prediction of objective and subjective safety criteria across industries and countries (Nahrgang, Morgeson, & Hofmann, 2011; Christian et al., 2009). The meta-analysis, based on a sample of 202

published studies that passed the authors' inclusion criteria, encompassing 236 independent samples (N=127,266), attests also that time has come to re-focus our attention on theoretical and conceptual issues, having demonstrated the predictive validity of safety climate as a leading safety indicator

4.1.2 The relationship between safety climate, behaviors and outcomes

Research consistently concludes that employees who report higher perceptions of safety climate also report higher engaging in more safety compliance and participation behaviors, which in turn are associated with a reduction of negative safety outcomes, like injuries and accidents (Christian et al., 2009; Neal & Griffin, 2006; Neal et al., 2000; Sinclair, Martin, & Sears, 2010; Vinodkumar & Bhasi, 2010; Zohar, 2002).

As general tendency, meta-analyses show that safety climate is more strongly associated with discretional safety behaviors like safety participation rather than compliance, even if traditionally, most of research on safety climate outcomes has been focused individual safety compliance (Christian et al., 2009; Wallace & Chen, 2006). In line with this focus, considerable empiric evidence has showed that greater individual safety compliance is associated with fewer adverse events, accidents and injuries (Zohar, 2002; Nahrgang et al., 2011).

These findings show that safety compliance is clearly essential for accident and injury prevention. Nevertheless, more recently scholars have identified broader safety behaviors beyond compliance that are increasingly important to prevent accident s and injuries in an organizational context. For instance, different clusters of safety citizenship behaviors can influence safety outcomes in a complementary way (Curcuruto et al., in press): whereas affiliative safety citizenship was found associated with minor incident events like property damages and micro-injuries (Zohar, 2002), challenging (or proactive) safety citizenship were found positively related with near-miss reporting and negatively with LTI (lost time injuries

entailing days of absence from work) (Kongsvik, Fenstad, & Wendelborg, 2012). The authors conclude that further research should address in which condition distinct forms of safety participation or citizenship may play a complementary role to safety compliance in improving the overall safety performance by organizations, and eventually, reducing the occurrence of negative outcomes for both people and companies.

4.1.3 Safety indicators

As mentioned in the previous section on safety behaviors, safety climate research has been hampered by the lack of objective criterion data (Christian et al., 2009; Neal & Griffin, 2006; Zohar, 2000). Given the difficulties of obtaining objective data, past studies have often used either self-reports of behavioral safety (DeJoy, 2005; Thompson, Hilton, & Witt, 1998), self-report of accident occurrences (Hofmann & Stetzer, 1996), experts' ratings of safety level (Zohar, 1980), or retrospective accident data (Brown & Holmes, 1986).

To address these difficulties, many studies have recognized the concept of *micro-accidents* as a well-established outcome criterion of safety climate (Turner, Tucker & Kelloway, 2015; Zohar, 2000; 2002). Micro-accidents refer to on-the-job behavior-dependent minor injuries requiring medical attention. However, contrary to ordinary accidents, they do not incur any lost work days. A separate term is used to denote the marked differences in terms of underlying distributions of the two injury categories. Microaccidents have three methodological advantages as a criterion of behavioral safety (Zohar, 2000): (a) They occur much more frequently than lost-workday accidents, resulting in a homogeneous distribution as a function of time, as opposed to the highly skewed distribution characteristic of accident data in a single organization; (b) they provide an objective measure of behavioral safety unaffected by sources of bias associated with self-report or other forms of rating; and (c) they are strongly associated with lost-days accidents.

Near-miss is another kind of indicator used in safety climate research which is based on the analysis of potential incidents (Kongsvik et al., 2012). In the most used taxonomy systems, a near miss is considered to be an unplanned event that did not result in injury, illness, or damage – but had the potential to do so (Curcuruto et al., in press). Only a fortunate break in the chain of events prevented an injury, fatality or damage; in other words, a miss that was nonetheless very near. However, near-miss reporting is usually considered a cue for proactive management of safety in organizations, rather than a reactive lagging indicator of safety performance, like property damages and micro-injuries (Reason, 1997; 2008). Achieving a high number of near misses is the goal as long as that number is within the organization's ability to respond and investigate. Thus, many opportunities to prevent the accidents that the organization has not yet had are lost. Recognizing and reporting near miss incidents can make a major difference to the safety of workers within organizations (Kongsvik et al., 2012), and provides immense opportunity for employees' safety participation (Griffin & Neal, 2000),

Accident reporting is another relevant phenomenon associate to safety climate.

However, empiric studies showed the relationship between safety climate and critical events for organizational safety might be so linear. Research indicates that these may be substantial underestimates of the true prevalence of accidents and injuries (Probst, Brubaker, & Barsotti, 2008).

A recent multilevel study conducted with a public transit employees indicated that variables such as safety–production conflict and high-productivity climate are negatively related to accident-reporting attitudes (Jiang & Probst, 2015). As expected, among employees in workgroups exhibiting a positive safety climate, this negative effect was attenuated.

Researchers found also significant cross-level interactions. Using hierarchical linear modeling and survey data collected from 1,238 employees in 33 organizations, Probst (2015)

recently investigated the effects by employee-level supervisor safety enforcement behaviors and organizational-level safety climate on employee accident underreporting. Once again, findings showed that negative effects of supervisor enforcement on underreporting were attenuated in organizations with a positive safety climate (Probst, 2015). These findings seem to suggest prudence in addressing the causal link between safety climate and safety outcomes, without considering the interaction of safety climate with other types of contextual variables related both to risk and safety management and other typologies of organizational climate.

From a practical perspective, these findings may benefit human resources and safety professionals by pinpointing methods for increasing the accuracy of accident reporting through interventions aimed to improve safety climate at team and organizational levels , reducing actual safety incidents, and reducing the costs to individuals and organizations that result from underreporting.

4.1.4 Organizational performance

Ongoing changes in economic, social, and environmental conditions also require change, adaptation and innovation in hazardous industries which have theoretical implication for existing safety climate models (Griffin, Cordery, & Soo, 2015). Rapid changes in technology and global markets, together with increasing social and environmental risks, create new levels of uncertainty and complexity. In addition, advances in safety over recent decades seem to be reaching a plateau. The rate of fatalities at work has declined but remains too high, and major accidents continue to have enormous impact on people, business, and the environment (Probst, 2015). Although safety has improved over recent decades, catastrophic accidents continue to occur and the number of workplace fatalities remains unacceptably high (SWA, 2014). Improvements in safety statistics appear to be slowing, with declines in some indicators (DNRM, 2014). Without a new integrating approach, it will be more difficult to achieve more positive outcomes from safety investments. Currently, we know surprisingly

little about the long-term benefit of safe work systems for industry, the community, and the economy. Although cost-benefit analyses demonstrate that safer systems provide long-term savings (e.g., lower insurance premiums), there is almost no systematic information or evaluation of the way safer systems generate productivity and innovation. In short, safety climate and safe organizational systems are valued for their "preventive" role more than their "generative" contribution to change and growth (Griffin et al., 2015). A preventive focus in safety climate research is clearly important. Substantial advances have been achieved to reduce the negative consequences of poor safety. However, the benefits of preventive methods seem to be approaching a limit. In the face of pervasive change, organisations must respond adaptively and embed novel and proactive safety solutions in ongoing operations.

An increasing attention on this kind of adaptive changes has been identified in approaches such as resilience engineering (Hollnagel, Paris, Woods, & Wreathall, 2012) and high reliability organisations (HROs) (Weick & Suitcliffe, 2007). These paradigms focus their attention on how successful organizations maintain reliability while adapting to unexpected change and unplanned events (e.g., Roberts, 1990). Usually, distinct types of change are reflected in the response to major disaster compared to the continuous improvement of HROs described above. First, disasters and other major events generate efforts for fundamental and far-reaching change to achieve optimal levels of safety and reliability. By their nature, these changes are typically reactive. In contrast, changes to highly reliable systems involve more proactive and forward looking changes that tend to be more incremental in nature (Griffin et al., 2015). The susceptibility of reliable operations to external disruption have generated efforts to create more adaptive capabilities through which organizations continually adapt to changing conditions in the external context. Both types of change have been the motivation for substantial improvements in safety operations for hazardous industries.

The idea of existing dynamics of safety proactivity and innovation is not new in safety climate literature (Zohar & Luria, 2005), considering organizational functions of safety related to continuous improvement and learning (Curcuruto & Griffin, in press). However, there is currently no conceptual framework for describing qualitatively different drivers and kinds of change in safety systems (Zohar, 2008). Without an adequate framework, important aspects of innovation and changes safety related might not be effectively integrated with existing safety climate models. Moreover, it has been recently argued that the process of proactively changing core safety systems is not well articulated in current approaches to safety management (Griffin, Hodkiewicz, Dunster, Kanse, Parkes, Finnerty, Cordery, & Unsworth, 2014).

In this perspective, a possible avenue for future research aimed to cover the gap between safety climate and innovation dynamics by organizations might be offered by the concept of "dynamic safety capability" to explain the nature of this capability and the nature of organizational change that is involved. This concept has been defined as an organization's capacity to generate, reconfigure and adapt operational routines to sustain high levels of safety performance in environments characterized by change and uncertainty (Griffin et al., 2015). Although safety capability and climate constructs have different theoretical heritages, they still present similarities to identify ways capability and climate function to enable the development. Both the paradigms are linked to a managerial orientations by organizations which are strong determinants of both safety and innovation in organizations (Grote, 2007; Hülsheger, Anderson, & Salgado, 2009; Nahrgang et al., 2011). In this perspective dynamic capability paradigms might help to extend the application of safety culture because it focuses on the capacity to create change in the future. However, the practical imperative to improve organizational safety can lead to a focus on cultural an managerial deficiencies in an organization. Research in the area of safety climate often focuses on methodological issues

such as dimensionality, agreement, and aggregation. The focus on assessment can also lead to emphasis on improving a poor safety climate (Health and Safety Executive, 2005) rather than preparing positive climate for future change. Conversely, there is growing evidence that a deep safety capability ensures that organisations can adapt, innovate, and perform at the highest level. Consequently, future research on safety capability might help to improve our knowledge about how safety climate might work as generative driver for innovation and productivity. Both safety and innovation are important sources of productivity improvement and the ability to adapt to change is a defining feature of modern organisations, particularly high risk environments industries

5 Future directions

Our review explored definitions, determinants, and processes of safety climate as well as consequences for people, teams and organizations. We conclude with an overarching framework that summarizes key features of the review and point to future directions for research and practice. We consider future directions within each of the topic areas plus broader implications based on the changing nature of work, environmental concerns, and economic development.

5.1 New challenges from the transformation of organisations

The first section of our review aimed to summarize the existing approaches in the definition of safety climate nature and contents, integrating complementary approaches over the past 35 years of research. A broad consensus defines safety climate as a perceptual, collective, multidimensional and multilevel organizational phenomenon. Studies have also investigated how team and organization levels of analyses interact (Zohar & Luria, 2010; 2005), and how this cross-level interaction might generate emergent phenomena (Probst, 2015) affecting the final safety outcomes for organizations and teams.

The changing nature of work and organizations over the last two decades raises questions about the generalizability of current theoretical assumptions about safety climate. The modern economy is characterized by multinational corporations, organizations with weaker external boundaries, more complex jobs, cross-national locations, and more heterogeneous workforce demographics and cultures. These changes in the external and internal environment of organizations generate implications that have yet to be investigated in relation to safety climate. Meta-analyses show that safety climate has a stronger effect on discretional safety participation than compliance, and those managers and supervisors are consistent sources of safety climate across different types of industries and organizations. However, working conditions characterized by higher levels of interdependence and constrictions in agency and autonomy might modify the impact of safety climate in unpredictable ways. For example, complex multi-team structures, where individual respond to more than one supervisor on various projects might influence the way the organizational climate for safety is perceived. Future research should address the impact of these changes to understand how safety climate dynamics may interact with new organization, team and work structures.

5.2 New insights from motivation theories

Our review of safety climate and motivation focused on the shared interpretation of organizational values in daily work activities, group dynamics and social interactions phenomena (Zohar, 2010). We have also seen that a well-established corpus of empiric evidences has been cumulated in the last fifteen years about the role of individual motivation as privileged mediation construct through which safety climate affects individuals' safety behaviours, with a special focus on discretional safety participation (Griffin & Neal, 2000).

However, new conceptual developments from general motivation research stream in organization make us consider new conceptual horizons and research lines for future studies

and hypotheses. For instance, traditional research on motivation in safety climate studies underlined the relevance of the subjective-value of safety for individuals, on the basis of shared perceptions and sense-making of organizational values and priorities. However, recent development for self-determination theory and psychological empowerment motivation paradigms have opened new research perspective on a more active and interactive influence by individuals on the organizational environment through the creation of broader role orientation by individuals in safety management (Zohar, 2008). Future research could try to address research hypotheses on how complementary motivational mechanisms might produce distinctive and emergent effects on different kind of individual's behaviours and team safety performance, envisioning multiple paths of motivational influence from management and supervisor safety climates. To date, this kind of more composite research model appears still exceptions rather than part of systematic research streams.

5.3 New outcomes for organizations

Our review of the link between safety climate and organizational outcomes suggests a range of future research challenges. We began this last main section with an overview of traditional measures of critical incidents which are broadly used as reactive criteria to assess organizational safety and reliability. We then reviewed areas that are under-investigated in relation to safety climate such as productivity, organizational change, and innovation. We described the dynamics and processes of safety climate might interacts with other organizational capabilities to create positive outcomes organizational systems. Areas that might benefit from further links to safety climate include organizational sustainability, workforce well-being, and continuous improvement in reliability systems.

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