

Vulnerabilidad Organizativa Acumulativa (VOA) / Cumulative Organizational Vulnerability (COV): Theoretical and Conceptual Framework

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Abstract

Vulnerabilidad Organizativa Acumulativa (VOA), hereafter referred to as Cumulative Organizational Vulnerability (COV), is proposed as a theoretical construct for understanding how organizational vulnerability develops in complex and digitalized environments. The construct conceptualizes vulnerability not as an isolated condition, but as a progressive and systemic process resulting from the cumulative and non-linear interaction of three interrelated dimensions: cognitive-operational demands, psychosocial-organizational conditions, and technological-digital pressures. From this perspective, vulnerability emerges over time through sustained exposure to interacting demands that gradually erode the organization's capacity to sustain effective, adaptive, and legitimate decision-making. The framework is particularly relevant in high-responsibility professional settings, such as policing, where digital transformation, technological mediation, and sustained decision pressure converge. This paper develops the conceptual architecture of the VOA/COV construct, clarifies its analytical scope, and establishes the theoretical foundation for future empirical validation and measurement.

Keywords: Cumulative Organizational Vulnerability; Vulnerabilidad Organizativa Acumulativa; Cognitive Load; Technostress; Psychosocial Risk; Digital Policing

1. Introduction

Contemporary organizations increasingly operate in environments shaped by digital transformation, accelerated information flows, and growing decision complexity. In such contexts, vulnerability cannot be adequately understood as the result of isolated failures, individual limitations, or punctual organizational stressors. Instead, vulnerability may develop progressively through the sustained interaction of multiple demands that, over time, erode the adaptive capacity of both professionals and institutions.

This dynamic becomes particularly visible in high-responsibility organizational settings, such as policing, where professionals are exposed simultaneously to cognitive overload, psychosocial pressures, and technology-mediated decision environments. Despite the growing relevance of these combined demands, existing research has often addressed them in a fragmented manner, separating cognitive workload, psychosocial risk, and technostress into distinct analytical domains (Bakker & Demerouti, 2007; Salanova et al., 2020).

In response to this limitation, this paper introduces the construct of Vulnerabilidad Organizativa Acumulativa (VOA), hereafter referred to as Cumulative Organizational Vulnerability (COV), as an integrative theoretical framework. The construct seeks to explain how organizational vulnerability emerges not from a single factor, but from the cumulative and non-linear interaction of three core dimensions: cognitive-operational demands, psychosocial-organizational conditions, and technological-digital pressures.

From this perspective, vulnerability is conceptualized as a progressive and systemic process rather than a static condition. It accumulates over time through the continuous exposure to interacting demands, reaching critical thresholds at which the organization's capacity to sustain effective, adaptive, and legitimate decision-making becomes compromised. This approach allows for a more comprehensive understanding of organizational fragility in complex and digitalized environments.

The aim of this paper is to establish the theoretical and conceptual foundations of the VOA/COV construct. Specifically, it defines its core dimensions, clarifies the dynamic logic underlying their interaction, and outlines the analytical scope of the model. While the present work does not provide empirical validation, it lays the groundwork for future research focused on the operationalization and measurement of cumulative organizational vulnerability.

This article is situated within a broader and sequential research program aimed at developing the construct of Cumulative Organizational Vulnerability (COV/VOA) from its conceptual formulation to its empirical validation and applied implementation. In this context, the present study corresponds to the initial theoretical stage, focused on defining the construct, its core dimensions, and its underlying dynamic logic. Subsequent phases of the research will involve the operationalization of the construct through validated measurement instruments, its empirical testing in specific organizational contexts, and its integration into governance-oriented and early-warning systems. Therefore, this paper does not aim to provide empirical evidence at this stage, but rather to establish the conceptual foundations necessary for the progressive development of the model.

2. Defining Cumulative Organizational Vulnerability (VOA/COV)

Cumulative Organizational Vulnerability (COV), originally conceptualized as Vulnerabilidad Organizativa Acumulativa (VOA), is defined as a systemic and progressive phenomenon that emerges from the sustained interaction between cognitive demands, psychosocial conditions, and complex technological environments. This interaction generates a gradual erosion of the organization's capacity to sustain effective, adaptive, and legitimate decision-making processes.

The construct is grounded in a dual conceptual logic. First, it is **cumulative**, in the sense that vulnerability does not arise instantaneously, but develops through the progressive accumulation of unresolved tensions and demands over time. Second, it is **emergent**, meaning that vulnerability cannot be attributed to any single dimension in isolation, but rather arises from the dynamic convergence of multiple interacting factors.

From this perspective, vulnerability is not conceived as an episodic condition or a discrete failure, but as a dynamic process of organizational degradation. This process unfolds through continuous exposure to interacting demands that, when sustained, progressively compromise the organization's functional capacity. As such, the construct shifts the analytical focus from isolated risk factors to systemic processes of accumulation and interaction.

Importantly, COV does not reside exclusively at the individual level, nor can it be fully explained by organizational structure or technological systems alone. Instead, it is located at the intersection of these domains, where cognitive-operational demands, psychosocial-organizational conditions, and technological-digital environments continuously interact. This relational positioning allows for a more comprehensive understanding of vulnerability as a multi-dimensional and non-linear phenomenon.

This conceptualization is particularly relevant in contemporary organizational settings characterized by digital transformation and technological mediation. In such contexts, traditional approaches to organizational risk may fail to capture the cumulative and systemic nature of vulnerability, making it necessary to adopt integrative frameworks such as COV to better understand and anticipate processes of organizational degradation.

3. Core Dimensions of the Construct

The Cumulative Organizational Vulnerability (COV) construct is structured around the interaction of three core dimensions: cognitive-operational, psychosocial-organizational, and technological-digital. Each dimension captures a distinct yet interrelated domain of organizational functioning, and their combined dynamics explain the emergence of cumulative vulnerability in complex and digitalized environments.

3.1. Cognitive-Operational Dimension

The cognitive-operational dimension refers to the demands placed on cognitive processes involved in decision-making within complex operational environments. It encompasses factors such as cognitive load (Hart & Staveland, 1988), multitasking, interruptions, time pressure, and informational complexity, all of which influence the capacity of professionals to process information and make effective decisions.

In high-demand contexts, sustained exposure to these factors may lead to cognitive saturation, fragmentation of attention, and degradation of decision-making quality. From the perspective of COV, this dimension captures how the progressive accumulation of cognitive demands can undermine the organization's operational effectiveness. As such, it reflects a gradual erosion of the capacity to sustain coherent, timely, and accurate decision-making under pressure.

3.2. Psychosocial-Organizational Dimension

The psychosocial-organizational dimension refers to the structural and relational conditions within the organization that shape well-being, motivation, and the capacity to sustain performance over time. It includes elements such as psychological demands, control over work, social support, recognition, job insecurity, and role conflict, as conceptualized in established models of psychosocial risk (Karasek, 1979; Bakker & Demerouti, 2007).

These factors influence not only individual well-being but also the broader organizational climate in which decision-making processes take place. Within the COV framework, this

dimension captures the extent to which the organizational environment supports or undermines the professional's capacity to cope with sustained demands. When psychosocial conditions deteriorate, the organization's ability to maintain stable and adaptive functioning is progressively weakened, contributing to cumulative vulnerability.

3.3. Technological-Digital Dimension

The technological-digital dimension refers to the impact of digitalization and technological mediation on organizational processes, decision-making, and control structures. It includes phenomena such as technostress, hyperconnectivity, technological dependency, information overload, and the increasing use of opaque or complex systems, including artificial intelligence (Tarafdar et al., 2007; Salanova et al., 2020).

This dimension highlights how technology not only supports organizational functioning but also reconfigures it, introducing new forms of pressure, uncertainty, and dependency. Within the COV framework, technological environments act as amplifiers of both cognitive and psychosocial demands. The sustained exposure to technologically mediated pressures contributes to the accumulation of vulnerability, particularly when systems lack transparency, accountability, or adequate human oversight.

4. Dynamic Interaction and Cumulative Logic

The explanatory strength of the Cumulative Organizational Vulnerability (COV) construct lies not only in the identification of its core dimensions, but in the dynamic and cumulative logic through which these dimensions interact over time. Rather than operating as independent or linearly related factors, the cognitive-operational, psychosocial-organizational, and technological-digital dimensions form an interconnected system characterized by continuous interaction and mutual reinforcement, in line with systemic and multi-demand organizational approaches (Bakker & Demerouti, 2007).

From this perspective, vulnerability is not produced by the isolated intensity of a single dimension, but by the sustained convergence of demands across multiple domains. The interaction between dimensions is inherently non-linear, meaning that small increases in pressure within one domain may produce disproportionate effects when combined with stressors in other domains. As a result, vulnerability emerges as a systemic outcome rather than as the direct consequence of a specific variable.

A central feature of the COV framework is its cumulative nature. Organizational vulnerability develops progressively through repeated exposure to interacting demands that are not adequately absorbed or regulated by the system. Over time, this accumulation generates a gradual degradation of organizational capacity, affecting decision-making processes, operational performance, and institutional legitimacy. Importantly, this degradation may remain partially invisible until critical thresholds are reached, at which point its effects become significantly more evident.

The concept of thresholds is particularly relevant in this context. The model assumes that vulnerability does not increase in a smooth or continuous manner but may instead intensify abruptly once certain limits are exceeded. These threshold effects reflect the systemic nature of the construct, where the interaction between dimensions amplifies the impact of accumulated pressures. Consequently, the organization may transition from a state of relative stability to one of compromised functioning in a non-linear and sometimes unpredictable way.

This dynamic and cumulative perspective allows for a more comprehensive understanding of organizational vulnerability in complex environments. By emphasizing interaction, accumulation, and threshold effects, the COV framework moves beyond static and reductionist approaches, offering a systemic interpretation of how vulnerability is generated and sustained over time.

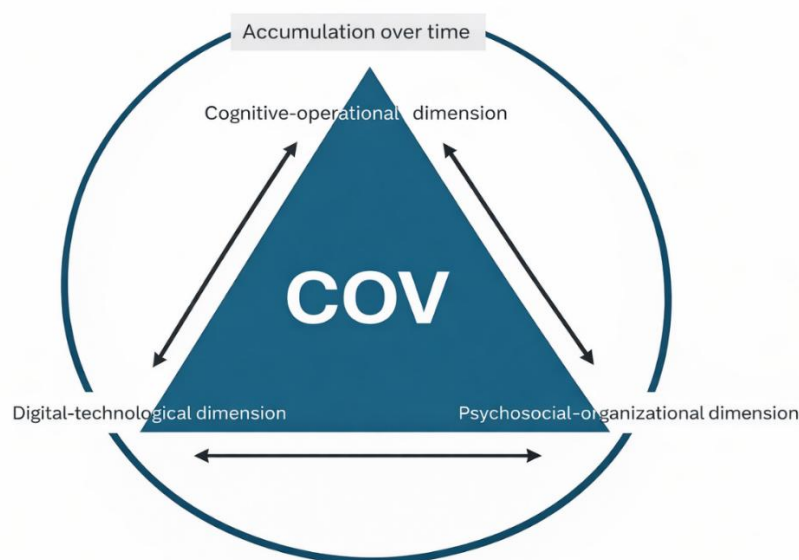


Figure 1. Conceptual model of Cumulative Organizational Vulnerability (COV) (Rodríguez Otiñano, 2026).

5. Analytical Scope and Future Empirical Validation

The Cumulative Organizational Vulnerability (COV) construct is conceived as an analytical framework designed to support the interpretation of complex organizational dynamics, rather than as a prescriptive model or a direct decision-making tool. Its primary function is to provide a structured lens through which the cumulative effects of interacting cognitive, psychosocial, and technological demands can be understood and assessed.

In this sense, COV does not incorporate governance or decision-making mechanisms within its core definition. Instead, it serves as a foundational construct upon which subsequent models of analysis, interpretation, and organizational intervention may be developed. This distinction is particularly relevant in contexts where advanced analytical approaches, such as explainable artificial intelligence, may be applied to support decision-making processes based on the patterns identified through the construct.

The framework also establishes the basis for future empirical validation and operationalization. Each of the three core dimensions identified in the model can be associated with validated measurement instruments that capture specific aspects of organizational functioning, including cognitive load, psychosocial conditions, and technostress. Through the integration of these measurement approaches, it becomes possible to construct composite indicators capable of reflecting the cumulative nature of organizational vulnerability.

Future research will focus on the development and validation of such indicators, with the aim of translating the conceptual model into measurable variables. This process will enable the identification of patterns, thresholds, and risk profiles associated with cumulative vulnerability in real organizational settings. In particular, the empirical application of the construct will make it possible to explore its relevance in high-responsibility environments characterized by sustained decision pressure and technological mediation.

Ultimately, the COV framework is intended to bridge the gap between theoretical conceptualization and empirical analysis, providing a coherent basis for the development of evidence-informed approaches to organizational risk assessment and management in complex and digitalized contexts.

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