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Partners or Tools? – Anticipatory Governance for Human-AI Complementarity in Higher Education

Abstract

Artificial intelligence (AI) is accelerating structural change in higher education, reshaping teaching, research, and administration. To remain viable and socially responsible, universities must move beyond reactive governance and develop future-oriented capacities. This paper introduces anticipatory governance as a framework for higher education institutions to co-evolve with AI systems. Anticipatory governance is defined as the systematic use of foresight, participatory processes, and adaptive coordination mechanisms that prepare organizations for uncertain futures. Building on organizational theory and higher education governance research, we develop a framework that integrates structural governance challenges, the emergence of "shadow AI", and the concept of complementary intelligence, which positions AI as a cognitive partner rather than a mere tool. The paper shows how anticipatory governance can guide universities in redesigning faculty roles, student learning partnerships, and administrative decision-making.

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Keywords

forward-looking leadership, higher education transformation, human-AI co-evolution, complementary intelligence, transformational leadership

Partner oder Tools? – Vorausschauende Governance für die Komplementarität von Mensch und KI im Hochschulwesen

Zusammenfassung

Künstliche Intelligenz (KI) beschleunigt den Strukturwandel im Hochschulwesen und verändert Lehre, Forschung und Verwaltung. Um zukunftsfähig und sozial verantwortlich zu bleiben, müssen Universitäten über reaktive Governance hinausgehen und zukunftsorientierte Kapazitäten entwickeln. Dieser Beitrag stellt vorausschauende Governance als Rahmenkonzept für Hochschuleinrichtungen vor, um sich gemeinsam mit KI-Systemen weiterzuentwickeln. Antizipatorische Governance ist definiert als der systematische Einsatz von Vorausschau, partizipativen Prozessen und adaptiven Koordinierungsmechanismen, die Organisationen auf ungewisse Zukunftsszenarien vorbereiten. Aufbauend auf Organisationstheorie und Forschung zur Hochschulgovernance entwickeln wir einen Rahmen, der strukturelle Governance-Herausforderungen, das Aufkommen von „Schatten-KI“ und das Konzept der komplementären Intelligenz integriert, das KI als kognitiven Partner und nicht als bloßes Tool positioniert. Der Artikel zeigt, wie vorausschauende Governance Universitäten dabei unterstützen kann, die Rollen der Lehrkräfte, die Lernpartnerschaften der Studierenden und die Entscheidungsfindung in der Verwaltung neu zu gestalten.

Schlüsselwörter

Vorausschauende Führung, Transformation der Hochschulbildung, Gemeinsame Evolution von Mensch und KI, Komplementäre Intelligenz, Transformative Führung

1 Introduction

The starting point of this paper is the assumption that higher education development in the context of the rapid advancement of Artificial Intelligence (AI) must no longer be designed primarily reactively, but rather evolutionarily, adaptively, and proactively with foresight. The focus is on the question of how universities can remain viable for the future and assume social responsibility through a changed understanding of governance and leadership, particularly in the sense of "anticipatory governance".

Anticipatory governance represents a shift from traditional institutional stewardship toward future-oriented organizational capacity. Originally introduced in the 1990s and initially shaped by neoliberal New Public Management reforms, anticipatory governance has evolved into an independent concept of forward-looking institutional governance. Today it finds broad application in e-government, international development, environmental and climate policy, conflict prevention, and particularly in science and technology research addressing emerging technologies (Heo & Seo, 2021). This paper positions anticipatory governance as a necessary evolution for higher education institutions to address AI-driven transformation while maintaining their essential democratic and educational missions.

The challenges for universities do not arise solely from AI but are embedded in comprehensive societal transformation processes such as digitization, sustainability, inclusion, globalization, and individualization. Universities have already responded to these developments in the past with diverse measures and adaptations. With the emergence and rapid advancement of AI, however, these transformation requirements gain new dynamics and urgency (Gering et al., 2025). AI acts as an accelerator and amplifier of existing change processes and presents universities with new challenges at multiple levels, from teaching and research to administration and curriculum development.

University governance in particular moves to the center, as this is where different reform impulses and governance claims in dealing with AI converge. The enormous

speed at which generative AI systems in particular are developing not only changes the requirements for governance and leadership but directly impacts the working, teaching, and learning culture as well as examination formats and the daily collaboration of students, teachers, and staff. The stage model of development toward Artificial General Intelligence (AGI) proposed by Morris et al. (2024) illustrates how rapidly AI systems are moving toward complex, human-intelligent task fields between 2022 and 2025:

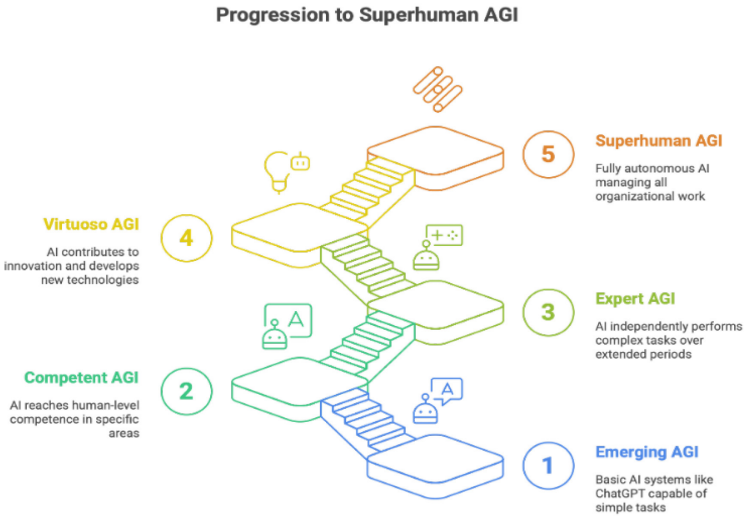

Figure 1: Five-stage progression model toward *Artificial General Intelligence* (AGI), from emerging AI systems to fully autonomous superhuman AGI (adapted from Morris et al., 2024)

With each advancement, existing routines, roles, and practices are called into question and must be actively shaped and steered. This makes clear that a central challenge for universities lies in developing their structures and cultures in the process of co-evolution with AI in such a way that they can use the potential of artificial intelligence responsibly and with a future orientation.

2 Governance Challenges in Contemporary Higher Education

2.1 Structural Challenges in Educational Governance

The significance of educational governance is closely linked to a decentralization of control and influence on the education system in recent decades. Educational governance aims to capture how various actors involved in particular political processes in educational contexts coordinate their actions while collaborating in political networks with multiple actors. This development creates complex relationship networks characterized by dynamic negotiation processes (deBoer & Huismann, 2020, pp. 335–336; deBoer et al., 2007).

Critically viewed, the history of steering public educational institutions appears as a history of failure, with inclusion serving as a pertinent case in point (byrd, 2022). In this context, Schreyögg (2013) refers to the "persistence" of educational institutions, which manifests itself in institutional inertia and organizational rigidity (Schreyögg, 2013; Dee et al. 2023, p. 16).

Three central causes can be identified for this stability: First, the loose coupling of systems, in which universities and education policy largely operate separately from each other. Weick (1995, p. 134) describes organizations as "loosely coupled systems in which action is underspecified, inadequately rationalized, and monitored only when deviations are extreme". Second, recontextualization by actors, whereby educational policy requirements are subjectively interpreted and appropriated. Third, the path dependency of developments, where earlier decisions limit the scope for future changes, often to the point of "institutional lock-in" (Beyer, 2006, p. 12).

2.2 AI-Specific Governance Challenges for Universities

AI does not enter universities into a neutral space but encounters institutions with strong immune systems.[3] As Papert (1992) already argued with regard to computers, schools (and by extension higher education) tend to assimilate potentially disruptive technologies in ways that stabilize rather than transform existing structures. What appears as innovation on the surface often becomes assimilation into traditional teaching practices, administrative routines, and research logics. AI-based assessment systems, tutoring platforms, and automated text generators are already used less as instruments of transformation and more as efficiency tools that reinforce conventional formats such as multiple-choice tests or standardized assignments. In this sense, universities risk repeating what Papert described: turning subversive potential into conservative consolidation.

This dynamic is reinforced by hopes of a techno-solutionistic (Morozov, 2014) approach expressed by the political temptation to frame AI tools as simple remedies for structural problems such as staff shortages, underfunding, or curricular overload. Instead of addressing the deeper institutional causes, governance strategies often highlight efficiency gains and time savings leading to the value of AI in education being frequently justified economically rather than pedagogically. Such framing not only obscures the social and political dimensions of university reform but also risks legitimizing AI as a substitute for human resources.

From a governance perspective, this creates several challenges. First, an assimilation trap: the tendency of universities to neutralize disruptive potential and integrate AI into existing routines without questioning fundamental assumptions about teaching, research, or administration. Second, the solutionism trap: the portrayal of AI as a fix

3 While higher education systems differ significantly between countries in terms of governance traditions and institutional arrangements, the acceleration of AI-driven transformation brings forward challenges that, in the long run, tend to converge across systems. Our focus therefore lies less on national specificities and more on structural tendencies that shape universities' encounters with AI globally.

for systemic crises, which shifts responsibility away from structural reform toward technical quick fixes. Third, the shadow AI problem (Challapally et al., 2025): unsanctioned grassroots adoption by faculty, staff, and students, which expands faster than governance structures can respond, creating risks in areas of data protection, academic integrity, and liability.

Thus, the governance challenge for universities is not only to regulate the functional integration of AI across teaching, research, and administration, but also to resist the tendency of assimilation and solutionism. Anticipatory governance must create spaces where AI is neither mythologized as a universal cure nor domesticated as mere efficiency software, but instead integrated in ways that genuinely expand human creativity, critical reasoning, and institutional responsibility.

2.3 Multi-Level Governance Complexity

Here, diverse approaches to education-related governance become apparent, which in the educational context essentially comprise three core areas: university autonomy and increasing individual university design leeway, corporatization of individual universities, and evidence-based education policy and university development (Neave, 2012; Amaral et al., 2009). In this context, the increasing relevance of a datafication of education has been observed in recent decades, an increase in the importance of data and (data-supported) evidence-based approaches in the steering of universities, as well as at the level of teaching design (e.g., datafication and individual support). AI technologies and applications with their divergent possibilities align with this datafication of education.

Beyond this perspective, the governance perspective expands the view beyond traditional steering approaches and focuses on the coordination of action between different actors in multi-level systems. Instead of just looking at state reforms, the formation of new order through society as a whole is considered. Governance encompasses all forms of collective action, “from institutionalized civil society self-regulation through various forms of cooperation between state and private actors to sovereign action by state actors” (Mayntz, 2004, p. 66).

Educational governance is concerned with the systematic examination of processes of emergence, maintenance, and transformation of social order and services in the education sector by foregrounding the coordination of actor behavior in complex multi-level systems (de Boer et al., 2007, pp. 139–140). Educational governance research emphasizes the interaction of actors in mutual dependence (actor constellations) as well as their "stubbornness" and the requirement that reform impulses must first be appropriated before they can become effective.

In the context of educational governance approaches, however, power differences always become visible, as actors have different opportunities for participation and influence in shaping universities and teaching. At the same time, for several decades, civil society actors as well as business (or market) actors have been gaining increasing influence, while the boundaries between them are blurring. The governance concept ultimately enables a comprehensive analysis of steering and restructuring issues in education as problems of action coordination between actor constellations.

3 Theoretical Framework: Anticipatory Governance for Higher Education

3.1 Conceptualizing Anticipatory Governance

This perspective complements the concept of "anticipatory governance" (Guston, 2014), which describes a forward-looking, participatory, and adaptive form of governance that is particularly relevant for dealing with emergent technologies like AI. Instead of linear steering models based on past experiences, circular, self-reflexive processes are emphasized that enable continuous learning and adaptation. Universities in particular are thus challenged to act ambidextrously (March, 1991; Tushman & O'Reilly, 1996), on the one hand further developing what has proven successful, and on the other hand continuously responding to new challenges and opportunities.

Anticipatory Governance (AG) results from a combination of:

governance – decision-making rules and processes which determine stakeholders' rights and responsibilities through coordination

anticipatory – organization or individual capacity to deal with new situations and realize accepted values, changing the focus from forecasting to being ready for future challenges (Heo & Seo, 2021)

In short, anticipatory governance can be described as a sustainable decision-making process based on consensus about a desirable future or vision that involves the participation of various actors, including government, market, public, and science. Anticipatory governance uses foresight to develop future plans and implement measures, and employs foresight as an instrument or process that enables governments to deal with accelerating and complex forms of change.

3.2 Organizational Templates for Anticipatory Governance

Taking into account Flyverbom and Garsten's (2021) framework, anticipatory practices in universities can be read as organizational "templates" for producing futures. Yet these templates are not neutral: they channel institutional responses either toward solutionist assimilation or toward transformative reimagination.

Indicative Snapshots: Rankings, dashboards, and indicators stage AI adoption as measurable progress. Such representations often reduce complex institutional change to adoption rates or efficiency gains. In this way, they embody the assimilation logic: AI becomes proof of modernization without questioning underlying structures of teaching, research, or administration.

Prognostic Correlations: Forecasts based on data analytics promise to show "where AI will hit hardest". While they can support resource allocation, they tend to domesticate disruption by framing it as incremental adjustment. Instead of rethinking the university in an AI era, correlations encourage universities to tweak existing routines to maintain stability.

Projected Transformations: Scenario planning, in contrast, can resist assimilation. By imagining alternative curricula, faculty roles, and governance arrangements, projections enable critical reflection on what forms of higher education are desirable. They open a space for asking not just *how to adapt to AI*, but *how to redesign the university with AI*.

Phantasmagoric Fictions: Narratives and imaginaries – whether hopeful or cautionary – mobilize collective imagination. While they can reproduce empty hype, they also hold the greatest potential to inspire genuine transformation: by articulating visions of human–AI complementarity that foreground creativity, ethics, and democratic participation.

In sum, Flyverbom and Garsten's templates help to reveal how anticipatory practices in higher education oscillate between assimilation and transformation. Universities often gravitate toward snapshots and correlations that stabilize existing structures under the guise of innovation, while projections and fictions offer pathways for reimagining institutional futures. Yet a critical gap remains: how can universities systematically privilege transformative practices over solutionist ones, and how can AI be positioned not as a threat or mere efficiency tool but as a genuine partner in governance?

The next section outlines our approach to this challenge. By integrating the framework of anticipatory governance with the concept of complementary intelligence, we propose an architecture that enables universities to resist solutionist assimilation and instead cultivate human–AI co-evolution as the basis for future-oriented institutional design.

3.3 Integrated Anticipatory Governance Architecture

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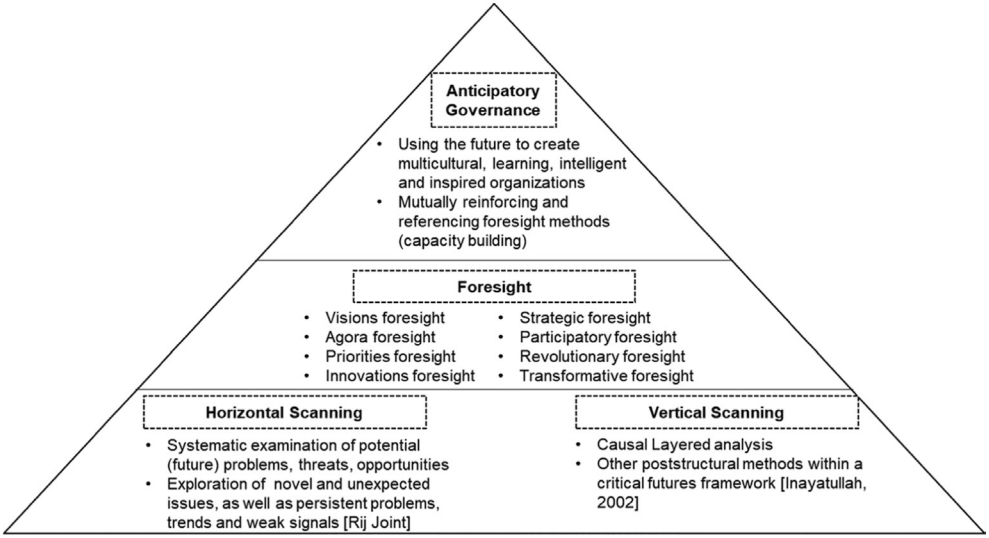

Figure 2: Hierarchical model of anticipatory governance, integrating foresight methods with horizontal and vertical scanning approaches for future-oriented organizational development (Heo & Seo, 2021)

Figure 2 illustrates this integrated approach through a hierarchical model. At the base, horizontal scanning identifies potential problems, threats, opportunities, and weak signals across the environment, while vertical scanning employs causal layered analysis and related critical futures methods to surface deep structures and assumptions.

These scanning processes feed into multiple types of foresight. For example, visions foresight develops shared long-term aspirations, while agora foresight emphasizes participatory deliberation with diverse stakeholders. Other forms such as priorities

foresight and innovations foresight link foresight to agenda-setting and technological change, while strategic, participatory, revolutionary, and transformative foresight represent increasingly ambitious approaches to systemic change.

At the apex, these activities crystallize into anticipatory governance: an institutional capacity to embed futures thinking in decision-making, build future receptivity among actors, and coordinate collective action. The framework thereby addresses the governance gaps identified in Section 2 by creating institutional mechanisms for proactive adaptation rather than reactive response to technological change. Unlike traditional educational governance that focuses on coordination between existing actors, anticipatory governance includes technological systems as legitimate participants in governance processes and systematically incorporates future possibilities into present decision-making.

4 Complementarity as Prerequisite for Human-AI Governance Relations

4.1 AI as General Purpose Technology in Higher Education

Large Language Models (LLMs) like ChatGPT have developed into a General Purpose Technology in a short time, comparable to historical developments like electricity or the computer. Eloundou et al. (2023) show that about 80 % of the US workforce is affected by this development, with at least 10 % of their tasks being transformed by AI. For around 19 % of workers, even more than half of their activities could be affected. However, these figures date from 2022–2023 and do not yet reflect the rapid development toward AGI. While the first waves of generative AI primarily affected text and image generation, current developments show that even creative and cognitively demanding professions are increasingly being transformed (Autenrieth, 2024, p. 3). Jobs originally classified as “AI-resistant” “white-collar” positions (e.g., programming, legal and business consulting) but also therapy (Stade et al.,

2024) and medical diagnostics (Tu et al., 2025) are already experiencing profound changes in their activity profiles today.

4.2 AI as Cybernetic Teammate in Educational Contexts

Dell'Acqua et al. (2025) show, for example, how generative AI fundamentally transforms collaboration and knowledge transfer within teams. AI functions not merely as a tool but as a "cybernetic teammate" that offers qualitatively similar advantages to human cooperation by diversifying expertise, reducing emotional burdens, and improving the efficiency and quality of decisions. Teams that integrate AI show significantly higher performance and benefit from a democratization of specialized expertise that was previously reserved for specific functional areas (Dell'Acqua et al., 2025, p. 4).

However, this transformation requires organizations to rethink in ways that go beyond merely increasing efficiency. AI changes not only how tasks are completed but also the fundamental concepts of teamwork, role distribution, and organizational structure. Organizations that see AI merely as an efficiency tool miss the opportunity to establish AI as an integral part of a new leadership and collaboration paradigm. The challenge for leadership is to recognize and proactively shape these new potentials by developing flexible, adaptive, and integrative organizational structures that place human-machine interactions at the center (Autenrieth, 2025, forthcoming).

Specific Applications in Higher Education:

Teaching Partnerships: Faculty increasingly collaborate with AI systems for curriculum design, content creation, assessment development, and personalized feedback. This partnership model requires new governance frameworks that define responsibilities, ensure quality control, and maintain academic integrity while leveraging AI capabilities for enhanced learning experiences.

Research Collaborations: Researchers utilize AI as cognitive partners for literature synthesis, hypothesis generation, data analysis, and manuscript preparation. Universities must govern these collaborations to ensure research quality, reproducibility, and ethical compliance while enabling innovative research methodologies.

Administrative Support: University administrators work with AI systems for student services, enrollment management, resource allocation, and strategic planning. This requires governance structures that maintain human oversight for consequential decisions while enabling efficiency gains and improved service delivery.

4.3 Complementary Intelligence Framework

In the context of this acceleration, the concept of complementary intelligence (Autenrieth, 2025 and Brynjolfsson, 2022) gains crucial importance. It overcomes the dichotomous view of human versus machine and instead focuses on synergistic potentials:

Extended creativity instead of substitution: While earlier waves of automation primarily affected repetitive activities, today's AI systems extend the creative and analytical capabilities of knowledge workers. The emphasis is not on replacing human creativity but on potentiating it.

Partnership instead of tool use: Modern AI systems are evolving from passive tools to cognitive partners that not only execute but think along, make suggestions, and adaptively co-design processes.

Human meta-cognition and ethical judgment: The actual strength of humans in this partnership lies in the ability for meta-cognition, contextual understanding, and ethical judgment which are dimensions that even advanced AI systems cannot yet convincingly represent.

5 Conclusion

The rapid development of artificial intelligence challenges universities to rethink their structures, cultures, and steering mechanisms. AI acts as an accelerator of already existing transformation processes and makes clear that higher education development today must no longer be designed reactively but rather with foresight, adaptively, and evolutionarily. This requires an "anticipatory governance" that relies on continuous learning, collective intelligence, flexible cooperation, and the active shaping of human-machine interactions. Central to this is the development of meaningful narratives and visions that provide orientation and enable collective action.

Universities must act ambidextrously, further developing what has proven successful while remaining open to new things. Successful governance and leadership means creating framework conditions for emergent cooperation, including with AI, and understanding change as a collective process. AI should be viewed not merely as a tool but as an actor and partner in shaping teaching, research, and administration.

The anticipatory governance framework presented here offers universities a comprehensive approach to navigating AI-driven transformation while maintaining their essential missions. By integrating Flyverbom and Garsten's (2021) organizational templates with educational governance theory and complementary intelligence principles, universities can develop institutional capacity for proactive co-evolution with AI systems.

This approach positions universities not as passive recipients of technological change but as active shapers of AI-influenced futures. Through systematic environmental scanning, participatory foresight processes, and adaptive coordination mechanisms, universities can model responsible AI integration for society while preserving their roles as democratic institutions committed to human flourishing.

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