Leadership for Resilient Organizing: a Critical Realist Approach to Revisit the Role of Leadership in High-Risk Organizations

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Abstract:

There is a growing interest in studying leadership for resilient organizing. Models of leadership evolved from static, leader-centric, toward more social and processual, generating new questions about the role of leaders. Process perspective on leadership brings into light the importance of the context in which leadership unfolds. This in turn calls for the development of interdisciplinary and multi-level approaches, better able to capture not-easily observable, complex dynamics of social interactions. Based on a Critical Realist epistemology and applying abductive reasoning, we elaborate an integrative conceptual framework for studying leadership as a context-depended organizational process. We focus on the leadership process within complex and high-risk organizations, where leaders' attention is turned to safety. Our model posits that leaders cannot directly influence subordinate behavior. Leaders can only influence organizational contexts/structure, which then activate generative mechanisms. These interact with one other shaping behaviors and organizational practices.

Keywords: resilience, leadership as process, critical realism, leadership for safety, high-risk organizations

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INTRODUCTION - COMBINING PROCESS AND CONTEXT FOR A BETTER UNDERSTANDING OF LEADERSHIP

The notion of resilience has been extended to research on the reliability and safety of complex systems (Hollnagel et al., 2006; Morel et al., 2008). Increasingly, these research avenues point to the role of leaders in the development of resilience and safety (Atkins, 2008; Hannah et al., 2009; Madsen et al., 2006; Roberts & Bea, 2001; Weick & Roberts, 1993). The investigation of the impact of leadership on resilience is one of the emerging research trends (Linnenluecke, 2017). However, the leadership processes enabling the development and implementation of resilience principles continue to be poorly understood.

A traditional leader-centric research fails to explain the link between leaders' characteristics and organizational outcomes (Dinh & Lord, 2012). Recent literature suggests that leadership development is the result of social interactions (Alvesson & Blom, 2015; Day, 2000; Fairhurst & Uhl-Bien, 2012; Kempster & Parry, 2011). The growing recognition of this social and dynamic nature of leadership (Collinson, 2005; Day, 2000; Parry, 1998; Uhl-Bien et al., 2007) has resulted in a recent call for multi-level and process perspectives (Antonakis et al., 2014). Novel approaches are needed to uncover the complex 'mechanism that explains the causal relationship between inputs (e.g., leader behaviors) and outputs (e.g., organizational performance)' (Fischer et al., 2017, p. 1727) in order to advance theory and guide leadership interventions (Dinh et al., 2014).

Studying leadership as a process requires taking into account the particular context in which it unfolds. This context influences leadership (Fairhurst, 2009; Lord & Dinh, 2011; Osborn et al., 2002; Thomas et al., 2013), but at the same time, leadership participates in the creation and modification of the context (Fiedler, 1996; Hernandez et al., 2011; Journé & Raulet-Croset, 2008; Oc, 2018). According to Dinh and Lord (2012) the leader's direct effect on the organization has often been overestimated (Day, 2000; Fischer et al., 2017; Langley & Tsoukas, 2017; Meyer et al., 2005). Since leadership develops through complex, dynamic interactions between people and the environment – the context - (Day et al., 2014), understanding of leadership as a process starts by careful analysis of the context in which it is embedded.

The extreme nature of the high-risk context in which leadership for safety develops provides an opportunity, for both practitioners and academics, to develop valuable insights about leadership in general (Bamberger & Pratt, 2010). This emerging research field combines different theoretical perspectives from multiple disciplines such as for example: organizational studies (e.g. Barling et al., 2002; Weick et al., 1999), sociology (e.g. Bourrier, 2005; Perrow, 1984), psychology(e.g. Rhona Flin & Fruhen, 2015; Hofmann et al., 2003; Zohar & Luria, 2003), ergonomics (e.g. Leplat 1997; Dekker 2003) and civil engineering (e.g. Kines et al. 2011). However, the question - how to take into account the complex contextual influences on the leadership processes for safety? - remains largely unanswered.

The theoretical shift to processual and contextual view of leadership calls for the development of new conceptual frameworks and methodologies, better able to capture not-easily observable complex dynamics of social interactions. To fully acknowledge the complex and contingent nature of leadership (Hazy & Uhl-Bien, 2015, p. 100), research should focus on the underlying causal mechanisms of leadership. These mechanisms could be uncovered and understood by exploring the effects of leadership at the multiple levels: individual, dyadic, group, and/or organizational with both top-down and bottom-up interacting forces (Dionne et al., 2014; Hazy & Uhl-Bien, 2015; Ospina & Uhl-Bien, 2012). In order to better understand how leadership plays out across multiple levels, leadership scholars (Dinh et al., 2014; Oc, 2018; Osborn et al., 2002) invite to reach beyond the boundaries of the leadership literature and to integrate theories from outside the leadership field. They claim that this is the solution to getting a fuller picture of organizational context-embedded phenomena in all their complexity.

In line with Kempster and Parry (2011), we believe that Critical Realism provides an epistemological approach allowing to capture the complexity of the leadership process, which unfolds in specific contexts. Bridging competing paradigms of positivist or interpretivist traditions (Denis et al., 2012; Smith, 2006) and applying abductive reasoning, Critical Realism invites researchers to integrate diverse theories into one coherent theoretical framework. By acknowledging the multi-level nature of social phenomena, this approach allows to reorder dispersed theoretical elements regarding individuals, dyads, groups and organizations in relevant levels of analysis: observable events, context, social structure and underlying causal mechanisms (Ackroyd & Fleetwood, 2004; Margaret Archer, 1998; Smith, 2006). It also draws attention to the fact that leaders do not have direct influence on observable subordinate

behavior. Rather, they have a limited and indirect influence on organizational culture, calling for the redefinition of the role of leaders.

The paper is structured as follows. First, we analyze the contextual specificity of safety and resilience in high-risk organizations. Second, we present our review of key literature on leadership for safety. Third, we emphasize theoretical foundations and methodological implications of the Critical Realist approach for studying safety leadership. Fourth, we propose an integrative theoretical framework of leadership for safety. Finally, we discuss the contributions and limitations of our research.

1. CONTEXTUAL SPECIFICITY OF SAFETY AND RESILIENCE IN COMPLEX AND HIGH-RISK ORGANIZATIONS

The context or a set of broader organizational dynamics, must be taken into explicit consideration in studying leadership as process (Osborn et al., 2002). In this paper, we propose to study leadership development process within complex and high-risk organizations, where leaders' attention is turned to a particular organizational objective – safety.

There is a growing interest in studying high-risk contexts (Hällgren et al., 2017). After tragic accidents of the recent decades such as the nuclear accidents at Chernobyl in 1986 or Fukusima-Daiichi in 2011, the reliability and safety of socio-technical systems became central for organization scholars and many national and international professional associations. For example, in France, the Institute for Industrial Safety Culture (Institut pour une culture de sécurité – ICSI), was created two years after the explosion at the AZF factory in Toulouse in 2001 and in 2005, Foundation for a Culture of Industrial Safety (Fondation pour une culture de sécurité industrielle – FONCSI) was created to support the institute's activities. The importance of safety leadership is also recognized by the International Atomic Energy Agency (IAEA) and its member states have included it in the frame of its fundamental safety principles. In the same line, risk, safety science and high reliability organizations (HRO) literature points to an increasing role of leaders in the search for solutions in face of the complexity of safety issues.

1.1. COMPLEX HIGH-RISK ENVIRONMENTS

The technical and economic progress is accompanied by the production of risks, requiring organizational efforts and capabilities to cope with uncertainties (Beck, 1992). High risk in daily practices is inherent of certain types of organizational activities such as, for example, nuclear power production, air traffic control or chemical manufacturing.

Traditionally risk is defined as a probability of occurrence and consequences of physically harmful events, which can be quantified by formal expert evaluation. This non-dynamic expert-based view of risk leads to the reinforcement of technical and regulatory barriers to cover risks (Scheytt et al., 2006). However, this view is highly criticized, especially in terms of appropriate risk assessment (Maguire & Hardy, 2013; Pidgeon, 1991). Despite considerable technological and regulatory efforts to control risks, uncertainty remains present and should be faced. Extensive risk management activities may paradoxically create additional uncertainties (Scheytt et al., 2006) and disruptions (Leveson et al., 2009). Therefore, dealing with uncertainty should not only be based on technological compliance, but also on the understanding and influencing of the interplay between technological, social and organizational factors (Leveson et al., 2009; Osborn & Ashforth, 1990). This challenge appears increasingly crucial in complex, high-risk environments.

Complex systems are comprised of a large set of interacting and coevolving agents, producing emergent effects (Coveney, 2003). The emergence arises spontaneously from the actions and interactions of lower level agents (Lichtenstein & Plowman, 2009; Uhl-Bien & Arena, 2018). Hence, a complex environment is inherently uncertain; it offers a multitude of potentially contradictory (paradoxical) paths (Denison et al., 1995; Osborn, 2008), conflicting constraints and amplification effects (Marion & Uhl-Bien, 2001; Uhl-Bien & Arena, 2018). Complex and tight coupling of socio-technical systems (Perrow, 1984) may remain opaque for direct technical or procedural control and could lead to an additional accumulation of latent conditions of failure and risks (Rasmussen, 1997; Reason, 1998). In line with this, the investigation of major accidents shows that technical means controlled by procedures are no longer sufficient to protect organizations from the loss of their production capabilities.

1.2. MANAGED AND REGULATED SAFETY

Safety science highlights the importance of the interplay between two forms of organizational safety: regulated and managed (Besnard et al., 2017; Morel et al., 2008; Oliver et al., 2017). While regulated safety focuses on technical/procedural barriers and predictable outcomes, managed safety refers to the capacity to handle unpredictable and uncertain events through proactive behavior and appropriate actions. The complexity of the environment highlights the importance of human and organizational factors in ensuring safety (Hofmann et al., 2017). Only the simultaneous development of both forms of safety can ensure safety outcomes.

However, a recent study shows that high reliability systems (regulated safety) can limit the cognitive abilities of actors (managed safety) often faced with ambiguous or unexpected situations (Oliver et al., 2017). This uncertainty contributes to the escalation of risk and may lead to violations of organizational limits (Farjoun & Starbuck, 2007). It is therefore essential to understand the tensions between regulated and managed safety. Whereas safety science literature informs us about the different aspects of regulated safety, there is dearth of research on managed safety and on the efficient articulation of the two types of safety.

The common answer to cope with uncertainties for organizations is presented in the development of safety culture (e.g. Pidgeon, 1991; Reason, 2000). Due to the environment specificity, complex and high-risk organizations are considered even more vulnerable to deficiencies of safety culture.

1.3. SAFETY CULTURE AND MANAGED SAFETY

The term of safety culture is introduced in the report of the International Atomic Energy Agency (IAEA) after the Chernobyl Accident (Besnard et al., 2017; INSAG International Atomic Energy Agency, 1991). Since this publication, safety culture has popped up in a variety of scientific domains and is now largely accepted by the industry operators. However, there is no consensus on the definition of safety culture (Guldenmund, 2000). Referring to a three-level framework of organizational culture (basic assumptions, espoused values and artifacts) by Schein (2004), International Nuclear Safety Group (INSAG) defined safety culture as an assembly of organizational or individual characteristics and attitudes focused on the priory of safety (INSAG International Atomic Energy Agency, 1991). Safety science scholars and operators extend the this definition beyond values, assumptions and beliefs to a global set of shared structures, behaviors role, social and technical practices (Besnard et al., 2017, p. 9; Pidgeon, 1991; Reason, 1998, 2000). In particular, Reason (1997) defines safety culture through its different interacting aspects: informed culture, reporting culture, just culture, flexible culture and learning culture. In practical terms, this conceptualization of culture implies sharing information about near misses and proactive checks of safety systems, readiness to report errors, trust, encouragement to provide safety information, adaptability by reconfiguring organizational structure in dynamic environments, willingness and competence to learn from safety systems (Fruhen et al., 2013). Nevertheless, the process of transformation of these safety values in operational behavior remains very poorly understood (William Ocasio & Wohlgezogen, 2010).

1.4. HRO AND RESILIENCE

HRO scholars (e.g. La Porte & Consolini, 1991; Weick, 1987; Weick et al., 1999; Weick & Roberts, 1993) study organizations manifesting a low occurrence of errors, but these errors potentially have a very high impact (e.g. nuclear power plants, air traffic control, etc.). Authors from this field (Vogus et al., 2010) offer a theoretical framework to analyze safety culture through three processes: enabling, enacting and elaborating safety culture. Enabling aims to create a favorable context for the development and implementation of safety culture in daily activities. Enacting safety culture refers to effective translating of safety values into organizational practices to increase reliability. Finally, elaborating implies continuous improvement and learning.

Weick, Sutcliffe and Obstfeld (1999) identify five processes that contribute to high organizational reliability: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise. These processes are closely related to the concept of mindfulness that refers to individuals' ability to focus their attention on a specific object while simultaneously paying attention to so-called peripheral elements, particularly weak signals that may announce future problems or opportunities (Vogus et al., 2010; Weick & Sutcliffe, 2006). The idea is to construct meaning from a panel of relevant signals relative to the object in question and its immediate context and then to imagine appropriate, more or less innovative, responses (i.e. outside established procedures). The concept of mindfulness echoes that of attention quality (W. Ocasio, 1997; William Ocasio, 2011). Distributed and coordinated collective mindfulness helps to detect weak signals that are characteristic of complex environments (Vogus & Welbourne, 2003). When unexpected events occur, collective mindfulness can also enable more relevant decisions to be made (Fiol & O'Connor, 2003). Thus, a "mindful" organization can manage unexpected events in an adaptive and flexible manner (Levinthal & Rerup, 2006).

This research defines the guiding principles necessary to developing safety culture and more broadly, organizational reliability and resilience (Fiol & O'Connor, 2003; Levinthal & Rerup, 2006; Sutcliffe et al., 2016; Vogus & Welbourne, 2003). However, the translation of safety and reliability principles into operational behavior remains an open question (Hofmann et al., 2017; William Ocasio & Wohlgezogen, 2010). Despite increasingly pointed role of leaders in the development of safety (Atkins, 2008; Hannah et al., 2009; Hofmann et al., 2017;

Roberts & Bea, 2001; Weick & Roberts, 1993), the leadership processes enabling the development and implementation of safety culture principles are not clearly determined.

2. LEADERSHIP FOR SAFETY IN HIGH-RISK ORGANIZATIONS

Global research on leadership has evolved around a few key themes, such as roles and styles, the influence of context, recognition of autonomy or more recently leadership in complex environments. The behaviors and roles of leaders have been analyzed through two major dimensions: the first, the behavioral dimension, focuses on human relations and the second focuses on task and production efficiency (Bergeron, 1979; Mintzberg, 1973; Yukl, 1989). The result of the behavioral approach emphasizes the need to combine roles and behaviors according to the particular context. This combination is studied through leadership styles (Bergeron, 1979; Fiedler, 1967). Safety leadership as a process follows the evolution of generic leadership studies.

2.1. STUDYING LEADERS' BEHAVIORS FOR SAFETY: THE CLASSICAL APPROACH

In spite of a growing interest in safety leadership (Christian et al., 2009; Mark A. Griffin & Talati, 2014; Vogus et al., 2010; Zhang & Wu, 2014; Zohar, 2002b), research remains focused on leadership styles (Huang et al., 2004; Pilbeam et al., 2016). In their review of the leadership literature, Pilbeam et al. (2016) note that the majority of safety leadership practices are considered as behavior and style, focusing on general leaders' traits and behaviors to motivate and increase team/organizational commitment and safety communication (Huang et al., 2004), and are measured by generic scales (Multifactor Leadership Questionnaire-MLQ and Leader-Member Exchange-LMX).

These theories align more closely with the particularities of transformational leadership, which is the most frequently cited as safety-related leadership behavior (Barling et al., 2002; R. Flin & Yule, 2004; Mark A. Griffin & Talati, 2014; Mullen & Kelloway, 2009; Zohar, 2002a, 2002b). Specific behaviors include encouraging safety climate, shared goals, encouraging employees' participation in the decision-making process and care of individual needs. The four components of transformational leadership (intellectual stimulation, personalized consideration, idealized influence, and inspiring motivation) remain focus on direct influence on followers and underestimate the complexity of organizational dynamics. Notwithstanding interesting advances, these perspectives on leadership argue direct interpersonal influence and put aside the complexity of processual and contextual nature of leadership (Dinh & Lord, 2012; Osborn & Ashforth, 1990).

2.2. COMPLEXITY LEADERSHIP

Complexity leadership theory offers a salient framework for exploring emergent leadership phenomena and leaders' adaptability to different contexts. This highly-cited and new trend of leadership research (Antonakis et al., 2014; Batistič et al., 2017) draws on complexity science. The latter studies the behavior of systems composed of a large set of interacting and coevolving agents, which produce emergent effects (Coveney, 2003). Complex systems are characterized by uncertainty, emergent dynamics, recursive causalities that largely limit prediction (Osborn et al., 2002; Uhl-Bien et al., 2007). In this perspective, leadership is no longer an act of influence over individuals but rather part of a complex web of influence among many forces; it is a dynamic, complex and interactive process (Osborn & Hunt, 2007; Uhl-Bien et al., 2007).

The literature on complexity leadership identifies three key interrelated elements of leaders' actions: managing tensions between conflicting forces, fostering organizational flexibility and adaptability, empowering followers and developing followers' adaptability through learning.

Safety leadership is defined by Wu (2008) as "the process of interaction between leaders and followers, through which leaders can exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors" (C. Wu et al., 2016, p. 790). Safety leadership in high-risk contexts implies facing non-linearity, high level of variability in outcomes, emergences due to amplifying effects and tensions between conflicting forces (Hällgren et al., 2017; Hannah et al., 2009). Complexity leadership responds to the challenge of studying leadership development as a dynamic and contingent process, but this leadership approach focuses on innovation, but overlooks the safety issues.

2.3. METHODOLOGICAL INTERROGATIONS: NEED OF AN INTEGRATIVE FRAMEWORK

In spite of important advances, safety and risk studies, literature on HROs and leadership separately provide only partial understanding of the different elements of the leadership for safety, dismissing the examination of how leadership as a process occurs within complex and high-risk organizations balancing technical, organizational and individual factors (Osborn & Ashforth, 1990). This raises a question of a rigorous method, allowing integration of these dispersed elements into a coherent framework of leadership. This issue concerns all cases of studies of the leadership embedded in specific contexts (Hannah et al., 2009), as is the case of this article's that focuses on the context of safety in high-risk environment

A complex phenomenon implying multiple level of analysis, safety leadership calls for interdisciplinary research. However, the state-of-the art knowledge on safety leadership is

domain-specific with no inter-disciplinary conversation or mutual enrichment. Even if safety and reliability research domains take into account organizational factors of safety leadership, they fail to provide deep understanding of organizational dynamics leading to safety. They tend to focus on rare event such as accidents and ignore the analysis of the day-to-day activities, so much more prevalent in organizational life (Hannah et al., 2009; Osborn & Ashforth, 1990). In face of these shortcomings, new concepts and methods are required (Hannah et al., 2009).

3. CRITICAL REALIST EPISTEMOLOGICAL FRAMEWORK FOR STUDYING LEADERSHIP AS A CONTEXT-DEPENDED ORGANIZATIONAL PROCESS

Leadership studies have been dominated by positivist and interpretivist traditions. In line with Kempster and Parry (2011), we believe that the Critical Realist epistemological framework, developed by Roy Bhaskar (1978) offers a ground for leadership research design, particularly adapted for processual and context-based approach to leadership. A growing number of researchers argue that Critical Realism could provide a coherent and robust underpinning philosophy (Carlsson, 2007; De Vaujany, 2008; Fleetwood, 2014; J. Mingers, 2004; John Mingers et al., 2013) thus resolving some long-standing theory-practice inconsistencies in positivism and interpretivism (Smith, 2006), more particularly inconsistencies about the nature of causality in the social world. Critical Realist ontology posits the existence of a world independent of our knowledge that is characterized by non-deterministic causality. This conception of the world recognizes the existence of more or less obvious causal powers, mechanisms and structures, ‘existing independently from, but capable of producing patterns of events that we observe’ (Avenier & Thomas, 2015, p. 68).

3.1. STRATIFIED VISION OF REALITY

Independent reality results from a complex interaction between observable and non-observable entities (physical, social, conceptual) owning powers and tendencies to act in a particular way, depending on contextual conditions. The operation and interaction of these activated tendencies (mechanisms and structures) generate the flow of events (Bhaskar, 1998a, 2008; Fleetwood, 2014; John Mingers et al., 2013). To understand these dynamics, Critical Realism is based on a stratified conception of the world involving three domains: the real, the actual and the empirical.

The ‘real’ domain comprises generative mechanisms and structures that have causal powers leading them to behave in particular ways under certain conditions (Bhaskar, 1978). Generative mechanisms may either be dormant for a while or may be counteracted by opposing

mechanisms (Tsoukas, 1989). The activation and interaction of causal powers and tendencies generates events that compose the 'actual' domain. Finally, the 'empirical' domain is the domain of experienced events and represents a small subset of the actual domain (Brannan et al., 2017; J. Mingers, 2004; John Mingers et al., 2013; John Mingers & Standing, 2017; Smith, 2006).

Through abductive mode of reasoning (Boisot & McKelvey, 2010; Brannan, Fleetwood, O'Mahoney, & Vincent, 2017; Mingers, 2004), researchers try to investigate the deep causal mechanisms and contextual conditions responsible for the patterns in observed events (Brannan et al., 2017).

3.2. SOCIAL STRUCTURE

In the Critical Realist approach, the relationship between the individual level (action) and collective level (structure) are apprehended in recursive way. According to Bhaskar (1998b), structures are both ever-present conditions and continually reproduced outcomes of human agency (Figure 1). Social structures have emergent properties that are irreducible to those of their constituent parts (Tsoukas, 1989). Pre-existent structures have emergent causal powers that interact with other objects, also possessing other causal powers. This interaction generates non-predictable but nonetheless explicable outcomes (M. Archer, 1998b). According to (Bhaskar, 1998b) social structures do not exist independently of the activities they govern and of the agent's conception of what they are doing in their activities (i.e. theories of activities). According to (M. Archer, 1998b), social structures refer to the differential allocation of: (1) productive resources to persons or groups, and (2) persons and groups to function and roles. Social structures also include cultural systems constituted by all things capable of being understood or known by someone (M. Archer, 1998a). In addition, (M. Archer, 1998a) outlines the existence of objective contradictions and complementarity within a cultural system. Social structures enable and constrain the actions of humans who constantly reproduce and transform them (Fleetwood, 2014).

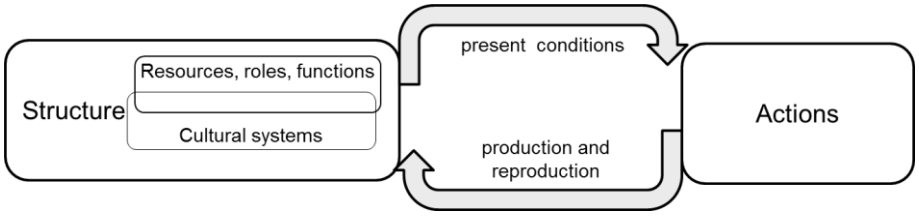

Figure 1. Dual nature of social structure

3.3. METHODOLOGICAL IMPLICATIONS OF CRITICAL REALISM APPROACH

Focused on the interaction of context, structural entities, events and their underlying generative mechanisms (Avenier & Thomas, 2015; Tsoukas, 1989; Wynn & Williams, 2012), Critical Realism highlights the role of the large and interdisciplinary literature review. Scholars propose using existing theories as part of an abduction process that may offer guidelines to build hypothetical explanations of investigated phenomena (McAvoy & Butler, 2018): 'we use what we do know to explain what we do not know' (Brannan et al., 2017, p. 24). To achieve abstraction, researchers may re-describe the components of structural entities and their interactions from existing theories in order to propose potential explanations (Wynn & Williams, 2012). A wide-ranging literature review must be undertaken in order to explore all possible explanations of similar mechanisms by different disciplines. Since Critical Realism offers a stratified view of reality - selected elements of existing literature should be reordered by levels of analysis. Critical Realism seeks theories to support the empirical data to find the abstraction of suitable mechanisms and the search for contextual effects (Kempster & Parry, 2011). Constructing an integrated theoretical framework in the Critical Realism perspective combines and redistributes dispersed elements of the contexts, structures, mechanisms and observed events (Pawson & Tilley, 1997) in order to help build potential explanations of investigated phenomena in the logic of abduction.

4. RESULTS: BUILDING AN INTEGRATIVE MULTI-DISCIPLINARY FRAMEWORK OF LEADERSHIP FOR SAFETY

4.1. A CRITICAL REALIST APPROACH TO REORGANIZING THE LITERATURE

The objective of this article is to build an integrated multi-level conceptual framework of leadership for safety adopting a Critical Realist approach. To do this, we conducted an in-depth literature review connecting diverse domains (such as, for example, high reliability organization, resilience, complexity, leadership, safety, uncertainty and risk management) and stemming from different epistemological paradigms. We identified generative mechanisms and the role of the context and social structure in their activation. This identification involves the interpretation of the existing literature with focus on causal relations that explain observable practices. This process involves distinguishing causal mechanisms from contexts and structure.

Previous literature on leadership studied leadership style adapted to enhance safety such as transformational leadership (Barling et al., 2002; R. Flin & Yule, 2004; Mark A. Griffin &

Talati, 2014; Mullen & Kelloway, 2009; Zohar, 2002a, 2002b). This literature remains focused on direct interpersonal influence and does not consider the complexity of organizational dynamics. This approach is reinforced by recent research studying leadership influence on followers through behavior-psychology lens (e.g. Christian et al., 2009; M. A. Griffin & Neal, 2000; Hofmann et al., 2003; Kines et al., 2011; Zhang & Wu, 2014; Zohar, 2002a; Zohar & Luria, 2005, etc.).

The concept of safety culture proved to be relevant for exploring the organizational dynamic (Pidgeon, 1991, 2010; Reason, 1997; Vogus et al., 2010). However, how safety and reliability values and principles are translated into collective operational behaviors remains an open question. In addition, research studying the impact of a favorable context (Dahl & Kongsvik, 2018; Rhona Flin & Fruhen, 2015; Hofmann et al., 2003; C. Wu et al., 2016; Zohar, 2002b) on safety culture fails to explain how this context influences the culture and what is the role of leadership in their development. In line with the Critical Realist approach, we argue for the necessity to explore deeper levels of reality: the interaction of the context, the mechanisms and the actions of social structures that produces and reproduces the cultural system oriented toward safety.

To sum up the literature studies leadership at different levels (see Figure 2). However, it does not explain the interactions among these levels.

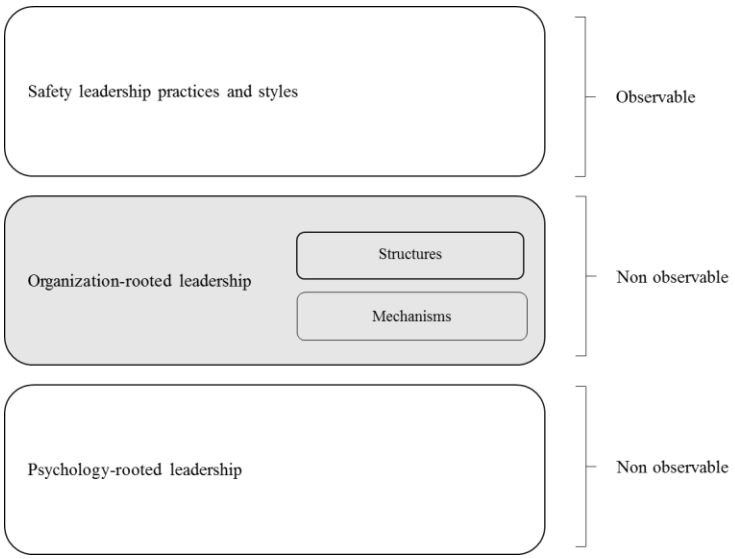

Figure 2. Layers of leadership

4.2. AN INTEGRATIVE FRAMEWORK OF ORGANIZATIONALLY-ROOTED LEADERSHIP FOR SAFETY

In line with the Critical Realist approach, described below, we undertake a "creative analysis" of existing interdisciplinary literature. We identify the possible generative mechanisms of safety leadership development from existing literature on risk, safety, HRO and leadership theories. We then integrate these different streams of literature into a comprehensive framework of leadership as a social process.

Analyzing and combining existing literature elements in an abductive manner, we found five key mechanisms of managed safety development in the context of regulated safety, namely: mobilizing a relational eco-system, awareness of risk, vigilance towards weak signals, open and flexible thinking and learning. The capacity to mobilize a relational eco-system is one of the key elements of complexity leadership theory. Awareness of risk, vigilance towards weak signals and open and flexible thinking refers to the development of mindfulness, developed in HROs literature. Learning mechanisms are linked to safety culture described by the HROs literature and to the continuous development of cognitive abilities highlighted by the complexity leadership theory.

In the Critical Realist perspective, practices and behaviors associated with managed safety are based on the activation of one or several of these mechanisms. The context activates the emergent power of social structures and the emergent powers of managed safety mechanisms; the interplay between these combined causal powers generates day-to-day practices for reliability. To discover these activation modes, it is important to understand the interaction between events, contexts, structures and mechanisms. We propose to synthesize these five mechanisms and explore the role of safety leadership processes in their activation through the following integrative framework (Figure 3).

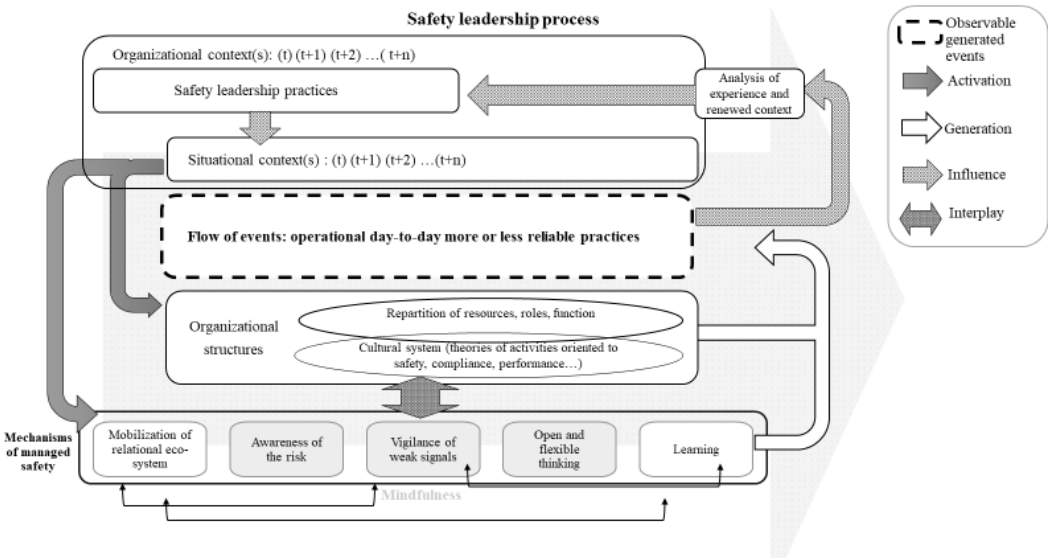

Figure 3. Integrative framework of organizationally-rooted leadership for safety

Figure 3 illustrates the interactions and embedding of theoretical concepts and their interaction with five mechanisms of managed safety within the safety leadership process. We start by presenting the deepest level of mechanisms and structures and then move up to observable elements of context and practices.

Mobilizing a relational eco-system. In complex and risky environments, understanding ambiguous and unexpected situations and finding relevant answers has become a primary function of leadership. To increase organizational adaptability, actors must be organized into a well-structured social network and must communicate with one another and with their environment. They must be bound by the goal of the common good and able to manage tensions to find and implement solutions to problems (Uhl-Bien et al., 2007). Mobilizing a relational eco-system implies understanding unexpected situations through activating the network of actors directly or indirectly involved in safety in order to manage tensions and find relevant solutions (Klein et al., 2006; Osborn & Hunt, 2007; Uhl-Bien et al., 2007). Therefore, the capacity to develop and mobilize a relational eco-system enables better understanding of stakeholders' contradictory visions and objectives as well as better resource allocation to implement suitable solutions.

Mindfulness mechanisms. Awareness of risk underlines the need to avoid over-confidence and implies alertness to possible dangers – not to 'forget to be afraid' (Reason, 1998, p. 305). Similarly, recent work in organizational psychology develops the concept of chronic unease,

defined as an attitude at individual level that increases awareness of changes in the work environment and thus facilitates risk recognition (Rhona Flin & Fruhen, 2015). Moreover, accidents do not happen suddenly - there are often prior warning signals (Weick & Sutcliffe, 2006). Vigilance to weak signals requires the ability to identify and select those that are relevant. The capacity to detect these signals in the environment refers to the quality of attention (W. Ocasio, 1997; William Ocasio, 2011). Finally, interpreting identified weak signals and formulating suitable responses require open and flexible thinking. The objective is to make sense of a panel of signals that are most relevant for the analyzed object and its context. The responses actors provide can be relatively innovative, particularly due to the reluctance to being blocked in 'routine' thinking and maintaining simplified interpretations (Weick et al., 1999).

Learning. Organizational learning is essential for safety culture consolidation and has a double objective. First, it aims to build on previous experiences, but, as March (2010) notes, learning from complex experiences is difficult and requires deliberating mechanisms. Second, organizational learning contributes to the development of operational teams' cognitive and behavioral capabilities. Enriched repertories of indicators and action allow continuous adaptability (Hällgren et al., 2017; Sutcliffe et al., 2016). Recent work highlights that leadership, that appears to play an particularly important role in learning (Brusoni & Rosenkranz, 2014; Von Krogh et al., 2012; Zohar & Luria, 2003) is still understudied. Leadership has a double role. First, it enables the development of knowledge at the individual level and second, it helps to articulate individual-level knowledge to create knowledge at the different organizational levels.

Organizational structures. These social structures refer to allocation of resources, roles and agents' functions. In addition to structural aspects, organizational structures also include cultural aspects. Safety culture should be integrated with and connected to a broader organizational culture (Hofmann et al., 2017). The cultural system consists of complementary and/or contradictory elements, namely different theories of activities oriented towards managed safety, regulated safety (compliance), performance, etc. These elements compete and influence the prioritization of one of them according to the context.

Context. By recognizing contingencies, we attribute a substantial role to wider organizational contexts (from a local work situation to a wider environment), affecting process elements. The context activates the causal powers of organizational structures and the causal powers of

managed safety mechanisms. The interplay of these causal powers generates the flow of observable events shown by more or less reliable day-to-day operational practices.

Safety leadership practices. The influence of safety leadership practices (for example, how meetings, actors' behavior, conversations, etc. are managed) intervenes to change the organizational context of operational activities. The shortcut 'leadership practices – safety culture – safety performance' lacks an understanding of the in-depth mechanisms generating reliable practices.

It is important to note that the literature and the field actors frequently focus on a detailed investigation of a cultural system oriented to safety with the assumption that controlling this level alone may be sufficient to provide reliable practices (Reason, 1997). Thus, the role of leadership is viewed as conveying relevant safety values. However, as discussed previously, research on leadership reveals that this view is incomplete. Moreover, field actors also acknowledge the need for a better understanding of complex safety leadership processes. We argue that leadership is not able to directly influence the cultural system, which is produced and reproduced by actions. The intervention of leadership can only affect the context. This context may activate the causal powers of the organizational structures and the mechanisms that interact to strengthen or neutralize each other. In line with a Critical Realism perspective, the conceptual integrative framework presented in Figure 3 combines and reorders the existing disparate literature on the safety leadership process and draws attention to the activation modes of the five mechanisms of managed safety depending on the specific context.

5. DISCUSSION AND CONCLUSIONS

In this article, we built an integrated multi-level conceptual framework of leadership development in the context of high-risk organizations, prioritizing safety. Adopting a Critical Realist approach allows to identify and reorder contributions of dispersed literature into a coherent framework in order to better understand the interactions involved in the leadership process and the ways to activate desired behaviors. This new articulation of knowledge provides a conceptual framework reflecting a renewed and more realistic view of leadership as process embedded in larger organizational dynamics, where leaders have only an indirect influence on reliable practices (the intended outcomes). We conclude this part by identifying limitations and further research avenues.

5.1. TOWARDS THE CONCEPT OF LEADERSHIP FOR SAFETY: RECONCEPTUALIZATION OF THE ROLE OF LEADERS

The epistemological approach presented provides a reconceptualization of the role of leadership captured in a particular context. The existence of in-depth mechanisms and structures indicates that there is no direct linear relationship between the way of thinking and organizational outcomes. It appears that leadership interventions can solely affect organizational contexts, which through interactions with organizational structure activates generative mechanisms. Activated mechanisms interplay amongst each other and generate observable behaviors and practices. Hence, to make leadership interventions effective, it is essential to understand generative mechanisms and their activation modes in specific contexts. This knowledge is crucial for effective leadership training. To continuously adjust their leadership safety practices, leaders should strive to understand complex organizational dynamics focused on safety. These deep-leadership interventions modify the context, which in turn may transform existing operational practices toward more reliability and safety.

Following Osborn and Ashforth (1990) we highlight the need to examine less direct and non-interpersonal means of leadership influence. The presented integrative framework brings attention to organization-rooted leadership based on a deep understanding of organizational dynamics, in our particular case aiming at improving safety. We propose the term of "deep leadership" to highlight that leadership processes are anchored in complex organizational dynamics.

5.2. A CONCRETE CONTEXTUALIZED EXAMPLE OF AN INTEGRATIVE MULTI-LEVEL FRAMEWORK OF LEADERSHIP

Organization-rooted leadership examination requires recognizing the embeddedness of leadership. As outlined by Osborn et al. (2002), leadership theory is part of a larger series of theoretical perspectives. Furthermore, our results show that studying leadership in specific contexts and/or aiming at a particular organizational goal can generate additional knowledge about leadership phenomenon in general. Typically, studying leadership in complex or extreme contexts enhances the understanding of the mechanisms and general ontology of leadership as process (Hannah et al., 2009; Osborn et al., 2002), particularly important in this context marked by difficulties to develop an appropriate organizational form (Osborn & Ashforth, 1990; Perrow, 1984). The integrative framework built to study safety leadership contributes to a further elucidation of the role of leadership as a process in complex environments.

We adopt an approach based on: 1) disassembling elements from different literature domains; 2) organizing them into discrete units (practices, mechanisms, structure); 3)

combining and re-assembling these dispersed contributions into a fuller picture. Through a Critical Realist approach, in this article we built an integrated multi-level conceptual framework of leadership development for safety. Within diverse literature domains stemming from different epistemological paradigms, we identify generative mechanisms and the role of the context and social structure in their activation. This identification involves the interpretation of the existing literature with focus on causal relations that explain observable practices. This process involves distinguishing causal mechanisms from contexts and structure. We cumulate, combine and integrate the selected elements of each literature domain in a coherent framework in order to provide a richer understanding of leadership in its specific context (Dinh et al., 2014; Hannah et al., 2009; Hofmann et al., 2017; Oc, 2018; Osborn et al., 2002).

We reordered dispersed contributions in multi-level perspective by underlying cross-level aspects of leadership development. Identified by Dinh et al. (2014) events, individual, dyadic, group, and organizational levels of analysis are reframed by focusing on generative mechanisms, structures, contexts and observable practices. Here the individual and collective levels are analyzed through the recursive action/structure lens developed by the Critical Realist approach. The framework presented in this article focuses on the explanation of how generative mechanisms of organizational structure (safety culture – organizational level) may affect individual or collective operational behaviors and generate events (observable reliable practices); or how individual leader's intervention (individual level) may affect the context (collective level), that will activate causal powers of organizational structure and mechanisms.

5.3. CONTRIBUTION - RECONCEPTUALIZATION OF THEORY-FIELD RELATION

The creation of an integrative framework allows for the recombination of existing multidisciplinary knowledge on potential generative mechanisms. The subject of leadership for resilient organizations covers a wide spectrum of literature dispersed in multiple scientific domains. Our objective is neither to identify new generative mechanisms nor to be exhaustive, but to understand how leadership practices, mediated through structure and context, activate generative mechanisms. For this purpose, we searched for theory on the different mechanisms, practices, structure and contexts in the different scientific domains. We reorganized the existing interdisciplinary knowledge into an integrative framework, capturing the underlying dynamics of leadership as process to improve organizational safety. This framework outlines the relationships between (unobservable) causal mechanisms, (partially observable) social structures, (observable) context and (observable) leadership practices that explain how

organizations perform more or less reliable (observable) practices. By focusing on relationships between the different levels, this framework provides a novel articulation and synthesis of the existing literature and thus creates new knowledge (Denyer et al., 2008).

Building an integrative theoretical framework corresponds to the first step of the Critical Realist method for exploring leadership development. This integrative framework is meant to guide subsequent empirical research. Responding to a call by Kempster and Parry (2011), it will provide the basis for gathering and structuring the data capturing the unobservable phenomena. Data will be collected on practices, social structures, contextual conditions and actors' accounts of why practices under investigation have taken place (Avenier and Thomas, 2015; Tsoukas, 1989) to retroduce and then either confirm or eliminate, or possibly identify new generative mechanisms.

The subsequent step will involve the analysis of empirical data through abductive reasoning (Avenier & Thomas, 2015; Kempster & Parry, 2011; Tsoukas, 1989; Wynn & Williams, 2012). Abductive reasoning differs from induction or deduction. Abductive theoretical explanation proceeds via the DREI process, which involves: **d**escribing the significant features of events, **r**etroducing possible causes (i.e. generative mechanisms), **e**liminating possible alternative explanations and **i**dentifying generative mechanisms at work (Avenier & Thomas, 2015; Bhaskar, 2008; John Mingers et al., 2013).

The study of safety leadership process proposed in this paper requires an adaptation of the DREI process. The following table synthesizes the different stages of the empirical study on the topic.

Table 1. Critical Realist informed approach to the safety leadership study

Step	Definition
1. Description of effective practices	1.1 Description of the effective implementation of safety practices and their contexts 1.2 Description of leadership practices, which support the implementation of safety practices
2. Description of structures	2.1 Description of formal practices and processes of safety and leadership 2.2 Description of redistribution of roles and resources 2.3 Description of cultural systems
3. Identification of generative mechanisms in the literature	Identification in the literature of generative mechanisms of safety

4. Retroduction	Identification of mechanisms which, in interaction with structures and leadership practices (contexts), explain the implementation of effective safety practices.
5. Empirical Corroboration	Making sure that the generative mechanisms of safety, identified in point 4, provide a plausible and argued explanation of all practices observed in the different cases.

The abductive case studies have the potential of providing theoretical contributions in terms of an in-depth understanding of both the modes and conditions of activating mechanisms and the ways to develop leadership to enhance safety. The objective of his paper was to provide a better understanding of the role of: 1) the deep generative mechanisms of managed safety and 2) leadership practices that activate these mechanisms. In other words, the main contribution of this article resides in a more in-depth understanding of how context-creating leadership practices, mediated by powers of organizational structure, may activate mechanisms that generate safety practices. The interactions between leadership practices/contexts/structures and their feedback over time constitute leadership process represented in the conceptual framework of this paper. A further empirical study will allow to operationalize these interactions and enrich the framework.

5.4. LIMITATIONS AND FUTURE RESEARCH AVENUES

Through the analysis and integration of a rich literature in a coherent theoretical framework, the Critical Realist approach to study the complex process of leadership for safety constitutes a significant theoretical contribution. However, this type of research has several limitations. The most important one is that Critical Realist research is difficult to implement because of the primary requirement of an in-depth, interdisciplinary study of the context.

A systematic literature review constitutes the first step of the effort to identify generative mechanisms (e.g. Tranfield et al., 2003). However, the results about modes and conditions of the activation of generative mechanisms are always context specific. Additional efforts have to be made to allow for generalization toward broader leadership contributions.

In this paper we presented leadership as process through a context-based approach. At the same time, we argued that the role of leadership is to influence organizational contexts, which are a main leverage for leadership interventions. Contextual leadership researchers have already recognized a two-way influence between context and leadership (Hernandez et al., 2011; Oc, 2018; Osborn et al., 2002; Osborn & Hunt, 2007). Osborn et al. (2002) suggest that exploring

the impact of the combined context/leadership dynamics on organizational outcomes is what researchers should focus on next. We are convinced that Critical Realism provides the most relevant epistemology to take up this challenge.

Furthermore, in this article we use specific safety leadership issues to apprehend processual and context-based character of leadership through a Critical Realist approach. The context of HRO activities has specific properties, for example, in terms of the embedded prioritization of safety and strong procedural and regulatory requirements. We encourage further research to study the leadership process that applies the Critical Realist approach in other contexts. We believe that leadership as a process should be investigated with different lenses and in different contexts characterized by emergence and recursive causality. One such example would be leadership for innovation.

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