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Editor's Note:

Knowledge Battle Model (KBM) in Cognitive, Information, and Hybrid Warfare: Explaining the Transformation from Data to Meaning in the Architecture of Information Warfare

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Abstract

Purpose: This Editor's Note aims to explain the transformation in the nature of contemporary warfare and to introduce the Knowledge Battle Model (KBM) as a conceptual framework for understanding conflicts in the era of cognitive, informational, and hybrid warfare. The model argues that modern conflicts increasingly extend beyond physical battlefields into a multilayered architecture of knowledge that includes data, information, knowledge, cognition, and meaning. Within this framework, the Knowledge Battle Model conceptualizes knowledge as both the arena and the instrument of strategic confrontation, while the ultimate objective of adversaries is often the production and expansion of ignorance within the target society through distortion of perception, disruption of analytical capacity, and manipulation of meaning.

Methodology: The editorial adopts an analytical–interpretive approach grounded in the literature on cognitive warfare, information warfare, network-centric warfare, and hybrid warfare. By synthesizing major scholarly perspectives and examining conceptual developments in contemporary conflict studies, the study constructs the theoretical foundations of the Knowledge Battle Model (KBM). The framework conceptualizes conflict as a knowledge-centered continuum extending from data to meaning and analyzes the relationships among these layers in shaping strategic influence and informational dominance in networked conflicts.

Findings: The analysis indicates that strategic power in the contemporary networked world is increasingly rooted in the control and management of knowledge processes. Control over data flows, the organization and interpretation of information, the production of analytical knowledge, the shaping of perceptions, and the construction of narratives constitute key dimensions of modern strategic competition. Within the Knowledge Battle Model (KBM), these dynamics are structured across five interconnected layers: data battle, information battle, knowledge battle, cognitive battle, and meaning battle. These layers together form an integrated architecture through which actors attempt to influence perception, guide decision-making processes, and shape collective interpretations in the target society.

Conclusion: The study concludes that contemporary warfare should be understood as competition within the architecture of knowledge. The Knowledge Battle Model (KBM) demonstrates that success in modern cognitive and informational conflicts depends not only on military capabilities but also on the ability to dominate the knowledge cycle, from data acquisition to the construction of social meaning. Therefore, strengthening national resilience in the networked age requires reinforcing data governance, analytical knowledge production, cognitive literacy, and strategic narrative management.

Value: The originality of the Knowledge Battle Model (KBM) lies in its integration of concepts from information science, knowledge studies, cognitive science, and security studies into a unified analytical framework. By conceptualizing warfare as a multilayered competition across the knowledge architecture, the model provides a novel perspective for analyzing information and cognitive conflicts and offers a conceptual basis for future interdisciplinary research and knowledge-centered policy development in the field of hybrid warfare.

Keywords: ***Knowledge Battle Model (KBM), Information Warfare, Cognitive Warfare, Hybrid Warfare, Knowledge Architecture, Information Ecosystem, Narrative Construction, Knowledge-Research Studies***

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1-Introduction

In recent decades, rapid advances in information and communication technologies, the expansion of digital networks, and the growing reliance on data-driven infrastructures have profoundly transformed many fundamental concepts in the fields of security, politics, and international relations. Among the concepts most significantly affected by these developments is the notion of warfare. Whereas classical military thought primarily understood war as the organized confrontation of armed forces within a physical geographic space, this understanding has increasingly been challenged in the contemporary information age. The emergence of cyberspace, the increasing complexity of communication systems, and the expanding role of data and information in political and military decision-making indicate that many contemporary conflicts unfold in domains that extend far beyond traditional physical battlefields (Libicki, 2007; Nye, 2010).

In recent security studies literature, this transformation has been described through a variety of concepts, including information warfare, network-centric warfare, cognitive warfare, and hybrid warfare. Scholars in these fields have demonstrated that in many contemporary conflicts, dominance over data and information flows, the ability to shape perceptions, and the capacity to manage narratives and interpretive frameworks can influence outcomes as much as, if not more than, conventional military capabilities (Alberts, Garstka, & Stein, 1999; Hoffman, 2007; Libicki, 2007). Consequently, the battlespace of modern conflict is no longer limited to physical geography; it increasingly encompasses information networks, media environments, knowledge systems, and the cognitive processes through which individuals and societies interpret events.

Within this evolving environment, knowledge and its foundational components, data, information, knowledge, cognition, and meaning, have emerged as central elements of power and competition. These elements not only underpin decision-making processes but also constitute the primary arenas in which strategic rivalry unfolds. A growing body of scholarship suggests that many contemporary geopolitical competitions are structured around the control and organization of knowledge flows: competition over the collection and analysis of data, the management of information infrastructures, the production of authoritative knowledge, the influence over public perceptions, and ultimately the construction of dominant narratives and interpretive frameworks (Castells, 2010; Nye, 2010).

From this perspective, knowledge can no longer be understood merely as a neutral resource for analysis and decision-making. Rather, it increasingly functions as a strategic domain of competition in its own right. The processes through which raw data are collected, organized, interpreted, cognitively processed, and ultimately transformed into socially meaningful narratives form a multilayered architecture through which power is exercised and contested.

Despite these developments, the existing literature in security and conflict studies still lacks an integrated conceptual framework capable of explaining how these various domains, from raw data to social meaning, interact within a unified analytical continuum. Existing bodies of research tend to focus on only one part of this phenomenon. The literature on network-centric warfare emphasizes information connectivity and informational superiority; studies of information warfare concentrate on influence operations and the manipulation of data and communication systems; research on cognitive warfare focuses on perception and mental influence; and the literature on hybrid warfare highlights the strategic

integration of military and non-military instruments. However, the analytical relationships among these different layers remain insufficiently theorized.

This conceptual gap is particularly significant because contemporary conflicts increasingly unfold across five interconnected layers of knowledge:

• Data level: the collection and monitoring of raw signals and measurements, as well as the extraction of patterns from sensor-based observation systems.

• Information level: the organization, processing, and directional flow of data in ways that produce structured and usable informational patterns.

• Knowledge level: the systematic interpretation, analysis, and modeling of information in order to generate analytical frameworks and strategic understanding.

• Cognition level: the processes of perception, attention, bias formation, and cognitive judgment that shape how individuals and groups interpret information and make decisions.

• Meaning level: the construction and contestation of narratives and interpretive frameworks through which actors define reality, identity, and legitimacy.

Taken together, these layers form a knowledge continuum that extends from the generation of raw data to the production of socially shared meanings. Understanding contemporary conflict therefore requires analytical attention to how competition unfolds across this entire continuum and how developments at one layer influence processes at others.

This editor's note seeks to address this theoretical gap by drawing on insights from security studies, information science, and knowledge studies. It proposes a conceptual framework referred to as the Knowledge Battle Model (KBM), which aims to explain how contemporary conflicts can be understood as a series of interconnected battles across the five layers of knowledge: data, information, knowledge, cognition, and meaning. The model assumes that each layer constitutes a distinct arena of competition while simultaneously forming part of a chain-like architecture in which developments in one layer shape and transform dynamics in the others.

Accordingly, the remainder of this text proceeds as follows. First, the broader transformation of warfare toward knowledge-centered domains is introduced. Second, the historical evolution of warfare from industrial military confrontation toward information-based and cognitive forms of conflict is examined. Third, the emerging battlespaces across the continuum from data to meaning are analyzed. Finally, the Knowledge Battle Model (KBM) is presented as a conceptual framework for understanding these transformations. The broader objective is to establish a shared analytical vocabulary for examining contemporary warfare and to provide a foundation for expanding interdisciplinary research on knowledge-based conflicts.

2-Problem Statement: Contemporary Warfare and the Question of Knowledge

The rapid expansion of digital technologies, communication networks, big-data systems, and advanced information-processing tools in recent decades has fundamentally transformed the nature of war and security competition. While military power in the industrial era rested primarily on hardware superiority, industrial capacity, and logistical strength, a significant part of contemporary geopolitical rivalry now unfolds in domains that are inherently

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knowledge-centered. Under such conditions, control over information flows, the ability to analyze data, and the capacity to shape human perception have become critical sources of power (Nye, 2010; Libicki, 2007).

This transformation is not merely a shift in the tools of warfare; it represents a deeper conceptual reconfiguration in the very understanding of what war is. In many modern conflicts, competition begins not on the physical battlefield but within the multilayered processes of knowledge production and organization. The collection of data through sensors and surveillance systems, the processing and structuring of information within digital networks, the production of analytical knowledge to support decision-making, the shaping of human cognition and judgment, and ultimately the construction of narratives and interpretive frameworks, all have become central arenas of rivalry among state and non-state actors.

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Within the security studies literature, each of these dimensions has been examined under concepts such as network-centric warfare, information warfare, cognitive warfare, and hybrid warfare. For example, network-centric warfare emphasizes connectivity and information superiority (Alberts, Garstka, & Stein, 1999), while information-warfare studies focus on influence operations, deception, and manipulation of information flows (Libicki, 2007). Cognitive-warfare approaches examine mechanisms for shaping perception, belief, and decision-making (Nye, 2010; Claverie & du Cluzel, 2022), and hybrid-warfare literature highlights the synergy among military, informational, political, and media instruments in contemporary conflict (Hoffman, 2007; Hoffman, 2014).

Despite these advancements, existing literature has tended to examine these fields in isolation. As a result, there is still no comprehensive conceptual framework capable of explaining these various dimensions within a single analytical continuum. In particular, the systematic connections among the layers of knowledge, ranging from data to meaning, remain largely neglected.

Yet contemporary conflicts unfold simultaneously across multiple layers of knowledge. At the lowest level, competition occurs over the collection and control of raw data generated by signals, measurements, and sensors. At the next level, data are organized, processed, and transmitted, transforming into information, making information flows a crucial domain of strategic competition. At the knowledge level, analysis and modeling of information generate systematic understanding and provide the basis for strategic decision-making. At the cognitive level, human perception, attention, cognitive biases, and judgment play a decisive role in interpreting information and choosing courses of action (Kahneman, 2011). Finally, at the level of meaning, narrative and interpretive frameworks emerge through which reality, identity, and legitimacy are defined and contested.

One of the central challenges in analyzing contemporary warfare, therefore, is the absence of a model that can explain these interconnected layers within a unified conceptual architecture. Without such a framework, the analysis of information and cognitive warfare becomes fragmented, and it becomes difficult to fully understand the interactions among data, information, knowledge, cognition, and meaning.

On this basis, the key problem addressed in this editor's note is as follows: How can the transformation of contemporary warfare be analyzed through a knowledge-centered framework, and how might the mechanisms of competition

across the various layers of knowledge production and interpretation be explained? Put differently, if today's conflicts unfold across multiple knowledge layers, what model can conceptualize these layers and their interactions as interrelated battlespaces?

To address this question, this article introduces a conceptual framework termed the Knowledge Battle Model (KBM). The model proposes that modern conflicts can be understood as a set of interconnected battles across five layers of knowledge, data, information, knowledge, cognition, and meaning, and seeks to explain the interactions among these layers within the broader architecture of information and cognitive warfare.

In the next section, the historical transformation in the understanding of war will be reviewed to clarify the theoretical background of this discussion.

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3-The Historical Evolution of Warfare toward Informational and Cognitive Domains

The transformation of warfare over the past two centuries has followed a gradual yet profound historical trajectory. This process began with industrial wars grounded in hard military power and has progressively evolved toward contemporary forms of information, cognitive, and hybrid warfare. This shift has not merely resulted from changes in military technologies; rather, it reflects deeper transformations in the structures of knowledge, technology, and communication (Castells, 2009). Examining this historical genealogy is essential for understanding the architecture of knowledge in contemporary warfare, as it reveals how conflict gradually expanded from physical battlefields to domains such as data, information, knowledge, cognition, and meaning.

3-1-The Industrial Era: War as the Battle of Physical Forces

During the nineteenth and early twentieth centuries, warfare was primarily defined by industrial capacity, logistical capability, and conventional military power. The battlefield was associated with clearly defined geographic territories, organized armies, supply chains, artillery systems, and heavy weaponry. The nature of war in this period was fundamentally material and centered on the destruction of the adversary's physical capabilities. Knowledge during this stage existed mainly in the form of traditional military expertise and played a relatively limited role in determining the overall outcome of war.

3-2-Electronic Warfare and the Signal Age: The Entry of Data into the Battlefield

From the 1950s onward, with the emergence of radar technologies, sensor systems, and signal-based surveillance infrastructures, warfare entered a new phase in which data became a strategic resource. Electronic countermeasures, signal interception, electromagnetic tracking, and electronic jamming demonstrated that controlling sensor-generated data could directly influence military operations. This stage marked the beginning of what can be described as the Data Battle in modern warfare: a domain of competition centered on the collection, filtering, and pattern extraction from raw data.

3-3-The Information Revolution: The Emergence of Information Warfare

The technological developments of the 1980s and 1990s, particularly the expansion of digital networks, satellite systems, and high-speed computing, gave rise to the era of Information Battle. The 1991 Persian Gulf War is frequently cited as a defining example of this transformation, in which precise intelligence, digital

mapping technologies, and advanced command-and-control networks played a decisive role in shaping military outcomes.

During this period, military operations became organized not solely around firepower but increasingly around the speed, accuracy, and processing of information. Libicki (2007) characterizes this period as a transition from "battles over territory" to "battles over information flows." Similarly, Toffler and Toffler (1993) describe this shift as a movement from material resources toward informational and knowledge-based resources. In this context, information was no longer merely a supporting instrument of warfare but emerged as a central element of strategic power.

3-4-The Networked World: Network-Centric Warfare and the Architecture of Knowledge

By the early 2000s, the concept of network-centric warfare became formally established within military theory (Alberts, Garstka, & Stein, 1999). In this framework:

• networks constitute the primary infrastructure of power;

• data and information circulate continuously across interconnected systems;

• actors can influence or control physical battlefields through informational superiority.

At this stage, knowledge assumed a central role. Analytical interpretation, explanation, and modeling of patterns became essential components of decision-making processes. Military effectiveness increasingly depended not only on possessing information but also on transforming that information into systematic knowledge capable of guiding strategic choices. Within the framework of the Knowledge Battle, analytical capabilities and knowledge architectures thus became key instruments of strategic advantage.

3-5-Cognitive Warfare: The Human Mind as the Battlefield

From the mid-2010s onward, the rapid expansion of social media platforms, advances in neuroscience, developments in artificial intelligence, and the rise of automated content systems introduced a new stage in the evolution of warfare commonly described as Cognitive Battle.

At this stage, human cognitive processes, such as perception, attention, memory, bias, and judgment, became primary arenas of strategic competition. The ability to shape collective perceptions, selectively amplify information, manage attention, and activate cognitive biases has become a crucial dimension of contemporary conflicts. As Nye (2010) emphasizes, power in the contemporary era increasingly rests on the ability to shape perceptions rather than merely control material resources.

3-6-Narrative Warfare: Meaning as the Battlefield

Recent geopolitical developments, including the war in Ukraine, strategic competition between the United States and China, conflicts in the Middle East, and the recent imposed war against Iran, demonstrate that strategic competition increasingly occurs at the level of meaning. In the framework of the Knowledge Battle Model (KBM), this corresponds to the domain of Meaning Battle.

At this level, actors compete over the definition and interpretation of:

• reality

• identity

• legitimacy

• dominant interpretive frameworks

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Narratives have thus become strategic instruments. The construction, dissemination, and contestation of narratives now form an integral component of contemporary strategic operations.

3-7-The Final Transition: From Hard War to Knowledge-Based Warfare

Taken together, these historical developments indicate that warfare has gradually shifted from the destruction of an adversary's physical capabilities toward attempts to disrupt, control, or dominate the architecture of knowledge itself.

This historical trajectory is precisely what the Knowledge Battle Model (KBM) seeks to conceptualize in a structured manner. Within this framework, contemporary warfare can be understood as a series of interconnected battles across five knowledge layers:

• Data Battle , competition over raw data generated by sensors and signals

• Information Battle, competition over the processing and flow of information

• Knowledge Battle, competition over analytical frameworks and decision architectures

• Cognition Battle, competition over perception, attention, and cognitive judgment

• Meaning Battle, competition over narratives and interpretive frameworks

This evolutionary trajectory demonstrates that contemporary warfare unfolds across interconnected layers ranging from data to meaning, and each of these layers possesses the capacity to shape the overall direction and outcome of conflict.

3-8-The Need for a New Model

In light of this historical transition, existing scholarly literature, from network-centric warfare to cognitive warfare, explains only specific aspects of the phenomenon. None of these approaches integrates all five layers within a single conceptual architecture that also accounts for the interactions between them. This gap is precisely what the Knowledge Battle Model (KBM) is designed to address.

4-New Battlespaces: From Data to Meaning

The transformation of warfare in the information age has expanded the battlespace from purely physical domains to far more complex layers of knowledge. In this context, competition among actors no longer occurs solely in terms of weaponry or material military capabilities; rather, it now unfolds across multiple layers of knowledge production, processing, and interpretation (Kaldor, 2012). In other words, contemporary warfare can be understood as a constellation of simultaneous competitions across the layered continuum of knowledge, beginning with raw data and extending all the way to the construction of narratives and interpretive frameworks.

The Knowledge Battle Model (KBM) conceptualizes this process through five analytical layers: Data, Information, Knowledge, Cognition, and Meaning. Each layer possesses its own structure, logic, and mechanisms of competition, while also interacting dynamically with the others to form the overall architecture of knowledge in modern conflict.

4-1-Battle at the Data Layer: Collection, Monitoring, and Pattern Extraction

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The most fundamental level in the architecture of knowledge is the Data Layer, where the raw material for all subsequent knowledge processes is generated. In Knowledge Management and Information Science literature, data refers to raw observations, signals, or measurements that have not yet been organized into meaningful structures (Davenport & Prusak, 1998). However, in contemporary warfare, data is no longer a passive input or a technical artifact; it has become a strategic resource and a primary determinant of power. The ability to collect, store, analyze, and exploit data is now one of the core indicators of advantage on the battlefield.

In traditional warfare, situational awareness was acquired primarily through field reconnaissance, human intelligence, or limited signal interception. But in modern conflicts, the digital revolution and the proliferation of surveillance systems have turned the battlespace into a dense network of sensors and data-driven infrastructures. Reconnaissance satellites, UAVs, radar systems, electronic sensors, communications metadata, and even social-media–generated data now constitute crucial sources of wartime information. This has given rise to what some analysts term a sensor-centric battlespace, in which military superiority is directly linked to an actor's capacity to observe and monitor the environment (Alberts, Garstka, & Stein, 1999).

Competition in the Data Battle thus revolves around several core dimensions:

• Access to data: the ability to collect vast amounts of raw data from operational environments, adversaries, and target societies.

• Control of data: ownership, protection, and retention of collected data.

• Data quality: accuracy, completeness, and reliability, critical, as degraded or manipulated data can lead to strategic failure.

• Data analysis: the extraction of patterns, anomalies, and predictive signals from large datasets, particularly through AI and machine learning.

• Data disruption: attempts to corrupt, distort, or deny an adversary's data through deception, false signals, or sensor manipulation.

Indeed, the value of data in modern warfare lies increasingly in pattern recognition and predictive analytics. Machine-learning systems can detect behavioral trends, identify hidden networks, and anticipate threats(Mayer-Schönberger & Cukier, 2013). This makes the Data Layer the first battlespace in the KBM: the domain in which actors compete to "see the world more accurately." Superiority at this layer forms the foundation for advantage in all higher layers, Information, Knowledge, Cognition, and Meaning.

4-2-Battle at the Information Layer: Processing, Organization, and Direction

Along the knowledge continuum, the Information Layer is the point at which raw data becomes structured, processed, and usable for decision-making. Information is generated through processes of selection, classification, prioritization, and contextual organization. While information science defines information simply as "processed data," this definition is insufficient to capture the strategic complexity of modern information warfare (Davenport & Prusak, 1998).

In contemporary conflict, the Information Battle centers on controlling informational flows, shaping situational awareness, and determining what is highlighted, muted, or excluded. This is where information operations emerge,

operations designed to influence an adversary's decision-making by manipulating the informational inputs that feed their cognitive processes (Libicki, 2007).

If the Data Layer is the domain of "collection," the Information Layer is the domain of "direction."

Key dimensions of this battlespace include:

a) Processing and selection: architects of situational awareness

From massive volumes of data, only select elements evolve into operationally meaningful information. Processing systems, algorithms, and command-and-control structures determine which data becomes relevant.

b) Controlling information flows: regulating cognitive inputs

Actors compete to control:

• filtering
• prioritization
• amplification or suppression
• information traffic
• denial of access to critical material

This mirrors theories of agenda-setting and Salience in Media and Communication Studies (McCombs & Shaw, 1972).

c) Disinformation, misinformation, and malinformation

Wardle and Derakhshan (2017) refer to these as the "Information Disorder Triad," which seeks to destabilize informational integrity and degrade decision-making (Libicki, 2021).

d) Information saturation

A strategy aimed at overwhelming adversaries with an excess of information, real or fabricated, to induce analytical paralysis (Toffler, 1993).

e) Information dominance

The ultimate objective of this layer, achieved when an actor:

• possesses a more accurate operational picture;
• controls informational flows;
• conceals critical data from the adversary;
• and steers decision-making environments.

f) Organizational and human factors

Unlike the data layer, which is primarily technological, the information layer merges technology with organizational structures: command centers, analysts, communication bodies, and human judgment, all central actors in the Information Battle.

The Information Layer therefore constitutes the battlespace in which actors compete not only for what is known but for how knowledge becomes visible, prioritized, and actionable. It also serves as the strategic bridge to the upper layers of Knowledge, Cognition, and Meaning, core to the KBM's architecture.

4-3-Battle at the Knowledge Layer: Knowledge Production, Epistemic Superiority, and Decision Architectures

Within the KBM, the Knowledge Layer represents the stage at which information is transformed into structured understanding, analytical frameworks, and systematic interpretations. Knowledge is not merely an accumulation of information; rather, it constitutes conceptual understanding shaped by experience, context, theoretical frameworks, and interpretive reasoning (Davenport & Prusak, 1998).

In modern warfare, the significance of this layer has grown dramatically. If the Information Layer describes the control of informational flows, the

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Knowledge Battle concerns the competition to produce authoritative analytical frameworks and decision architectures.

Key components of this battlespace include:

a) Transforming information into knowledge

Knowledge emerges through the integration of structured information with contextual interpretation, expertise, and organizational learning (Nonaka & Takeuchi, 1995). Intelligence reports, strategic assessments, and predictive models are primary outputs of this level.

b) Strategic knowledge production

Institutions such as think tanks, research centers, universities, and policy-analysis units play crucial roles in shaping epistemic understandings of security and conflict (Haas, 1992). Knowledge production becomes a geopolitical resource.

c) Analytical frameworks and epistemic paradigms

Competing frameworks, such as hybrid warfare, network-centric warfare, or cognitive warfare, shape how reality is interpreted and thus directly influence strategic choices (Hoffman, 2007).

d) Organizational learning and strategic adaptation

Military institutions rely on after-action reviews, doctrinal reforms, and accumulated experience to refine their operational knowledge (Argyris and Schon 1995).

e) Knowledge networks and epistemic soft power

In a globalized world, knowledge circulates within transnational networks of scholars, experts, and policy practitioners (Castells, 2010; Nye, 2010). Engagement in these networks constitutes a form of epistemic power.

f) Dimensions of the Knowledge Battle

- Knowledge production capacity
- Strength of epistemic institutions
- Effectiveness of analytical frameworks
- Organizational learning capability
- Participation in transnational knowledge networks
- Internal and external credibility of produced knowledge

In sum, the Knowledge Layer is where information is transformed into the stable epistemic foundations that define the operational environment. This layer determines how reality is understood, modeled, and predicted, and thus plays a decisive role in shaping strategic outcomes.

4-4-Battle at the Cognition Layer: Perception Engineering, Cognitive Biases, and the Battle for Judgment

The Cognition Layer is where knowledge interacts with human mental processes and is operationalized through perception, interpretation, and judgment. Here, the central issue is not the availability of knowledge but rather how human actors perceive and interpret it. This has led many scholars to argue that contemporary conflict increasingly resembles cognitive warfare, a form of competition aimed at influencing minds directly (Claverie & du Cluzel, 2020).

Key mechanisms of the Cognition Battle include:

a) Perception as a battlefield

Human perception mediates the experience of reality. Cognitive operations seek to shape this interpretive lens, particularly through media, psychological operations, and tailored messaging.

b) Cognitive biases

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As Kahneman (2011) demonstrates, cognitive biases establish systematic vulnerabilities in decision-making. Adversaries can exploit:

• confirmation bias
• availability heuristic
• framing effects
• anchoring biases
• motivated reasoning

c) Psychological operations and perception engineering

These operations target emotions, motivations, and belief systems, aimed at altering public attitudes, elite perceptions, and strategic judgments (Castells, 2010).

d) Attention architecture

In a digital environment, attention is a scarce resource. Algorithms and media platforms shape what is visible, thereby influencing collective cognition (Davenport & Beck, 2002).

e) Strategic decision-making

Decision outcomes derive from cognitive interpretations. Thus, cognitive warfare seeks to reshape decision pathways even without kinetic force.

f) Dimensions of the Cognition Battle

• Perception formation
• Cognitive vulnerability and bias exploitation
• Psychological operations
• Attention control
• Strategic judgment and decision-shaping

In the Cognition Layer, victory means reshaping how actors perceive threats, interpret information, and make decisions.

4-5-Battle at the Meaning Layer: Narratives, Interpretive Frameworks, and the Struggle to Define Reality

The Meaning Layer represents the deepest level of the KBM continuum, where cognition, knowledge, and information are embedded within broader interpretive frameworks. Meaning determines:

• how events are interpreted,
• which identities are legitimized,
• and which actions are morally justified.

Drawing on Berger and Luckmann's (1967) theory of the social construction of reality, meaning is understood as a collectively produced interpretive structure.

Key mechanisms include:

a) Narratives as tools of meaning-making

Strategic narratives define actors, interpret events, and project future visions (Miskimmon et al., 2014).

b) Interpretive framing

Framing highlights particular aspects of reality to shape interpretation and preference formation (Entman, 1993).

c) Language and symbolic power

Political discourse constructs reality; terminology such as "resistance," "liberation," "terrorism," or "humanitarian intervention" carries ideological weight (Fairclough, 1995).

d) Legitimacy construction

Meaning determines political and moral legitimacy (Nye, 2010).

e) Dimensions of the Meaning Battle

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• Production of strategic narratives
• Competing interpretive frameworks
• Discursive and linguistic contestation
• Symbolic mobilization
• Legitimacy acquisition
• Narrative dissemination

Victory at this layer means defining the dominant interpretation of reality itself.

4-6-The Continuum of Knowledge Battles

Taken together, the five layers constitute a knowledge continuum:

• Data → Information → Knowledge → Cognition → Meaning

Each layer depends upon the previous one while maintaining its own logic. Data enables information; information becomes knowledge; knowledge shapes cognition; and cognition crystalizes into meaning. This continuum mirrors foundational theories in Knowledge Management and Sociology of Knowledge (Nonaka & Takeuchi, 1995; Davenport & Prusak, 1998).

From this perspective, contemporary warfare is a multilayered competition across the very architecture of knowledge. Understanding this continuum is essential for analyzing information and cognitive wars. It forms the conceptual foundation for the Knowledge Battle Model (KBM).

5-The Architecture of Information Warfare and the Role of Knowledge Battles

In recent decades, the concept of information warfare has become one of the central themes in the literature of security and military studies. The rapid expansion of digital networks, data-driven systems, global communication infrastructures, and large-scale data analytics has transformed information into one of the most critical sources of power in contemporary conflicts. Under such conditions, many scholars have emphasized that superiority in modern warfare is no longer determined solely by hard military capabilities; rather, it increasingly depends on the ability of actors to collect, process, analyze, and control information (Alberts, Garstka, & Stein, 1999; Libicki, 2007).

Within the literature on information warfare, this transformation is often described as a transition from force-centric and firepower-based warfare to information-centric warfare. In this framework, information is not merely a supporting tool for military operations but has become a core component of strategic power. The capacity to achieve information superiority, manage communication networks, and influence the flow of information can play a decisive role in shaping the outcomes of conflicts. The concept of network-centric warfare emerged precisely in this context, emphasizing that the connectivity of information networks and the effective flow of data can significantly enhance the efficiency and effectiveness of military operations (Alberts, Garstka, & Stein, 1999).

However, a closer examination of contemporary conflicts reveals that informational competition is not limited to communication infrastructures or data flows alone. What increasingly characterizes modern conflicts is the expansion of competition into deeper layers of knowledge production and interpretation. Data, information, knowledge, cognition, and meaning form a sequential chain of epistemic processes, and each of these layers can function as a distinct arena of strategic competition.

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From this perspective, information warfare should not be understood merely as competition over information itself, but rather as competition over the architecture of knowledge. This architecture consists of a set of interconnected layers that begin with the generation of raw data, evolve through processes of processing and analysis into knowledge, are interpreted through human cognitive mechanisms, and ultimately become stabilized in the form of narratives and interpretive frameworks. Each of these levels plays a distinct role in the formation of epistemic power and can therefore become an independent domain of strategic contestation.

At the lowest level of this architecture lies data. Data are the raw outputs of observation and measurement systems and are typically generated through signals, metrics, and sensors. In many contemporary security and military systems, extensive sensor networks, from reconnaissance satellites to digital monitoring platforms, continuously generate data about operational environments. These data possess a raw and unstructured character prior to processing or interpretation, yet they form the fundamental basis for higher layers of knowledge.

Once data are generated, these raw inputs undergo various processes of organization and processing through which they are transformed into information. At this stage, data are converted into usable patterns through operations such as processing, structuring, analysis, pattern recognition, and framing. The resulting information may appear in the form of reports, messages, analytical outputs, or operational intelligence that supports decision-making. Consequently, in many contemporary conflicts, the ability to control information flows and to process data rapidly and accurately has become a critical strategic advantage (Libicki, 2007).

However, information alone is not sufficient for a comprehensive understanding of the strategic environment. At a higher level, information becomes knowledge through deeper analysis and modeling processes. Knowledge refers to a systematic understanding of phenomena that emerges through the analysis of patterns, the explanation of relationships, and the modeling of trends. This layer plays a crucial role in the formulation of strategies and major policy decisions because knowledge enables actors to anticipate developments, identify opportunities, and assess the potential consequences of actions. In the context of the Knowledge Battle Model (KBM), this layer corresponds to the Knowledge Battle, where actors compete in the production of analytical frameworks, explanatory models, and strategic interpretations of complex realities.

Nevertheless, even knowledge does not fully determine outcomes without considering the role of human mental processes. At the cognitive level, information and knowledge are interpreted through mechanisms of perception, attention, cognitive bias, and judgment. Human actors do not receive information in a neutral or purely objective manner; rather, they interpret it through the lens of prior beliefs, values, and experiences. Consequently, cognitive perceptions and interpretive judgments can play a decisive role in shaping how actors understand situations and make decisions. In the KBM framework, this domain constitutes the Cognition Battle, where actors attempt to influence perception, attention, and decision-making processes.

At the highest level of this architecture lies meaning. Meaning emerges through narratives and interpretive frameworks that determine how events are understood, who is perceived as responsible, and which actions appear legitimate or illegitimate. In many contemporary conflicts, the primary competition is not

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merely over the control of information but over the construction of these interpretive frameworks. Actors attempt to shape how audiences perceive events by producing specific narratives and framing interpretations that influence public opinion and political decision-making. This domain corresponds to the Meaning Battle, in which actors compete to define reality, identity, and legitimacy through narrative structures and symbolic interpretation.

Accordingly, the architecture of information warfare can be understood as a multi-layered continuum extending from data to meaning. Within this continuum, each level both influences and is influenced by the others. Data provide the raw material for information; information enables the production of knowledge; knowledge is interpreted within cognitive processes; and these interpretations ultimately become stabilized in the form of narratives and meaning.

Furthermore, feedback relationships exist among these layers. Dominant interpretive frameworks can influence how information is interpreted and even which data are considered relevant. Similarly, cognitive biases may affect how information is analyzed and how knowledge is produced. These interactions demonstrate that the knowledge architecture of contemporary warfare is not a simple linear process but rather a dynamic network of epistemic processes that continuously interact with one another.

Within such a framework, contemporary warfare can be understood as a set of simultaneous competitions across different layers of knowledge. Actors may compete at the data level for access to information resources; at the information level for control over communication flows and infrastructures; at the knowledge level for the production of superior strategic analysis; at the cognitive level for influence over perceptions and judgments; and finally at the meaning level for the construction of dominant narratives.

Understanding this epistemic continuum provides the theoretical foundation for introducing the concept of knowledge battles. If contemporary conflicts unfold across multiple layers of knowledge, then each of these layers can be conceptualized as a distinct arena of strategic competition. In other words, the architecture of information warfare can be interpreted as a set of interconnected battlegrounds extending from data to meaning.

On this basis, it becomes possible to speak of Knowledge Battles, battles in which actors compete to control, direct, and interpret the various elements of knowledge. These battles rarely occur in isolation; rather, they typically unfold simultaneously and interactively. For example, manipulation of data can lead to the production of misleading information; misleading information can distort knowledge analysis (Floridi, 2014); distorted analyses can reshape cognitive perceptions; and this process can ultimately generate particular narratives about reality.

Therefore, a more comprehensive understanding of information warfare requires analyzing these layers of knowledge and their interactions within a coherent conceptual framework. Such a framework can clarify how knowledge-based competitions emerge across different levels and how these levels collectively constitute the architecture of contemporary information warfare.

In the next section, building upon this epistemic continuum, a conceptual framework titled the Knowledge Battle Model (KBM) will be introduced. This model seeks to demonstrate how the five layers of Data, Information, Knowledge,

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Cognition, and Meaning can be understood as interconnected arenas of knowledge battles within the architecture of contemporary warfare.

6-Knowledge Battle Model (KBM)

Based on the discussions presented in the previous sections, one of the most significant transformations in the nature of contemporary warfare can be described as the gradual shift of primary arenas of conflict from purely physical domains to knowledge-centered domains. The expansion of data infrastructures, information networks, knowledge-analysis systems, digital media environments, and complex mechanisms for shaping collective perception has led many strategic competitions to unfold within different layers of knowledge. Under these conditions, actors compete not only for control over geographical territories or material resources, but also for control of data flows, direction of information, production of strategic knowledge, influence over cognitive processes, and construction of dominant narratives.

Despite this transformation, the existing literature on information warfare, cognitive warfare, and hybrid warfare still lacks a conceptual framework capable of explaining these multiple layers of knowledge within a coherent and systematic architecture. Much of the existing research focuses on only one of these domains, for example, informational superiority in network-centric warfare, information operations in information warfare, or psychological influence in cognitive warfare. However, relatively few models attempt to explain the relationships among these levels within an integrated analytical system.

The Knowledge Battle Model (KBM) is proposed as an attempt to address this theoretical gap. The model is based on the assumption that contemporary conflicts can be analyzed as a set of interconnected battles occurring across different layers of knowledge. These layers include five principal levels: Data, Information, Knowledge, Cognition, and Meaning. Each of these levels is not only a stage in the transformation of data into meaning but also functions as an independent arena of competition, where actors struggle to control, shape, and interpret the elements of knowledge.

Within this framework, the architecture of knowledge is conceptualized as a layered structure. This architecture begins with the lowest level, data, moves through information and knowledge, reaches the level of cognition, and ultimately stabilizes at the level of meaning. Along this pathway, each layer both draws upon the layers beneath it and influences the layers above it. Consequently, the Knowledge Battle Model is not merely a linear chain of transformation from data to meaning; rather, it represents a dynamic system of interactions among different levels of knowledge, in which feedback processes also play a significant role.

One of the important conceptual features of this model is the deliberate use of the term “battle” rather than the more general term “war.” In the literature of military studies, the concept of war typically refers to a broad category or domain of warfare, for example, information warfare, cyber warfare, or cognitive warfare. Such terms generally denote overall forms or strategies of exercising power. In contrast, the concept of a battle refers to specific arenas of competition within a war, spaces in which actors directly compete for advantage.

The Knowledge Battle Model relies precisely on this conceptual distinction. The objective of the model is not simply to describe a type of warfare such as information warfare or cognitive warfare. Instead, its purpose is to identify specific arenas of competition within the architecture of knowledge. For this

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reason, each level of knowledge is defined as an independent battlefield in which actors compete to control the key elements of that level. In other words, if concepts such as information warfare or cognitive warfare represent broader categories of warfare, the KBM focuses on the concrete battles that occur within these domains.

From this perspective, the architecture of the Knowledge Battle Model consists of five primary battlefields:

- Data Battle
- Information Battle
- Knowledge Battle
- Cognition Battle
- Meaning Battle

This terminology emphasizes that competition in contemporary conflicts may occur at any of these levels and that developments at one level can influence the entire architecture of knowledge. For example, superiority in data collection can lead to informational advantage; superiority in knowledge analysis can shape strategic decision-making; and dominance in narrative construction can transform public perceptions of reality.

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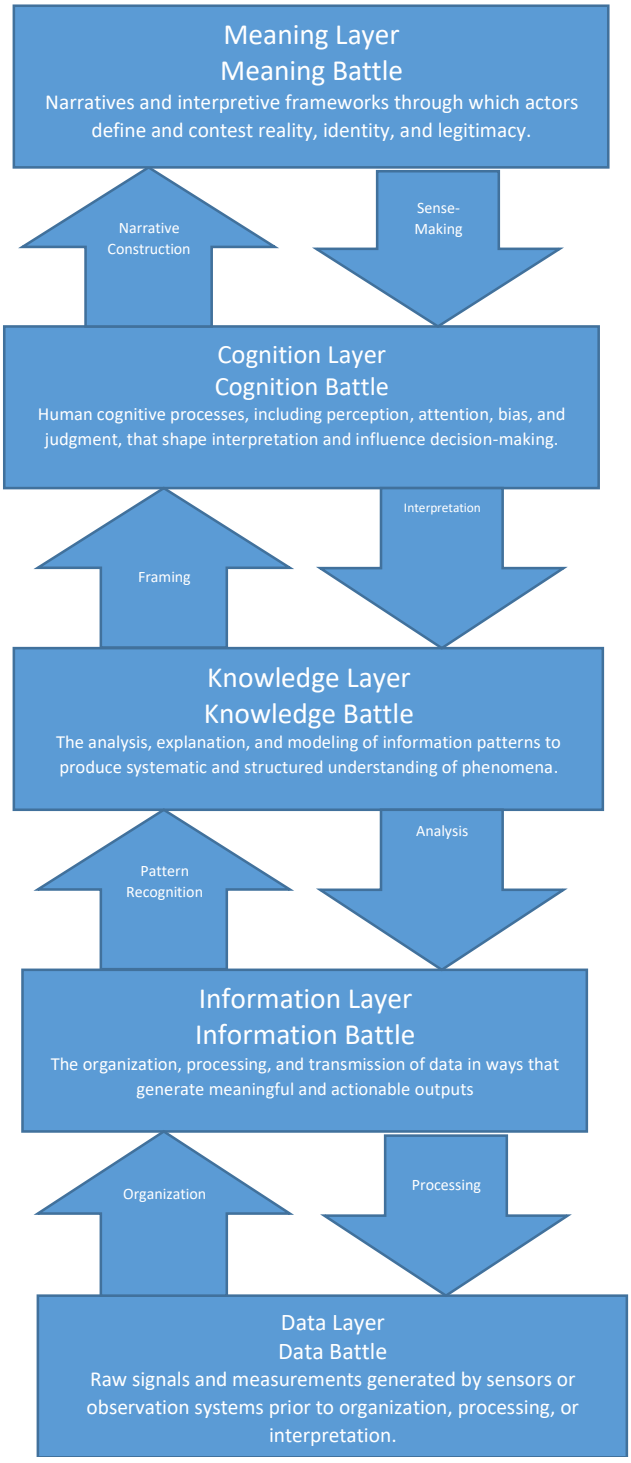

Figure 1 .The five-layer Knowledge–Battle Model (KBM).

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6-1-Data Layer

The lowest level in the Knowledge Battle Model is the Data Layer, conceptualized as the Data Battle. At this level, data are understood as raw outputs derived from signals, measurements, and sensors that have not yet been organized or interpreted. Such data are typically generated through observation and monitoring systems, including reconnaissance satellites, cyber monitoring platforms, sensor networks, and digital infrastructures.

Although these data lack analytical structure or explicit meaning at this stage, they constitute the foundation of all higher levels of knowledge. Information, knowledge, and even narrative interpretations ultimately depend on data collected from the environment. Therefore, the ability to establish extensive data-collection networks, develop sensor infrastructures, and extract precise signals from operational environments has become a significant strategic advantage.

Competition at this level primarily revolves around access to, collection of, and control over data resources.

6-2-Information Layer

Once raw data are produced, they enter the Information Layer, which constitutes the Information Battle. At this level, data are transformed into usable information through processes of organization and processing.

Within the KBM framework, this layer includes a range of processes that convert dispersed data into interpretable patterns. These processes include processing, organization, analysis, sense-making, interpretation, narrative construction, pattern recognition, and framing.

Through these processes, raw data become structured outputs capable of generating meaningful messages and patterns. At this level, speed and accuracy in processing and transmitting information are particularly important. Actors who can manage information flows more effectively gain a considerable advantage in contemporary conflicts.

6-3-Knowledge Layer

The third level of the model is the Knowledge Layer, conceptualized as the Knowledge Battle. At this level, available information is transformed into a systematic understanding of phenomena through deeper analytical processes and conceptual modeling.

Activities at this stage include analysis, explanation, and modeling of information patterns. The objective of these processes is to produce knowledge capable of explaining relationships among phenomena and enabling prediction and strategic decision-making. Consequently, knowledge at this level acquires a strategic character and plays a central role in policy design and high-level decision processes.

6-4-Cognition Layer

The Cognition Layer in the Knowledge Battle Model refers to the mental processes of human actors and is conceptualized as the Cognition Battle. This level includes a range of cognitive mechanisms that shape how information and knowledge are perceived and interpreted.

Processes such as perception, attention, cognitive bias, and judgment play a decisive role in determining how individuals interpret information and what decisions they ultimately make. Competition at this level therefore involves attempts to influence perceptions, interpretations, and decision-making processes.

6-5-Meaning Layer

The highest level in the Knowledge Battle Model is the Meaning Layer, conceptualized as the Meaning Battle. At this level, the central competition concerns the construction of narratives and interpretive frameworks through which social reality is understood.

Actors seek to produce narratives capable of defining reality, identity, and legitimacy. These narratives provide interpretive frameworks through which events are understood and determine which actions are perceived as legitimate or illegitimate. Consequently, competition at this level revolves around the ability to shape dominant narratives and symbolic interpretations.

6-6-Inter-Layer Dynamics and Feedback Mechanisms

One of the defining characteristics of the Knowledge Battle Model is that these five layers do not operate merely as a linear sequence but rather as a dynamic system of interactions and feedback mechanisms.

Within this architecture, data are transformed into information; information forms the basis for the production of knowledge; knowledge is interpreted through cognitive processes; and these interpretations ultimately become stabilized in the form of narratives and meaning.

At the same time, feedback processes operate from higher levels toward lower ones. In the Knowledge Battle Model, two major forms of feedback can be identified: cognitive feedback and meaning feedback.

Cognitive feedback refers to the influence of mental processes and cognitive biases on how information is interpreted and even on which data are selected for attention. Meaning feedback refers to the influence of dominant narratives and interpretive frameworks on the direction of information analysis and knowledge production.

Overall, the Knowledge Battle Model suggests that contemporary conflicts can be understood as a set of interconnected battles across different levels of knowledge. Within this framework, data, information, knowledge, cognition, and meaning are not merely epistemic elements; they also represent distinct arenas of strategic competition in which actors struggle to shape reality and influence the outcomes of conflicts.

Based on the conceptual graph presented in the model, these five layers can be understood not only as stages in knowledge transformation but also as five operational levels of competition, each with its own logic of power, dominant tools, and indicators of superiority. This layered structure allows for more precise analysis of the dynamics of knowledge battles and clarifies how each level resists threats, activates opportunities, and influences adjacent layers.

From this perspective, the Knowledge Battle Model is not merely a theoretical description of knowledge transformation; it can also be interpreted as a strategic map of informational, cognitive, and semantic competition that can be applied to case analysis, situational assessment, or policy design (Nowotny, Scott, & Gibbons, 2001; Stehr, 1994).

The following table summarizes the key characteristics of each layer, including the dominant tools, power logic, and central focus of competition.

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Table 1. Indicators of Superiority and Power Logic Across the Layers of the Knowledge Battle Model (KBM)

Layer	Indicator of Superiority	Dominant Tools	Logic of Power	Battle Focus
Data Layer	Volume and Accuracy	Sensors, Cyber Systems	Technical Monopoly	Data Collection and Ownership
Information Layer	Speed and Trustworthiness	Media, Algorithms	Information Dominance	Information Flow and Verifiability
Knowledge Layer	Predictive Capacity	Conceptual and Analytical Modeling	Analytical Superiority	Analysis and Strategic Decision-Making
Cognition Layer	Mindset Alteration	Content, Cognitive Biases	Mind Engineering	Perception and Cognitive Judgments
Meaning Layer	Public Acceptance	Discourse	Reality Definition	Narrative Construction and Legitimacy

In summary, the layered structure of the Knowledge Battle Model demonstrates that the model represents not simply a descriptive architecture but a multi-layered system of competitive mechanisms in which each level constitutes a potential point of intervention, defense, or influence. Actors ranging from states and military institutions to technology companies, media organizations, and even individual users may operate within different layers, yet actions at one level can generate direct or indirect consequences across the entire architecture of knowledge.

For instance, superiority in the data layer can facilitate control over information flows and shape analytical knowledge production, while failure in the meaning layer may undermine or neutralize advantages gained in other layers. In this sense, the tabular summary of the model complements the conceptual graph: the graph illustrates the structural relationships among the layers, whereas the table clarifies the operational logic and functional dynamics of each layer.

7-Application of the Knowledge Battle Model (KBM) in the Field of Knowledge-Research Studies

The Knowledge Battle Model (KBM) carries significant theoretical and methodological implications for the domain of Knowledge-Research Studies , a field which, in recent decades, has moved beyond its traditional focus on the organization of knowledge and information systems to include the study of knowledge production, circulation, application, and influence within social, media, decision-making, and governance structures.

The KBM demonstrates that knowledge is not merely a cognitive or scientific category but a strategic and competitive field in which actors struggle for dominance across multiple layers of reality production and interpretation. This perspective opens a new horizon for Knowledge-Research Studies and emphasizes the need to reconceptualize some fundamental notions of scientific understanding.

In accordance with the five-layer structure of the model, KBM applications in Knowledge-Research Studies can be explained through five major axes, followed by methodological and macro-level implications for the discipline.

7-1-Application in Data Studies: Data as a Battlefield

At the first layer, the KBM defines data as raw outputs obtained from signals, measurements, and sensors. In this view, data are not a neutral resource but rather a contested domain.

According to this model, several applications can be inferred for data studies:

Data collection itself constitutes a battlefield , what data are collected, from where, and through which instruments?

Unequal access to data generates asymmetrical structures of knowledge power.

The notion of "data neutrality" must be reconsidered, as data collection always involves selection, omission, and prioritization.

With the expansion of sensors, metrics, and digital networks, data battles have become decisive in the processes of knowledge production and security.

Thus, within Knowledge-Research Studies, greater emphasis should be placed on data politics and the architecture of data infrastructures.

7-2-Application in Information Studies: Information as Competitive Processes of Processing and Direction

Within the KBM, the Information Layer includes processes such as processing, organizing, analyzing, pattern-finding, meaning construction, interpretation, framing, and narrative building.

Applications inferred for information studies include:

Information production is not neutral; actors can reshape reality through framing, filtering, and directional processing of information (Entman, 1993).

Information superiority in modern contexts results not from data collection alone but from the power to process and to direct information flows.

Information systems should therefore be examined not only technologically but also in terms of power configuration.

Organizational, media, and political biases play decisive roles in information production.

Accordingly, Knowledge-Research Studies should develop analytical frameworks for information-flow architecture and information-production politics, inspired by the Information Layer of the KBM.

7-3-Application in Knowledge Studies: Knowledge as a Strategic Capacity for Explanation and Modeling

According to KBM, the Knowledge Layer encompasses analysis, explanation, modeling of patterns, and production of systematic understanding.

Applications for knowledge-level research can be summarized as follows:

The knowledge battle demonstrates that knowledge is a competitive domain, not merely a scientific product.

Analytical frameworks created by researchers are themselves part of the knowledge competition, they determine the capacity to define problems.

Modeling and explanation directly affect policy formation and strategic decision-making.

In the contemporary era, knowledge superiority has emerged as a new form of national power.

Thus, in knowledge studies, key questions include:

– How are knowledge structures formed?

– Which actors possess the power to define problems?

– How does knowledge acquire strategic roles in policy and security?

Engaging with these questions brings Knowledge-Research Studies into the realm of the politics of knowledge, a domain discussed by Nye (2011) and Castells (2009) in their studies on information societies and network power.

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7-4-Application in Cognitive Studies: Cognition as a Field of Intervention, Bias, and Judgment

In the Cognition Layer, the KBM identifies perception, attention, cognitive biases, and judgment as crucial mechanisms shaping decision-making.

Applications for cognitive dimensions within Knowledge-Research Studies include:

Human cognition is not merely a receptor of knowledge but also a producer of knowledge pathways.

Cognitive battles represent the competition to guide attention, activate biases, and shape judgments.

This perspective expands knowledge studies from analyzing knowledge structures to examining mental mechanisms and cognitive architectures of knowledge interpretation.

Concepts such as the "attention economy" (Davenport & Beck, 2002), bias engineering, and perception management become integral components of knowledge-related inquiries.

Consequently, Knowledge-Research Studies should progress beyond information analysis toward exploring the architecture of cognition.

7-5-Application in Meaning and Narrative Studies: Meaning as the Definition of Reality, Identity, and Legitimacy

The Meaning Layer of KBM includes narratives, interpretive frameworks, definitions of reality, identity, and legitimacy.

At this deepest level of knowledge, KBM offers profound implications for meaning-oriented research:

Meaning constitutes a "battle over the interpretation of reality," not merely reality itself.

The meaning battle teaches that narratives are not mere representations; they are cognitive and political weapons.

Systems of meaning can influence data, information, and knowledge flows.

Thus, in Knowledge-Research Studies, narratives should be analyzed as structures of power production, not only as cultural products.

This dynamic reflects what Nye (2004) termed soft power, the ability to shape the preferences of others through attraction, legitimacy, and persuasion. In the age of social media and networked narrative construction, this layer is the most directly connected to politics, security, and culture.

7-6-Methodological Applications: The Need for Multi-Layer Modeling and Multi-Level Analysis

The KBM also has essential methodological implications for knowledge-related research:

Knowledge-Research Studies should not examine merely one layer (such as information or knowledge) in isolation.

They must develop multi-level analyses, from data to meaning.

The dynamics of inter-layer feedback (cognitive and semantic feedback) should become integral elements of knowledge research methodology.

Employing interdisciplinary methods, from information science and cognitive science to discourse analysis, is indispensable (Fairclough, 1995; Reed, 2020).

Hence, the KBM provides a composite methodological framework enabling multi-layered and multi-disciplinary approaches to knowledge studies.

7-7-Macro-Applications for the Future of Knowledge-Research Studies: From Knowledge as a "Resource" to Knowledge as a "Battlefield"

The central principle proposed by the KBM for the future of knowledge studies is that knowledge in the contemporary world is not merely a resource or tool, it is itself a battlefield.

This paradigm shift, entails several consequences:

Knowledge studies must place the politics of knowledge and knowledge governance at the core of analysis.

Data, information, cognition, and meaning should be examined as strategic arenas of competition.

Power, politics, security, narrative, and perception become inseparable components of knowledge inquiry.

In essence, the KBM transforms Knowledge-Research Studies from a specialized academic domain concerned primarily with the organization and retrieval of information into a strategic field that investigates the mechanisms of production, distribution, and contestation of knowledge.

7-8-Synthesis: Applying the Knowledge Battle Model (KBM) within Knowledge-Research Studies

Ultimately, the Knowledge Battle Model reveals that the five levels, Data, Information, Knowledge, Cognition, and Meaning, are not only stages of processing knowledge but also five strategic arenas of competition.

Based on this conceptual structure:

Knowledge studies should move toward the analysis of knowledge power.

They should examine Interactions among layers and the roles of cognitive and semantic feedback.

They should develop new conceptual models for understanding the position of knowledge within politics, security, media, and culture.

From this perspective, the KBM can serve as a novel theoretical framework for Knowledge-Research Studies in the era of information, cognitive, and hybrid warfare, offering a systematic lens through which to interpret the transformations of knowledge as both a process and a strategic domain.

8-Future Research Directions Emerging from the Knowledge Battle Model (KBM)

The Knowledge Battle Model (KBM) not only provides a conceptual framework for analyzing information, cognitive, and hybrid warfare but also opens new research frontiers across knowledge studies, information science, cognitive science, communication studies, and security studies. By conceptualizing contemporary conflicts as unfolding across five interconnected layers, Data, Information, Knowledge, Cognition, and Meaning, the model enables the development of multi-disciplinary research programs capable of explaining the architecture of modern knowledge-centric conflicts.

Within this overarching structure, the future research horizons can be articulated along several core trajectories.

8-1-Research on Data Infrastructures and the "Data Battle"

The first research horizon concerns the study of systems of data production and data collection. In the KBM, the Data Layer is defined as:

"raw signals, measurements, and sensor-generated outputs that have not yet been organized, processed, or interpreted."

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This definition makes clear that data are not mere technical artifacts; rather, they constitute a foundational component of the infrastructure of knowledge, and therefore a domain of strategic competition.

Future research may thus engage with questions such as:

How do sensor networks, satellite systems, and digital infrastructures generate strategic data streams?

What architectures exist for integrating and aggregating data at national, trans-national, and network scales?

How does asymmetric access to data reshape the balance of power in information conflicts?

How do data governance regimes and data policies structure data advantages or vulnerabilities?

In this context, research on data politics, big-data infrastructures, and data governance (e.g., Kitchin, 2014) can substantially clarify the mechanisms through which data battles shape contemporary security environments.

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8-2-Research on Information Flows and Mechanisms of Processing

The second research frontier focuses on the Information Layer, defined in the model, again based on your document, as a domain comprising:

processing, organizing, transmitting data, analyzing patterns, sense-making, interpretation, narrative construction, framing, and pattern recognition.

Future research may examine:

the architecture of information flows within media networks and digital platforms;

how framing and narrative construction in the Information Layer shape public perception;

how speed, accuracy, and directionality of information processing become sources of strategic advantage;

the role of algorithms, platform infrastructures, and content-distribution systems in shaping information competitions.

Through such inquiries, scholars can explore the mechanisms underlying information battles, especially in environments where actors compete to control flows, filters, and interpretive processes that govern public and institutional awareness.

8-3-Research on Knowledge Production and Analytical Architectures

The third research horizon corresponds to the Knowledge Layer, which KBM defines as:

"the analysis, explanation, and modeling of information patterns to produce systematic understanding of phenomena."

This layer has a strategic quality because the knowledge generated here informs political, security, and military decision-making.

Consequently, future research may examine:

the role of universities, think tanks, research centers, and intelligence agencies in shaping knowledge architectures;

how analytical frameworks, conceptual models, and forecasting systems guide policy formation;

how scientific knowledge, strategic knowledge, and public policy interact in producing forms of knowledge power.

Such research deepens understanding of the knowledge battle, in which actors compete to define explanations, models, and analytical frameworks that guide public and institutional decision-making.

8-4-Research on Cognitive Processes and the Shaping of Perception

The fourth horizon concerns the Cognition Layer as:

"perception, attention, cognitive bias, and judgment that shape interpretation and influence decision-making."

Here, the KBM reveals that modern conflicts unfold not only in the realm of information but within human cognitive processes.

Potential research topics include:

How do digital media environments shape the mechanisms through which perceptions form?

How do social-media algorithms direct users' attention?

What roles do cognitive biases play in interpreting information?

How do information operations influence individual and collective decision-making?

These questions open pathways toward interdisciplinary research across cognitive science, media studies, psychology, information science, and security studies, illuminating the mechanisms of the cognitive battle.

8-5-Research on Semantic Systems and Narrative Competition

The fifth horizon corresponds to the Meaning Layer as:

"narratives and interpretive frameworks through which reality, identity, and legitimacy are defined and contested."

This is the deepest layer of the KBM, as meanings and narratives provide the interpretive structure through which all lower layers, data, information, knowledge, and cognition, are understood.

Future research may explore:

how actors engage in narrative competition in political, cultural, and media domains;

how interpretive frameworks shape collective identities, political legitimacy, and public understanding of crises;

how discourse analysis, media studies, and cultural studies can serve as conceptual tools for analyzing meaning battles.

Within this horizon, meaning is not merely a cultural product; it is a strategic mechanism for defining reality in competitive environments.

8-6-Research on Inter-Layer Dynamics and Feedback Mechanisms

One of the most important research directions emerging from the KBM is the study of dynamic interactions among layers. In the model, the layers do not operate linearly; rather, they form a dynamic system connected through reciprocal feedback.

Two forms of feedback are especially critical:

Cognitive feedback, which shows how perceptual processes and cognitive biases shape the interpretation and filtering of information.

Semantic feedback, which demonstrates how narratives and interpretive frameworks guide analytical processes, direct information flows, and even influence which data are collected in the first place.

Future research may involve:

modeling these feedback systems across the five layers;

examining how disruption in one layer produces cascading effects across others;

exploring how adversaries exploit inter-layer vulnerabilities to shape large-scale information and cognitive outcomes.

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This line of research is essential for fully understanding knowledge-centric conflicts.

8-7-Developing Interdisciplinary Frameworks for Studying the "Knowledge Battle"

Finally, an essential research horizon introduced by the KBM is the development of interdisciplinary approaches to analyzing knowledge-centric conflicts. Because the KBM integrates data science, information science, cognitive science, media studies, political science, international relations, and security studies, it can function as:

a shared conceptual language,

a multi-layer analytical architecture,

and a bridge between disciplines that traditionally study separate aspects of knowledge.

Future interdisciplinary programs may combine:

information-system analysis,

cognitive modeling,

narrative and discourse studies,

data-infrastructure research,

and security studies.

Through such combinations, the KBM can form the basis of a coherent and systematic field of knowledge-conflict studies.

Taken together, these research horizons demonstrate that the Knowledge Battle Model not only provides a conceptual structure for analyzing modern conflicts but also opens new possibilities for the academic domains concerned with knowledge. These horizons include:

the study of data infrastructures,

architectures of information flows,

the production of strategic knowledge,

cognitive processes and biases,

narrative and semantic competition,

and the modeling of inter-layer dynamics.

Focusing on these areas enables researchers to deepen their understanding of the role of knowledge in power, politics, and contemporary conflicts. It also lays the groundwork for future interdisciplinary research programs capable of systematically analyzing knowledge flows and their role in information and cognitive warfare.

In a world where power increasingly depends on control over knowledge flows rather than material resources, successful societies will be those that can produce knowledge while also cultivating the capacity to analyze, manage, and safeguard their knowledge systems. From this perspective, the KBM can serve both as a conceptual framework for understanding these transformations and as an intellectual foundation for future research and policy development in knowledge-centric domains.

9-Discussion and Conclusion

The rapid developments in information technologies, the expansion of digital networks, the development of data-driven infrastructures, and the growing role of media and information-processing systems have transformed the nature of warfare in the contemporary world. Whereas in the classical tradition of military studies war was mainly defined as the confrontation of military forces on physical

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battlefields, in recent decades this definition has increasingly appeared inadequate. Many of today's conflicts begin not on physical battlefields but in domains such as information networks, knowledge systems, media environments, and even at the level of perception and meaning. Under such conditions, control over the flows of knowledge, from the production of data to the shaping of meaning, has become one of the most important sources of power in political, security, and geopolitical competition.

In response to this transformation, this article proposed a conceptual framework entitled the Knowledge Battle Model (KBM). The central idea of this model is that many contemporary conflicts can be analyzed as a set of interconnected battles occurring across different levels of knowledge. These levels are organized along a conceptual continuum from data to meaning and include five main layers: data, information, knowledge, cognition, and meaning. Each of these layers not only represents a stage in the processing of knowledge but also constitutes an independent "battlefield" in which different actors compete to gain advantage.

At the lowest level of this architecture lies the data layer. According to the definition presented in the model, data consist of "raw signals and measurements generated by sensors or observation systems" that have not yet been organized or interpreted. This layer demonstrates that the first stage of knowledge competition emerges in the collection and control of data. The ability to access accurate, extensive, and timely data can create a significant advantage in analyzing situations and predicting developments. For this reason, data infrastructures, sensor systems, monitoring networks, and big-data technologies have become vital elements of power in the contemporary world.

Following the data layer is the information layer. At this level, raw data are transformed into usable information through processes such as organization, processing, and transmission. In the Knowledge Battle Model (KBM), this layer includes a range of activities and mechanisms such as processing, organization, analysis, sense-making, interpretation, narrative construction, pattern recognition, and framing. The defining feature of this layer is the speed and accuracy of information processing and flow. Competition at this level centers on who can transform data into usable information more quickly, more accurately, and more effectively, and how information flows can be managed and directed to benefit a particular actor.

In the next stage, the information produced in the second layer enters the knowledge layer. At this level, information is transformed through analysis, explanation, and pattern modeling into a systematic understanding of phenomena. Knowledge in this sense is not merely a collection of organized information; rather, it represents a structural understanding of the relationships among variables and the dynamics of phenomena. In the Knowledge Battle Model (KBM), this layer possesses a strategic character because the knowledge produced here can form the basis for decision-making and policy formulation. Superiority in the "knowledge battle" therefore refers to the ability to generate analytical frameworks and explanatory models that explain reality more effectively and predict future developments more accurately.

At a higher level lies the cognition layer. This layer relates to human mental processes, such as perception, attention, cognitive biases, and judgment, that play a fundamental role in shaping decision-making. At this level, the main issue is not simply what information exists, but how individuals perceive and interpret that

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information. Cognitive operations, perception management, direction of attention, and the exploitation of cognitive biases are among the tools used in this battlefield. For this reason, many analysts argue that contemporary wars have increasingly become a "war for minds."

Finally, at the highest level of the model's architecture lies the meaning layer. This layer concerns the systems of meaning and interpretive frameworks through which actors define reality, identity, and legitimacy. At this level, competition takes the form of struggles over narratives and interpretive frameworks. Narratives can determine how an event is understood, who is perceived as a victim or an aggressor, and which actions are considered legitimate or illegitimate. From this perspective, the battle of meaning represents the deepest level of knowledge competition, because semantic frameworks can influence the interpretation of information, knowledge, and even data.

One of the important characteristics of the Knowledge Battle Model (KBM) is that these five layers are not analyzed in isolation but rather as part of a dynamic system of interactions and feedback. Within this framework, two types of feedback are particularly significant: cognitive feedback and semantic feedback. Cognitive feedback indicates that mental processes and cognitive biases can alter the interpretation of information. In contrast, semantic feedback shows that narratives and interpretive frameworks can even influence the selection of data and the orientation of analytical processes. These interactions demonstrate that the flow of knowledge in this model is not merely a linear path from lower to higher levels, but rather a complex network of reciprocal influences among the layers.

From a theoretical perspective, the Knowledge Battle Model (KBM) attempts to fill a gap in the literature on information and cognitive warfare. While many existing studies focus on one of these domains, such as information warfare, cognitive warfare, or network-centric warfare, the KBM brings these domains together within a single integrative framework. This framework demonstrates that contemporary wars cannot be analyzed solely at the level of information or cognition, but must instead be examined along a continuum extending from data to meaning.

From a methodological perspective, the model is also of considerable importance. The Knowledge Battle Model (KBM) encourages researchers to employ multi-level and interdisciplinary approaches in analyzing contemporary conflicts. The analysis of knowledge battles requires the integration of perspectives from various fields, including information science, knowledge studies, cognitive science, media studies, political science, and security studies. Within this context, the KBM can function as a shared conceptual language that enables researchers from different disciplines to analyze complex knowledge-centered phenomena within a common analytical framework.

Ultimately, the most important conclusion that emerges from this discussion is that in the contemporary world knowledge itself has become a battlefield. Competition among political and security actors is no longer confined to geographical territories or material resources; it also unfolds over the control of data, the management of information, the production of knowledge, the shaping of perceptions, and the definition of meaning. Under such circumstances, understanding the architecture of knowledge and the mechanisms of competition at its different levels becomes a fundamental requirement for analyzing power and conflict in the twenty-first century.

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The Knowledge Battle Model (KBM) represents an attempt to provide a conceptual framework capable of explaining this complex reality. The model illustrates how a set of interconnected processes, from raw data to systems of meaning, ultimately shape decision-making, perceptions, and structures of power.

At the same time, the very name "NADAN" (ندان), the Persian acronym used for the Knowledge Battle Model, carries an important conceptual implication. While the model analytically focuses on battles unfolding across different layers of knowledge, namely data, information, knowledge, cognition, and meaning, the term "NADAN" itself also resonates semantically in Persian with the notion of "ignorance" or "unknowing." This dual meaning is not merely linguistic; it reflects a deeper strategic insight embedded in the logic of knowledge-centered conflict. In many contemporary knowledge battles, the ultimate objective of hostile actors is not only to gain informational or cognitive superiority but also to produce and expand states of ignorance within the target society.

In such a situation, the processes that sustain a society's knowledge system are gradually disrupted across multiple layers of the knowledge continuum. Data flows may be manipulated or selectively collected; information can be distorted through filtering, framing, and narrative construction; knowledge systems may become corrupted or fragmented; cognitive processes can be misled through bias activation and perception management; and, ultimately, systems of meaning may fall into confusion as competing narratives redefine reality, identity, and legitimacy. In this sense, ignorance is not simply the absence of knowledge but the outcome of systematic interventions across the architecture of knowledge production and interpretation.

From this perspective, the battle of knowledge is not merely an effort to achieve epistemic superiority. It is simultaneously a struggle to protect the integrity of a society's knowledge system and to prevent the production, diffusion, and institutionalization of ignorance within it. Thus, the symbolic implication embedded in the acronym "NADAN" highlights a central insight of the model: in knowledge-centered warfare, one of the most powerful strategic weapons available to an adversary is the deliberate generation of ignorance, manifested in confusion, misinformation, distorted understanding, and epistemic fragmentation, within the country that becomes the target of such conflicts.

Accordingly, the study of contemporary warfare without attention to this knowledge continuum from data to meaning would remain incomplete. Therefore, the development and expansion of this framework can contribute to the theoretical enrichment of security studies, information science, and knowledge studies, while also opening new pathways for future research.

10-Implications for Policy and Practice: Insights from the Knowledge Battle Model (KBM)

As discussed earlier, the Knowledge Battle Model (KBM) is not merely a theoretical framework for analyzing transformations in warfare in the information age; it also provides important practical implications for policymakers, security institutions, media organizations, knowledge-producing centers, and even educational systems. Since this model demonstrates that contemporary conflicts unfold across five interconnected layers of knowledge, data, information, knowledge, cognition, and meaning, practical strategies and policies must likewise be designed in accordance with each of these layers. Within this

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framework, a range of policy recommendations and practical implications can be identified at different levels.

10–1-Developing Data Infrastructures to Strengthen Capabilities in the "Data Battle"

The first practical implication of the Knowledge Battle Model (KBM) relates to the data layer. In this model, data are defined as "raw signals and measurements derived from sensors and observation systems" that have not yet been organized or interpreted. This definition highlights that the starting point of many knowledge-centered competitions lies in the ability to collect and access data.

From this perspective, one of the most important practical recommendations for governments and security institutions is investment in the development of data-generation and data-collection infrastructures. Such infrastructures may include sensor networks, satellite observation systems, national data repositories, big-data infrastructures, and digital monitoring systems. The greater the capacity of an actor to generate and collect accurate, extensive, and timely data, the greater its ability to analyze situations and anticipate emerging developments.

In addition, effective mechanisms for data governance must be established. Policies concerning data ownership, data accessibility, data security, and data sharing among institutions play a crucial role in ensuring the efficient use of data resources. In this regard, developing national frameworks for data governance and standardizing systems of data collection, storage, and management can significantly enhance the effectiveness of actors in the data battle.

10–2-Strengthening Information Processing and Flow Management in the "Information Battle"

The second practical implication of the Knowledge Battle Model (KBM) concerns the information layer. At this level, raw data are transformed into usable information through processes such as organization, processing, and transmission. According to the model, this layer encompasses a set of activities including processing, organization, analysis, sense-making, interpretation, narrative construction, pattern recognition, and framing.

Within this framework, one of the most important practical recommendations is the development of advanced information-processing capabilities. This can include the use of big-data analytics, artificial intelligence, machine learning, and information network analysis systems. Such technologies enable organizations to rapidly process vast quantities of data and identify meaningful patterns and signals within complex information environments.

At the same time, managing the flow of information within media and digital environments is critically important. In the contemporary information ecosystem, the speed at which information circulates has become a decisive factor in shaping public perception. Therefore, media organizations and communication institutions must possess strong capabilities in information-flow management, rapid crisis communication, and countering misinformation and manipulated information.

10–3-Strengthening Knowledge Production Systems and Strategic Analysis in the "Knowledge Battle"

Within the Knowledge Battle Model (KBM), the knowledge layer refers to the processes through which information is transformed into systematic understanding of phenomena. This layer involves activities such as analysis, explanation, and pattern modeling, which ultimately lead to the production of strategic knowledge.

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From this perspective, one of the most important practical implications of the model is the need to strengthen institutions responsible for knowledge production. Universities, think tanks, research centers, and strategic analysis institutions can play a key role in shaping national knowledge architectures. Supporting strategic research programs, developing advanced analytical capabilities, and creating collaborative networks between academic institutions and decision-making bodies can significantly enhance national capacities for knowledge production.

Another important issue concerns the transfer of knowledge between academic research and policymaking processes. In many cases, a gap exists between knowledge produced within universities and its application in decision-making processes. This gap often prevents knowledge resources from being fully utilized. Establishing intermediary institutions such as policy think tanks and strategic analysis centers can help bridge this divide and facilitate the translation of knowledge into policy and strategy.

10–4-Enhancing Cognitive Literacy and Mental Resilience Against Cognitive Operations

The fourth set of practical implications of the Knowledge Battle Model (KBM) relates to the cognition layer. At this level, the primary issue concerns how individuals perceive, interpret, and judge information. As indicated in the model, processes such as perception, attention, cognitive biases, and judgment significantly influence both individual and collective decision-making.

In this context, one of the most important practical recommendations is the development of educational programs aimed at enhancing cognitive and media literacy within society. Training citizens in skills such as critical thinking, recognizing cognitive biases, evaluating information sources, and analyzing media messages can increase societal resilience against information manipulation and cognitive influence operations (Vraga & Tully, 2021).

Furthermore, research in the field of cognitive science can provide valuable tools for understanding the mechanisms through which perceptions and judgments are shaped. Collaboration among experts in cognitive science, communication studies, and security studies can contribute to the design of more effective strategies for perception management and cognitive resilience in complex information environments (Comfort, Boin, & Demchak, 2010).

10–5-Developing Narrative Strategies and Meaning Management in the "Meaning Battle"

At the highest level of the Knowledge Battle Model (KBM) lies the meaning layer. At this level, competition revolves around narratives and interpretive frameworks through which actors define reality, identity, and legitimacy. This layer illustrates that many contemporary conflicts unfold at the level of meaning and narrative construction.

Within this framework, one of the most important practical implications of the model is the need to pay close attention to narrative strategies. Governments, media organizations, and cultural institutions must possess the capacity to produce, articulate, and disseminate coherent and credible narratives. Such narratives play a decisive role in shaping public interpretations of events, crises, and conflicts.

In addition, discourse analysis and the study of meaning frameworks in media environments can contribute to a deeper understanding of narrative competition. By identifying dominant interpretive frameworks and narrative

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structures, actors can better understand how meanings are constructed, how narratives become institutionalized, and how counter-narratives can be developed in response to competing narratives.

10–6-Designing Integrated Policies for Managing the "Knowledge Architecture"

One of the most important practical implications of the Knowledge Battle Model (KBM) is that effective management of information and cognitive conflicts requires an integrated perspective on the entire knowledge architecture. In many cases, policies and programs focus only on a single level, such as information or media, while other layers of knowledge remain neglected.

However, the KBM demonstrates that these layers are deeply interconnected. Weakness in data infrastructures can affect the quality of information. Deficiencies in knowledge analysis can lead to flawed strategic decisions. Likewise, the inability to manage meaning and narratives can undermine even strong informational and analytical capabilities.

For this reason, one of the most important policy recommendations derived from the model is the development of integrated strategies for managing the entire knowledge chain, from data to meaning. Such an approach can enhance coordination among institutions, improve policy effectiveness, and strengthen national capabilities in complex information environments.

Overall, the Knowledge Battle Model (KBM) demonstrates that contemporary competition unfolds across a set of interconnected layers of knowledge. Consequently, policies and strategic responses must take this multi-layered structure into account. The development of data infrastructures, the strengthening of information-processing capacities, support for strategic knowledge production, the enhancement of cognitive resilience, and the effective management of narratives and meaning all represent essential components of a comprehensive strategy for confronting knowledge battles in the contemporary world.

In this sense, the Knowledge Battle Model (KBM) can serve not only as an analytical framework for scholars, but also as a practical guide for policymakers and decision-makers seeking to manage knowledge-centered conflicts in the information age.

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