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Governance of Hybrid Academic Production: Authorship, Agency, and Algorithmic Capital in the AI Era

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ABSTRACT

The integration of generative artificial intelligence into academic research has largely been debated through a normative lens that opposes responsible use to misuse. This article argues that AI does more than raise ethical or operational dilemmas: it exposes a fundamental misalignment between how scientific knowledge is actually produced and the anthropocentric assumptions on which its governance mechanisms historically rest. Drawing on the Extended Mind and Extended Self perspectives, sociomateriality, Actor-Network Theory, and Bourdieu's theory of distinction, we reconceptualize academic production as a hybrid sociomaterial process in which humans and algorithmic systems operate interdependently in the generation, organization, and validation of knowledge. Within this process, we introduce the concept of algorithmic capital: an emerging form of symbolic distinction grounded not in access to AI but in the capacity to orchestrate it while rendering its mediation invisible, thereby preserving the appearance of human authorship. We then propose a multilevel, recursive governance framework that recognizes the distributed nature of agency, incorporates algorithmic systems as actors, and shifts the focus of governance from final products to the practices and relations that constitute knowledge production. Finally, we discuss implications for authorship, scientific evaluation, and researcher formation, arguing that AI reopens fundamental questions for organizational theory about how work is defined, how value is attributed, and how distinction is constructed in knowledge-intensive contexts.

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INTRODUCTION

The integration of generative artificial intelligence into the daily routine of academic research has intensified debates regarding authorship, originality, scientific integrity, and the limits of technological mediation (Bozkurt, 2024; Cotton et al., 2024). To a large extent, these discussions have been organized around a normative logic that opposes the responsible use of these tools against their misuse, often synthesized in the question: what can or cannot be done with AI in academic production? While such concerns are legitimate, they tend to reduce the phenomenon to a matter of individual conduct, obscuring deeper transformations in the very nature of scientific knowledge production.

This article stems from a distinct provocation. We argue that the emergence of artificial intelligence does not merely introduce new ethical or operational dilemmas; rather, it renders visible a fundamental misalignment between the way academic production actually occurs and the assumptions upon which its governance mechanisms were historically constructed. In particular, we maintain that contemporary scientific production can no longer be adequately described through an exclusively human logic based on individual cognition and clearly delimited authorship. Instead, it is configured as a hybrid process in which humans and algorithmic systems operate interdependently in the generation, organization, and validation of knowledge.

This transformation can be understood by bringing together two distinct theoretical traditions. On one hand, the 'Extended Mind' perspective suggests that cognitive processes exceed the biological limits of the individual, incorporating external artifacts as a constitutive part of cognition (Clark, 2001; Gallagher, 2018). On the other hand, the 'Extended Self' theory demonstrates how objects and technologies participate in the symbolic construction of identity (Belk, 1988; Mirbabaie et al., 2021). Generative artificial intelligence tensions this separation by acting simultaneously as a cognitive infrastructure and an interaction partner (Minina Jeunemaître et al., 2025), dissolving the boundaries between subject and tool (Amirjalili et al., 2024; Biermann et al., 2022).

More than merely expanding capabilities, this hybridization alters the symbolic foundations of academic production. As access to AI becomes widespread, the differential no longer lies in the use itself, but in the capacity to orchestrate, integrate, and, above all, render the algorithmic mediation invisible in the final products (Riva, 2025).

In this context, what we term 'algorithmic capital' emerges: a form of distinction based on the ability to mobilize AI systems in a sophisticated manner while simultaneously preserving the appearance of human authorship (Madella et al., 2026). This dynamic directly conflicts with scientific evaluation processes, which remain heavily predicated on criteria such as style, coherence, and authorial voice.

It is at this point that the paradox guiding this work becomes explicit. While academic production becomes progressively hybrid, the governance mechanisms regulating its legitimacy remain anchored in an 'anthropocentric ontology', based on the idea of individual authorship, clearly attributable responsibility, and the separation between subject and tool (Samuel, 2026). This creates a fundamental tension: how can authorship, responsibility, and quality be attributed in a context of distributed cognition and sociomaterial agency?

Given this scenario, the objective of this article is twofold. First, we reconceptualize academic production as a 'hybrid sociomaterial process', articulating literature on the extended mind, extended self, sociomateriality, and distinction theory (Belk, 1988; Clark, 2001; Desrochers et al., 2018). Second, we propose a governance framework that explicitly recognizes the distribution of agency between humans and algorithmic systems (Bomba & De Angeli, 2025; Samuel, 2026), incorporating the role of algorithmic capital and the centrality of visibility and invisibility practices in the legitimation of scientific knowledge. In doing so, we shift the debate on AI in academia from a normative logic centered on individual behavior to a systemic perspective capable of capturing the structural transformations currently underway.

FROM INDIVIDUAL COGNITION TO HYBRID INTELLIGENCE

The understanding of academic production has traditionally been anchored in the figure of the researcher as a relatively autonomous cognitive unit, responsible for conceiving, developing, and expressing ideas through internal mental processes. Although literature acknowledges the collective character of science, models of authorship, responsibility, and scientific evaluation remain based on the assumption that knowledge can be attributed to individually identifiable human subjects (Brand et al., 2015; Cotton et al., 2024). This assumption, however, becomes increasingly difficult to maintain in the face of advancing digital technologies, especially generative artificial intelligence (Dwivedi et al., 2023; Rudolph et al., 2023).

The 'Extended Mind' perspective offers an important starting point for understanding this shift. By proposing that cognitive processes can incorporate external artifacts (Carter & Palermos, 2016; Heersmink, 2017), this approach breaks with the internalist view of the mind

and suggests that thinking is a distributed process involving continuous interaction between the individual and the environment (Hollan et al., 2000). In this context, digital tools cease to be mere support and begin to actively integrate the realization of cognitive tasks, participating in memory, analysis, and the production of ideas. With generative AI, this dynamic intensifies: it is not just about accessing information, but about co-constructing reasoning, arguments, and narratives through continuous interaction (Bozkurt, 2024).

The 'Extended Self' theory, in turn, allows for an understanding of how this integration also occurs at a symbolic level (Belk, 1988). By incorporating technologies as part of identity construction (Minina Jeunemaître et al., 2025), individuals begin to define themselves in relation to the resources they mobilize and master (Ahuvia, 2005). In the academic context, this means that AI not only supports the researcher's work but also comes to compose the way they think, write, and position themselves within the scientific field (Ou et al., 2024).

The articulation between these two perspectives points toward the emergence of forms of 'hybrid intelligence', in which humans and algorithmic systems operate in an intertwined manner (Dellermann et al., 2019; Raisch & Krakowski, 2021). In these arrangements, knowledge emerges from the continuous interaction between human and non-human capacities, making it increasingly difficult to attribute its origin to a single agent. It is not just about doing more or better, but about thinking differently through iterative cycles of interaction.

This hybridization, however, is not without tension. While it expands analytical and creative capabilities, it challenges established notions of intellectual autonomy and authorship. As reasoning becomes co-constructed, it becomes difficult to delimit where the human contribution ends and the machine's contribution begins. This indeterminacy is not merely technical but ontological. And it directly affects the mechanisms of academic recognition and legitimation (Perkins & Roe, 2024).

In this sense, hybridization should not be seen as an exception or transition, but as a new structural condition of academic production. More than tool users, researchers begin to operate as 'augmented cognitive systems' (Grumbach, 2026). The basic unit of analysis shifts from the isolated individual to the sociotechnical arrangement that sustains the research activity. It is from this shift that it becomes possible to advance toward a broader understanding of the implications of AI for the governance of scientific production.

ARTIFICIAL INTELLIGENCE AS AN ACTOR: A SOCIOMATERIAL TURN

Recognizing academic production as a hybrid process implies taking an additional step: abandoning the idea that artificial intelligence acts only as functional support and recognizing its role as an active participant in the production of knowledge. This requires shifting the analysis from the predominant view of technology as an instrument to a 'sociomaterial approach' (Orlikowski & Scott, 2008), in which humans and technological artifacts jointly constitute cognitive and scientific practices (Van Dijk & Rietveld, 2016).

In traditional models, research support technologies are treated as passive resources. This logic still guides much of the discussion regarding AI in academia (Bearman et al., 2022; Michel-Villarreal et al., 2023), where these tools are seen as instruments to be regulated or controlled (Chan, 2023; Floridi et al., 2018). However, generative artificial intelligence introduces a significant rupture: they do not only execute tasks, but they suggest paths, structure arguments, and influence decisions throughout the research process.

To move in this direction, it is necessary to abandon the notion of technology as a neutral instrument (Birhane et al., 2022; Martin, 2019). Actor-Network Theory (ANT) offers a useful lens by proposing that humans and non-humans should be understood as actants—elements that exert effects on the networks that constitute social reality (Latour, 2005). Agency, in this sense, is not an exclusive property of humans but an effect of relations (Müller, 2015; Müller & Schurr, 2016). Applied to academic production, this perspective allows for understanding AI as an active part in the configuration of scientific results.

Artificial intelligence thus acts as an 'epistemic agent.' By suggesting concepts, reorganizing arguments, and proposing narrative structures (Bozkurt, 2024), it influences not only the form but the content of what is produced (Dwivedi et al., 2023; Kasneci et al., 2023). This influence is relational and emerges from interaction with the researcher (Raisch & Krakowski, 2021), but it is sufficient to challenge the idea that scientific knowledge can be attributed exclusively to human intentionality.

The implications for authorship are profound. If knowledge results from interaction networks between humans and algorithmic systems, authorship ceases to be an individual attribute and becomes a relational effect. However, this distribution of agency is not accompanied by an equivalent distribution of responsibility. This creates a fundamental dissociation: while agency is distributed, responsibility remains concentrated in the human (Tomczyk, 2024).

Furthermore, the increasing participation of AI makes it harder to distinguish between contribution and mediation. Unlike previous technologies that operated as support, AI participates directly in the elaboration of content (Dwivedi et al., 2023; Tang et al., 2024). The boundary between what was produced by the researcher and what emerged from interaction becomes opaque. This opacity challenges scientific evaluation mechanisms, which are still based on identifying individual contributions (Alberts, 2013; Mazumdar et al., 2015).

Recognizing AI as a sociomaterial actor, therefore, implies shifting the focus from technology use to the interaction networks that sustain knowledge production (Gourlay & Oliver, 2018; MacLeod et al., 2019). Rather than asking how AI is used, it becomes necessary to understand how different human–algorithm configurations distribute agency, produce results, and generate new forms of value and legitimacy (Peeters, 2020; Savolainen & Ruckenstein, 2024). It is from this shift that space opens up to understand the symbolic transformations associated with AI, especially regarding distinction and the emergence of new forms of capital in the academic field.

FROM UTILIZATION TO DISTINCTION: ALGORITHMIC CAPITAL IN ACADEMIC PRODUCTION

The reconceptualization of academic production as a hybrid and sociomaterial process, combined with the recognition of artificial intelligence as an actor, raises an additional question: what now constitutes value and distinction in the context of AI-mediated scientific production?

In the previous sections, we argued that cognition becomes distributed (Hollan et al., 2000) and agency becomes shared. It then becomes necessary to understand how these transformations impact the symbolic legitimation mechanisms that structure the academic field (Bourdieu, 1991).

A first major shift concerns the loss of value associated with simple access to technology. As generative artificial intelligence systems become widely available, their use ceases to constitute a competitive differential. In other words, the use of AI, in itself, is no longer a marker of competence or sophistication. This movement shifts the focus of distinction from access to the mode of appropriation (Calderón Gómez, 2021; Van Dijk, 2017), that is, the manner in which these systems are mobilized, integrated, and controlled in the knowledge production process.

It is in this context that we can introduce the concept of 'algorithmic capital.' More than technical mastery, this capital refers to the ability to orchestrate interaction with AI systems in a way that maximizes cognitive gains without compromising the perception of human authorship and control. It is, therefore, a sociomaterial competence involving not just knowing how to use technology, but knowing when, how, and to what extent to delegate, integrate, and hide its participation in the final products.

This last aspect is particularly relevant. Unlike other academic technologies whose mediation tends to be explicit and socially accepted, generative AI introduces an ambivalence: while its use is increasingly widespread, the visibility of this mediation can compromise the legitimacy of the work produced. In this sense, practices of editing, rewriting, and textual 'cleaning' aimed at removing recognizable traces of algorithmic generation become an integral part of the academic production process. Distinction then comes to reside not only in the quality of the content but in the ability to render the machine's participation invisible.

This dynamic profoundly reconfigures scientific evaluation mechanisms. Criteria traditionally used in peer-review processes, such as textual fluidity, argumentative coherence, and stylistic consistency, begin to operate in a context where authorship is distributed but must be performed as an individual (Amirjalili et al., 2024; Dwivedi et al., 2023). In other words, the legitimacy of scientific knowledge depends, in part, on the ability to sustain the appearance of an exclusively human production, even when that production results from intensive interactions with algorithmic systems.

Thus, algorithmic capital can be understood as a new form of symbolic capital in the academic field, aligned with the logic of distinction described by Bourdieu (1984). As in other social contexts, value lies not only in the available resources but in the way they are mobilized and converted into legitimate recognition (Calderón Gómez, 2021). In the case of AI-mediated academic production, this conversion involves the simultaneous management of cognitive efficiency and the symbolic preservation of authorship (Amirjalili et al., 2024; Lund et al., 2023).

These transformations highlight an important limitation of current models of scientific production governance. By treating artificial intelligence predominantly as a technological resource to be regulated, such models fail to capture the symbolic and relational dynamics that come to structure the production and legitimation of knowledge. In a context where distinction depends on the orchestration and invisibility of algorithmic mediation, governance cannot be restricted to controlling use; it must consider the ways in which value, authorship, and legitimacy are continuously negotiated within the academic ecosystem.

It is from this shift that it becomes possible to advance toward a proposed governance framework capable of accommodating the hybrid, sociomaterial, and symbolically mediated nature of contemporary academic production.

GOVERNANCE OF ACADEMIC PRODUCTION IN HYBRID CONTEXTS

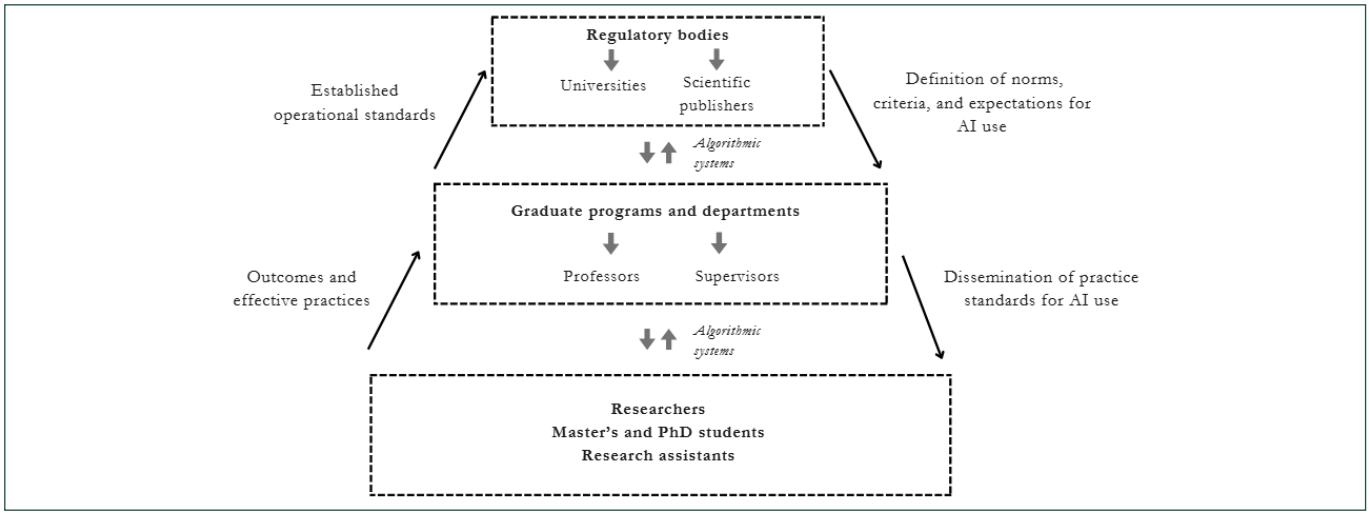
Traditionally, the governance of academic production has been guided by principles such as transparency, traceability, and individual accountability, materialized in institutional policies, editorial guidelines, and scientific evaluation practices. This system assumes it is possible to identify relatively clearly who produced what, how, and under what conditions (Brand et al., 2015; Mazumdar et al., 2015). Within this premise, the focus lies on the attribution of authorship, neglecting how knowledge is effectively produced (Larivière et al., 2016; Mongeon et al., 2017). However, if these premises are maintained in the face of transformations in academic production associated with AI, a mismatch arises between evaluation criteria and actual modes of knowledge production. The risk is the emergence of dynamics marked by fear, AI usage restrictions, and attempts at concealment, where signs of algorithmic mediation are avoided to preserve perceived authorship and legitimacy.

In this scenario, the problem ceases to be purely normative and becomes one of coordination between formal requirements and effective practices, since different actors operate under partially conflicting logics. Governing, in this context, means managing tensions between visibility and invisibility, control and autonomy, standardization and discretion. A paradox is thus configured: while governance demands transparency, the mechanisms of distinction in the academic field begin to value, at least in part, opacity, requiring the governance system itself to be revisited.

Based on the discussions proposed here, we argue that the governance of academic production in hybrid contexts must operate as a dynamic process of articulation among multiple actors who participate in various ways in the production, coordination, and validation of knowledge. Universities, funding agencies, scientific publishers, regulatory bodies, graduate programs, departments, research groups, professors, advisors, researchers, students, and algorithmic systems interact in sociomaterial arrangements where rules, practices, and results are continuously defined, translated, executed, and reconfigured throughout the system.

Our proposal unfolds into recursive dynamics that traverse the different levels at which governance is organized. At the broadest level, institutions and regulatory bodies establish norms, criteria, and expectations that guide scientific production. At the organizational level, programs and departments translate this normative apparatus into routines, evaluation criteria, and training practices, coordinating its operationalization. Finally, at the level of daily practices, researchers execute these guidelines, producing results, effective practices, and academic output in continuous interaction with algorithmic systems.

The distinctive feature of our proposal lies in the fact that this movement does not end at execution. Practices and results produced at the micro level are incorporated into the organizational coordination level, where they undergo evaluation and organization processes, subsequently being projected to the macro level as stabilized forms of use. These forms feed back into the system by informing and tensioning the revision of norms, criteria, and expectations, reconfiguring the very conditions that guide their production. Beyond recursivity, the framework introduces algorithmic systems as actors participating in these dynamics across all levels, contributing to the production, coordination, and evaluation of knowledge, and introducing a dynamic of continuous reconfiguration.



Source: Developed by the authors.

Figure 1. Governance of academic production in hybrid contexts.

The governance of academic production in hybrid contexts is characterized by managing interactions between different levels and incorporating contributions emerging from effective research practices, while recognizing the participation of algorithmic systems as a constitutive part of these dynamics. Rules, criteria, and expectations are continuously defined, translated, executed, and reconfigured based on the circulation of practices and results throughout the system. Thus, academic production governance implies coordinating a system in motion, in which norms and practices are mutually constituted and continuously adjusted through the interaction between humans and technologies.

In this context, the proposed framework shifts the focus of governance from a logic centered on the final product to a perspective oriented toward processes, practices, and relations that constitute knowledge production. Moreover, by incorporating the hybrid and sociomaterial nature of these dynamics (Fawns, 2022), the notion of actor is no longer restricted to human or institutional entities but includes elements actively participating in knowledge production. This change also reconfigures the understanding of resources mobilized in scientific production. Instead of being treated as available inputs or support instruments, these resources are understood in their articulation with the practices and arrangements in which they are mobilized, directly integrating knowledge production processes. Thus, the framework offers an analytical basis more adherent to contemporary transformations in the academic field.

DISCUSSION AND IMPLICATIONS

The analyses developed throughout this article allow for a reflection that goes beyond the governance of academic production and reaches a more fundamental question: why do we do research?

If, on one hand, previous sections showed that knowledge production becomes progressively hybrid, distributed, and, to some extent, delegable, on the other hand, they also highlight the limits of an understanding of research centered exclusively on its final products. In the contemporary context, where artificial intelligence systems are capable of supporting (and in some cases, executing) various stages of scientific production, it becomes increasingly plausible to imagine scenarios in which the generation of texts, analyses, and argumentative structures is broadly automated (Cotton et al., 2024; Dwivedi et al., 2023). From this perspective, academic production, understood as output, tends to lose its distinctive character. At the limit, much of what is currently recognized as scientific production can be realized, at least partially, by algorithmic systems.

However, this realization shifts attention to a frequently neglected dimension: research as a 'process of formation.' Particularly in the context of doctoral training, the value of research lies not only in the artifacts produced, such as theses or articles, but in the transformation of the researcher throughout that process (Cardoso et al., 2022; Leshchenko et al., 2021). The product of a doctorate, in this sense, is not a text, but a modified subject (Inouye & McAlpine, 2019), capable of thinking critically, articulating complex arguments, and exercising judgment in contexts of uncertainty.

The emergence of artificial intelligence, however, also reconfigures this formative dimension. If knowledge production begins to occur in hybrid arrangements, the researcher's training itself can no longer be understood as the development of exclusively human capabilities. Increasingly, a 'hybrid researcher' is formed, whose competence lies not just in mastering content or methods, but in the ability to interact with, orchestrate, and integrate algorithmic systems into their cognitive processes.

This transformation introduces a new tension. On one hand, delegating cognitive activities to AI can reduce learning opportunities traditionally associated with scientific practice, such as writing, analysis, and argumentative construction (Gerlich, 2025; Perkins, 2023). On the other hand, refusing to incorporate these technologies may result in training researchers who are misaligned with contemporary practices of knowledge production and use. Academic training thus comes to demand a balance between developing human capacities and building hybrid competencies.

This issue becomes even more relevant in areas such as Management, where research is oriented toward training individuals capable of acting in complex organizational contexts. In this scenario, researchers are not just producers of articles, but agents who make decisions, interpret information, and influence organizational practices. And these agents increasingly operate as hybrid systems where human judgment and algorithmic capacity intertwine (Faraj et al., 2018).

Thus, the transformations discussed in this article suggest that the debate on AI in academia cannot be restricted to the regulation of scientific production but must include a broader reflection on the goals of research and academic training (Chan, 2023; Dwivedi et al., 2023). Governing knowledge production, in this context, also implies rethinking what it means to train researchers and which competencies must be developed in a world where thinking, deciding, and producing knowledge become sociomaterial activities.

This reflection makes even more visible structural tensions that, while not new, become harder to ignore

in the context of AI. First, the very purpose of academic research is called into question. If production can be partially automated, it is necessary to revisit what actually constitutes the value of scientific activity. Second, increasing hybridization challenges the historically reinforced separation between research and training. As argued, the value of research lies not only in its products but in the transformation of the subjects who perform it (Van Manen, 1990). Finally, academic evaluation systems themselves, heavily anchored in productivity and impact metrics (Ellegaard & Wallin, 2015), become tensioned in a context where production can be amplified by AI without necessarily translating into higher quality or better training (Baidoo-Anu & Owusu Ansah, 2023).

CONCLUSION

The transformations associated with artificial intelligence are not limited to the introduction of new tools in academic production but evidence a deeper shift in the very nature of intellectual work (Dwivedi et al., 2021, 2023). Throughout this article, we argued that knowledge production must be understood as a hybrid sociomaterial process (Orlikowski, 2007) in which humans and algorithmic systems operate interdependently, distributing agency (Reddy et al., 2019), reconfiguring practices, and tensioning the traditional foundations of authorship, evaluation, and scientific legitimacy.

In this context, we proposed the concept of 'algorithmic capital' as an emerging form of distinction based on the ability to orchestrate AI systems to maximize cognitive gains while preserving the appearance of human authorship. This shift suggests that value in the academic field depends less on access to technology and more on how it is mobilized, integrated, and, in some cases, made invisible.

To make the theoretical implications of this argument more explicit, we synthesize our contributions into the following propositions:

- Proposition 1: In contexts of hybrid production, algorithmic capital tends to replace methodological capital as the primary marker of distinction in the scientific field

- Proposition 2: As cognition becomes distributed, authorship ceases to be an individual property and begins to operate as a social performance sustained by practices of visibility and invisibility regarding algorithmic mediation.

- Proposition 3: The dissociation between the distribution of agency and the concentration of responsibility tends to intensify tensions in governance systems, requiring new mechanisms for attribution, validation, and accountability.

- Proposition 4: In knowledge-intensive organizational contexts, the ability to orchestrate hybrid human–AI systems becomes a core competence, with direct implications for performance evaluation, professional training, and the structuring of intellectual work.

These propositions extend the scope of the debate by connecting it directly to core issues in organizational theory and management. The emergence of 'algorithmic capital' reconfigures performance evaluation criteria, shifting the focus from individual execution to sociotechnical orchestration. Simultaneously, it challenges traditional models of work design and competence development by blurring the boundaries between human contribution and technological mediation (Chan, 2023; Raisch & Krakowski, 2021). For knowledge-intensive organizations—such as universities, consultancies, and technology-based firms—these transformations highlight the need to rethink incentive systems, performance metrics, and training practices in light of the increasing hybridization of cognition.

From these discussions, a research and practice agenda emerges with relevant implications for the field of Management. First, it is necessary to empirically investigate how 'algorithmic capital' is distributed, recognized, and converted into value in different organizational contexts. Second, it is crucial to examine the ways in which evaluation and governance systems are being reconfigured as a result of the increasing algorithmic mediation of intellectual work. Third, the training of professionals in hybrid contexts corresponds to a critical field of investigation, especially regarding the competencies needed within sociotechnical arrangements. Finally, the growing valorization of the invisibility of algorithmic mediation raises important questions about transparency, legitimacy, and trust, both in academia and other organizational contexts.

More than a debate about technology, artificial intelligence reopens fundamental questions for organizational theory: how work is defined, how value is attributed, and how distinction is constructed in contexts of sociotechnical transformation. By rendering the hybrid nature of knowledge production visible, AI not only challenges existing governance mechanisms but demands a broader reconceptualization of the foundations upon which intellectual work, evaluation, and formation are organized in knowledge-intensive societies.

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