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Towards a Military Risk Taxonomy: Bridging Risk Science and NATO Doctrine

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This paper presents the development of a military risk taxonomy designed to bridge risk science with NATO's planning and decision-making processes. Drawing on qualitative analysis of NATO doctrines, directives, extensive non-participant ethnographic observation and interviews across seven headquarters, the study addresses misalignment between risk management theory and operational application. A taxonomy was developed that classifies risk-related factors into challenges, modifiers, and opportunities, providing a structured framework compatible with existing processes. Practitioner feedback from NATO planning experts provided preliminary support for the taxonomy's conceptual clarity, intuitive logic, and operational relevance, while emphasizing the need for doctrinal integration, linguistic precision. The taxonomy represents a pragmatic synthesis of risk science and professional praxis to enhancing NATO's capacity to recognize and assess risk within complex operational environments. It thus contributes to advancing the practical application of risk science in military planning and decision-making.

Keywords: Doctrine, Risk Management, Taxonomy, NATO.

1. Introduction

One of the late environmental philosopher Nils Faarlund tenets was 'Language is the instrument of thought, when words become dull, our thinking dulls as well'[a]. Our research into NATO's risk management has revealed tensions in how risk is conceptualized, its management is framed and communicated (Solli and Borrie 2025a; Solli and Borrie 2025b; Solli and Borrie 2025c). All of which demonstrated a need to 'sharpen' terminology to unify thinking of the basics of risk and its management. There are several practitioner-oriented understandings of risk in use today (Aven et al. 2018; Aven 2023), and there appear to be developed several risk related taxonomies. These focus on a subset of risk such as risk identification and cyber risks (Britos et al. 2006; Rabitti et al. 2025). One could argue that standards (International Standards Organization 2018), and the Society for Risk Assessment's (SRA)(Aven et al. 2018), glossary and models and conceptual framework developed by researchers serve as taxonomies of risk. However, it is questionable as to whether these are appropriate for military planning and decision-making. This paper, a part of NATO Supreme Allied Commander Transformation endorsed doctorate project, aims to develop a taxonomy of Risk for military practitioners. Grounded in fundamentals, concepts, and knowledge of risk science, while remaining cognizant of contextual and professional requirements, this study aspired to contribute to the application of risk science to specific contexts. This study built on previous research in this project and current risk science theory to build a taxonomy of risk useful for military practitioners

2. Theoretical and Professional Context

2.1. *Theoretical foundation*

Clarity of language and terminology is essential in order to achieve the rigorous standard to which science aspires (Winther 2015). The variance in etymology of risk from the 'dawn of human agency' to the elaborate academic discussions underpinning risk science demonstrates that clarity of terminology and definitions are equally important in the multi-disciplinary field of risk science (Aven 2025; Cline 2004). There are numerous definitions of risk in use. These are argued by Aven (2023) to for the most part fit within the same conceptual understanding of risk

[a] 'Språket er tankenes redskap – er ordene sløve, blir tankene sløve'

being the 'consequences of the activity with associated uncertainties' (C, U) (Aven et al. 2018, 4; Aven and Thekdi 2022, 11). This definition is accepted as the capstone conceptualization of risk. To describe the risk concept the (C, U) presentation is elaborated to (A', C' Q, K) with A' being a specific set of events, C' a selected range of potential consequences, Q the assessment of uncertainty and K represents the knowledge that A',C' & Q are based upon (Aven and Thekdi 2022). Furthermore, it is accepted that risk management is 'all activities to address risk' (Aven and Thekdi 2022, 201) and risk assessment is cognitive work, susceptible to cognitive bias. Such as being unjustifiably influenced by how issues are framed resulting in psudocertainty (Slovic, Fischhoff, and Lichtenstein 2000; Tversky and Kahneman 2018). Reinforcing the importance of clarity in terminology.

2.2. *Professional Context*

The North Atlantic Treaty Organization / Organisation du Traité de l'Atlantique Nord (NATO / OTAN) consisting of 32 member states, some of which have more than one official language, have made English and French its two official languages. This fact ads to the justification of this papers focus on precision in terminology. NATO military praxis is shaped by a layered governance structure of authoritative texts. At the top, capstone and keystone doctrines set out fundamental principles (NATO 2022). These are operationalized through directives and Standard Operations Procedures (SOP). While doctrine aims for conceptual alignment, directives and SOPs often diverge, creating inconsistencies in how risk is defined and applied across NATO (Solli and Borrie 2025c). The planning process is linear, while the decision-making process us cyclical. Where the first develops an operations design the latter steers and adjusts an operation based on the operations design (NATO 2019a; NATO 2019b; Solli and Borrie 2025a; Solli and Borrie 2025b). A more detailed presentation of these processes can be found in our referenced Risk Beyond Doctrine papers.

3.Methods of Research

This study draws on a qualitative analysis of NATO authoritative documents and empirical material from NATO headquarters. The documentary corpus comprises NATO capstone and keystone doctrines, relevant directives, and SOPs. Empirical material includes extensive non-participant ethnographic observation of NATO praxis conducted across seven headquarters during large-scale command post exercises, amounting to more than 800 hours of observation, as well as 27 semi-structured interviews with practitioners and decision-makers. For brevity the empirical data is not elaborated upon in this paper, but for interested readers a more nuanced description of the empirical data and the deductive and inductive coding can be found in our Risk Beyond Doctrine papers (Solli and Borrie 2025a; Solli and Borrie 2025b).

The analysis conducted to enable the taxonomy development proceeded in three steps; First identifying key terms central to risk science and NATO's planning and decision-making processes. Second, tracing their use and meanings across NATO authoritative documents and practical application. Finally, comparing these findings to reveal areas of alignment, divergence, or omission. This provided the foundation for synthesizing a pragmatic compromise-based taxonomy. The method is therefore aiming to produce a profession specific usable taxonomy nested within risk science rather than a universal taxonomy of risk. To enhance the study's rigor, a group of seven NATO subject-matter experts (SME) was invited to review the developed taxonomy. Their feedback was analyzed qualitatively and thematically coded to identify areas of support, cautionary concern, criticism, and recommendations for refinement.

3.1. Development of a Taxonomy

Classification and hierarchical structuring have since its introduction in the field of biology, by Carl Nilsson Linnaeus in 1735, motivated researchers to develop taxonomies aiding the understanding and analysis of complexity. As for any effort to structure and model complexity it is quite possible that it simplifies reality in a way that has negative consequences. The practice of developing taxonomies is therefore not without its fair share of criticism (Nickerson et al. 2013; Witteveen 2020). The taxonomy development for this paper utilized the pragmatic methodology developed by Nickerson et al. (2013) and illustrated in Figure 1. After determining the guiding foundation in meta-characteristics (1) and

the end condition (2) the developer is faced with a choice of inductive or deductive approach (3).

The deductive approach has a conceptual starting point, while the inductive approach is based on empirical data. Step four to six therefore exist in two versions. The deductive approach begins by conceptualizing (new) characteristics and dimensions (4C), then examine objects that fit (5C), before it create (revise) the taxonomy. The inductive approach first identify (new) subset of objects (4E), then identify common characteristics and group objects (5E), before it groups these into dimensions to create (revise) the taxonomy. Step seven is regardless of approach a check of the current state of the taxonomy satisfies the end conditions. If no, the developers loop back to step three and once again decide what approach to use for the next iteration of the process (Nickerson et al. 2013). Section 3.2 specifies how this method was applied.

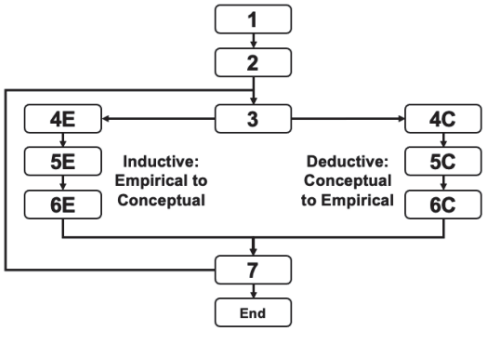


Figure 1 – The Taxonomy Development Method as presented by Nickerson et al. (2013, 345)

3.2. *How the taxonomy was developed*

The following meta-characteristic was derived from the study's aim of reconciling risk science with NATO decision-making practice: How risk-related phenomena may shape potential consequences that materially influence military planning and decision-making. The method further requires explicit end conditions as a mechanism to prevent infinite iteration (Nickerson et al. 2013). Accordingly, one objective and one subjective end condition were defined. The objective end condition was met when no additional dimensions could be included that in a distinct way could shape potential consequences relevant to military planning and decision-making. The subjective end condition was met when further refinement was assessed to increase analytical complexity without proportionate gains in planning and decision-making for military operations. The development proceeded through multiple iterations of steps three to seven, alternating between approaches leveraging risk science and the empirical data. This hybrid approach leveraged both an established risk science foundation for conceptual understanding and a substantial empirical dataset drawn from NATO professional practice as demonstrated in section 4. Conceptual risk constructs were initially confronted with empirical material, after which empirically derived categories were re-examined against established risk science concepts. This iterative oscillation was intended to ensure both conceptual coherence and practical relevance. A methodological pitfall in developing taxonomies grounded in professional practice is confirmation bias, either by insufficiently challenging established theory or by overfitting to observed praxis. By alternating between inductive and deductive iterations, this pitfall was actively managed, although it cannot be fully eliminated.

4. Findings and Taxonomy Reasoning

The following data from the overall research project is presented for its influence on the taxonomy development. Observations across multiple headquarters during large-scale command post exercises, interviews with planners and decision-makers, suggest that risk-related reasoning is embedded primarily within established analytical and procedural activities rather than within stand-alone risk assessment practices. Processes that are compatible with ISO 31000 and Aven and Thekdi's framework for risk management. The planning process develops linear plans of synchronized activities scheduled to achieve a given mission, while decision-making processes focus on correcting sequencing, tempo, resources, and reprioritizing forces and activities in order to steer the operation as conditions evolve. Across observed headquarters and interviews, this temporal and control-oriented focus shaped how potential consequences were recognized and addressed in practice. Notably testing sequencing, balancing forces and assets with elaborate wargames was praised for its importance for risk awareness. The planning relies on a series of prescribed sub-processes. The

intelligence process identifying and analyze actors, factor analysis explores relevant factors, and center of gravity analysis identify critical requirements, capabilities, and vulnerabilities. Subsequently, course of action development utilizes these analyses by developing ways to employ available resources to counter envisaged adverse consequences and generate and exploit opportunities in pursuit of mission objectives. Collectively, these activities were observed to address many elements typically associated with risk identification, analysis and treatment, albeit without being connect to the formal risk management. Despite this extensive analytical effort within the overall processes, interviewees frequently characterized risk analysis as superficial. Several described formal risk assessments as 'PowerPoint deep'. This was supported by observations from the headquarters.

Interview data further indicated uneven levels of formal training and conceptual understanding of risk across ranks and staff functions. Concerns were expressed regarding 'risk literacy', observing that factors relevant to comprehensive risk assessment such as timing, exposure, duration, and enabling or constraining conditions were often identified through standard planning analyses but not explicitly recognized or treated as components of risk. Instead, these factors were primarily used to refine sequencing and coordination of activities, rather than to systematically develop potential consequences. Explicit risk assessment activities were observed to occur through a combination of ad hoc nomination of 'risks' and small-group brainstorming focused on what might go wrong, rather than through systematic analytical integration. Additionally, the extent to which course of action development was informed by preceding risk assessments varied. As demonstrated in detail in previous research the interviewed personnel did mostly agree that all the planning and decision-making activities contribute to risk management. However, this is not formalized on in doctrine or praxis (Solli and Borrie 2025a; Solli and Borrie 2025b).

During every iteration of the taxonomy development the written sources and empirical data was revisited. Again, for brevity, table 1 only contain findings related to terms included in the final version of the taxonomy.

Table 1 – Synthesis of Terms

Term & Definition
Accelerate*: Increase of speed at which operational conditions or environmental factors evolve.
Duration*: Critical temporal variable that defines how long actions and conditions last, shaping risk and operational tempo.
Enablers*: Supporting capabilities and conditions that allow the force to function, generate effects, and achieve operational and strategic objectives.
Exposure*: The condition of being subject to factors such as threats, hazards that affect risk to force and mission
Hazard*: Non-intentional source of risk such as environmental or systemic condition that can cause harm to NATO forces, assets, or objectives
Resources*: Assets, authorities, and supporting elements that enable the force to plan, conduct, and sustain operations.
Superiority*: Relative advantage, physical, informational, cognitive, or temporal that allows one to act effectively while constraining or degrading the adversary's ability to act.
Threat: Actors or entities who possess intent, capability and capacity to obstruct or destroy NATO troops, material or mission - Intelligence doctrine (AJP-2)
'The potential adverse consequences of risk' - Operations doctrine (AJP-3)
Potential cause of harm or adverse effect to the mission, forces, or assets. - General understanding*
Timing*: Choosing the moment to act or synchronizing actions and effects to gain advantage, maintain initiative, and achieve objectives.
Vulnerability*: Susceptibility to harm caused by threats and hazards capable of generating adverse consequences for the force, mission, or institution.

** The descriptions of these terms are inferred from their use the source documents*

Observations and interviews revealed variation in how risk was conceptually understood. This variation was observed to influence whether planning factors were treated as inputs to analysis of risk or merely as contextual background for operational control and synchronization. Some

interviewees expressed concern with how difficult they found it to be for staff to identify develop and assess opportunities.

4.1. *A Synthesized Military Risk taxonomy*

The taxonomy analysis and development process supported synthesis of a military specific taxonomy (Figure 2). The taxonomy organizes risk-related phenomena according to how they shape potential consequences relevant to military operations. It is intended as a descriptive synthesis of observed and documented practice aligned as much as reasonably possible with risk science and clarifying contradictions in NATO's current terminology. The analysis and logic of the taxonomy underpinning Figure 2 are presented in the following sub-sections.

4.1.1 *Identifying the gap from which to start*

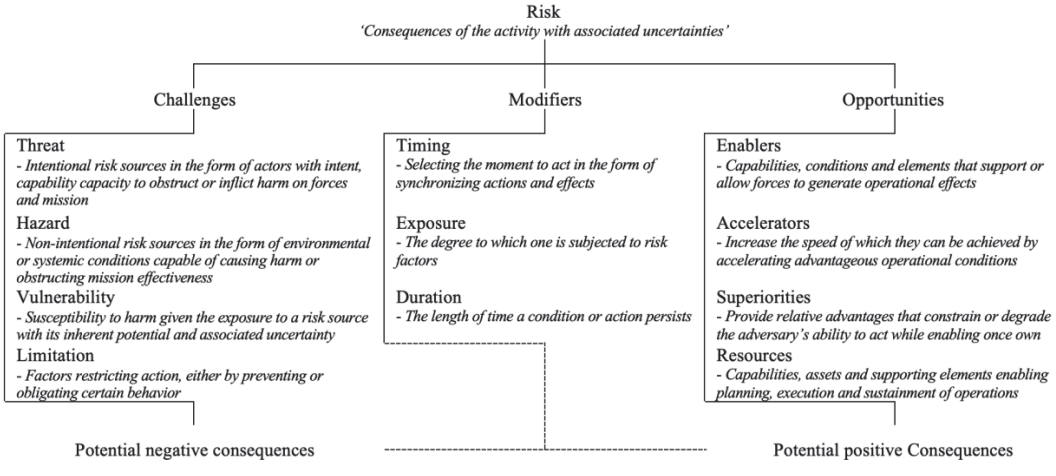
The initial deductive approach started with the capstone concept revealed that the concept does not distinguish between negative and positive consequences. Furthermore, how to get from events A' to the potential consequences C' was not described. Subsequent inductive analysis revealed that, while NATO did distinguish between negative and positive potential consequences, its planning and decision-making processes did not explicitly guide an analytical development of the potential consequences C'. Figure 2 Shows a Risk Taxonomy where this is resolved with explicit differentiation between positive and negative consequence pathways.

4.1.2 *Risk vs Opportunity*

NATO often places risk and opportunity, as separate concepts at opposite ends of a continuum within doctrine, despite one doctrine based on ISO 31000 explicitly stating that 'risk with positive potential is opportunity,' while 'risk with negative potential is threat' (NATO 2019b, D-1). From a scholarly perspective this confusion of terms is conceptually problematic. While it is equally problematic for practitioners. The Oxford Dictionary defines opportunity as 'a time when a particular situation makes it possible to do or achieve something' (Hornby 2020, 1089). While this definition also involves uncertainty, it is narrowly focused on positive outcomes. Risk, however, encompasses the full spectrum of possible outcomes, by acknowledging that all actions have consequences, and these consequences are inherently uncertain. Therefore, the binary opposition between risk and opportunity as proposed in most NATO doctrines is flawed. Opportunity should instead be considered a subset of risk. Specifically, one associated with beneficial potential. If risk is not the true opposite of opportunity, is threat?

Threat is generally defined by military intelligence by two core elements: the capability to cause harm and the intent to do so (NATO 2020). If risk were to be split into two subcategories; opportunity and threat, this framework would encounter significant challenges in a military context, particularly due to the constrained nature of the concept of threat. The

Figure 2 – Risk Taxonomy for NATO planning and decision-making processes



SRA glossary reinforces this view by incorporating intent into its definition of threat (Aven et al. 2018). Yet, hazards which also can cause harm are not typically framed in terms of intent, highlighting the distinction between threat and hazard (Aven et al. 2018; Hornby 2020). Therefore, it is more logical to treat both threats and hazards as risk factors subordinate to a classification of risk that is in opposition to opportunities. Rather than having threat, hazard and opportunity as coequal coordinate classifications. An alternative term is challenge, which can be understood as a condition, task, or situation that tests the capacity, skill, or resilience of an individual or system, requiring adaptive effort in response to uncertainty or adversity (Hornby 2020). Introducing challenge as the opposing correlate to the opportunity classification restores balance to the taxonomy. Unlike threat, which presupposes opposition, or hazard, which implies passivity, challenge denotes a dynamic encounter: an obstacle that tests capability. In this sense, challenge and opportunity stand as epistemic mirrors. Two modes of engaging with uncertainty, one through resistance, the other through possibility. Furthermore, challenge is not already included in NATO doctrine and risk management terminology, reducing the obstacles of implementing it in the taxonomy. Challenge serves the same role for potential negative consequences as opportunity does for positive ones.

While challenge and opportunity respectively represent the negative and positive valences of risk, there exist a set of factors that influence the magnitude, and direction of both. These can be classified as modifiers, factors that act upon risk elements without belonging exclusively to either category. Based on the presented scientific definition of risk and the argument that consequences evolve contextually rather than existing as static attributes, modifiers are understood as situational determinants that amplify or attenuate risk across the spectrum of potential outcomes. In operational contexts, such modifiers like timing, duration, and exposure exerts influence over the interplay between consequence and uncertainty: the timing of an action can convert an opportunity into a challenge or vice versa; prolonged duration may either consolidate superiority or deepen vulnerability; and exposure defines the degree to which one is subject to risk factors. Introducing modifiers as a third classification between Challenges and Opportunities therefore allows for a more coherent and symmetrical taxonomy of risk. One that recognizes not only the variance of potential outcomes but also the factors that modulate their contextual evolution and time.

4.2. *Practitioner feedback*

The NATO SMEs who critically assessed the taxonomy praised its ability to improve nuance and analytical depth, while leveraging exciting NATO processes in an intuitive and logical way. The taxonomy's potential to address a void between doctrine and operational art was raised. The novelty of the modifiers classification and its perceived potential of utility was particularly valued. However, several cautioned the importance of ensuring compatibility with existing processes and the importance of tailoring the tools to the generational differences amongst the practitioners which echoed the introduction to this paper´s point of clarity in language and definitions. One respondent cautioned against allowing scientific precision to undermine practical applicability. Adding experience as a factor to the modifiers classification was recommended by one officer. While another suggested changing the exposure factor to intensity and removing the limitation factor. It was also addressed how contemporary digital tools can aid the analytical process based on the taxonomy. Collectively, the SME's assessment described the taxonomy as a conceptually mature, operationally credible, and promising framework.

5. Discussion

The following discussion assesses the practical suitability of the taxonomy for real-world use. It represents a pragmatic compromise between risk science and NATO's processes. Inherent in any compromise between theory and practice there are strengths and limitations. The main limitation is that it captures only part of what risk science offers in conceptual and technical knowledge. Specifically, it addresses the identified gap from A' (events) to C' (potential consequences) in Aven and Thekdi's framework. Not incorporating the Q and K of the risk description, the taxonomy does not conflate development of potential consequences and the analysis of said consequences. Arguably important for NATO to consider, though must be addressed by NATO's

risk analysis. Nevertheless, the taxonomy can move NATO closer to risk science while retaining operational applicability. The presented impression of shallow risk analysis may be due to the lack of connection between risk analysis and the other sub-processes. An issue the proposed taxonomy can help to alleviate by strengthening the Alliance's capacity to identify, assess, and appreciate risk within existing processes. Leveraging existing NATO analyses enhance both effectiveness and nuance. However, if the taxonomy is implemented without sufficient integration or training, it may add complexity and confusion to NATO's understanding of risk.

Within the A′–C′ relationship described earlier, the classification nuance demonstrates how the taxonomy structures both negative and positive potential consequences consistently. The classification of opportunities as a distinct set of risk factors linked to the development of potential positive consequences directly addresses concerns raised by interviewees regarding the difficulty of identifying and developing opportunities. However, it can be argued that resources might also constitute a relevant risk factor under the challenges classification. A lack of resources cannot reasonably be expected to contribute to opportunities, nor can an adversary's surplus of resources. A counterargument is that such imbalances are already captured under the taxonomy's vulnerabilities and threats factors, respectively. This suggests that the taxonomy's current structure provides sufficient differentiation between opportunity development and challenge factors, while still maintaining conceptual coherence across the framework.

The SMEs overall supportive attitude, though a positive sign, does not qualify as formal validation of the taxonomy. It does however give reason to assume that formal validation is plausible, if proper integration can be achieved. It also indicates that the taxonomy resonates with existing planning heuristics resulting in cognitive compatibility experienced as intuitiveness. The taxonomy encourages the practitioners to draw risk factors from existing processes which could also contribute to this experience of intuitiveness and increase effectiveness. The criticism directed at the problem of integration of science and practice is to be expected. The alignment of risk science and NATO practice, would probably be impossible to do without such questions raised by practitioners. Similarly, concerns from risk scientists that the taxonomy deviates from established risk science is also to be expected. Bridging risk science and military doctrine requires a pragmatic balance between conceptual rigor and operational usability. Several of the SMEs did however caution the importance of ensuring effective implementation and integration into the existing planning and decision-making processes. A valid point that may require adaptation of terminology, process, training, and tool design. The suggestion to remove limitation factor from the challenge characterization would simplify the application of the taxonomy by reducing complexity. It would also leave the taxonomy without a counterbalance to the opportunity classification's resources factor. The inclusion of experience as a modifiers factor may be conceptually appealing but difficult to apply consistently. Experience is challenging to assess objectively. Nevertheless, its relevance is evident but context-specific. If Brazilian and Norwegian soldiers were to operate in the Amazon, the Brazilians' experience with jungle warfare would amplify their superiority and the Norwegians' vulnerability, whereas the opposite would be true in Arctic environments.

6. Conclusion

This study developed a military risk taxonomy that bridges the conceptual rigor of risk science with the practical demands of NATO's planning and decision-making processes. By synthesizing theoretical constructs with empirical insights, the taxonomy provides a structured and coherent framework for understanding how risk-related factors shape potential consequences in military operations. The resulting classification offers a balanced representation of both negative and positive potential outcomes, leveraging existing processes to reduce duplication of effort, while introducing analytical depth previously absent in NATO's formal risk management. Feedback from subject-matter experts provided preliminary support for the taxonomy's clarity, alignment with existing processes, and practical relevance, while emphasizing the need for proper integration. Future work should therefore focus on formal validation, integration within NATO's analytical tools and strengthen both the analytical quality and usability of the risk taxonomy across defense contexts.

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