The Impact of Hybrid Intelligence on the Evolution of Work Teams in the Quantum era

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Abstract: For incumbent enterprises, quantum technologies (QTs) represent not merely a radical technological innovation, but a fundamental evolutionary milestone. As a new technological reality, QTs act not merely as an external catalyst of operational change, but as an endogenous systemic factor of internal organisational change that transforms these organisations in an unprecedented way. The primary research focus of this study lies in the applied investigation of a novel model of organisational intelligence, emanating from the triple-fusion of human intelligence, artificial intelligence (AI) and QTs. Utilising a proactive approach, the triple-fusion model provides unique insights into how frontier cognitive architectures act as an impulse that reconfigures hybrid intelligence (HI) within work teams, driving a concurrent process of their evolution, transition, and transformation. The first phase of the triple-fusion model is based on the fusion of AI and QTs, resulting in Quantum Artificial Intelligence (QAI). The second phase of the triple-fusion model entails the strategic integration of human agents and QTs, culminating in the emergence of a novel paradigm of intelligence – namely, Quantum-Human Augmentation. The third phase of the triple-fusion model synthesises the outcomes of the preceding two stages – namely, QAI and Quantum-Human Augmentation. The definitive resolution of this phase, and of the overarching triple-fusion framework, is the emergence of multi-HI. This construct represents a novel model of organisational intelligence that functions as a fail-safe bridge between work teams grounded in human intelligence and work teams grounded in multi-HI. Work teams grounded in multi-HI will exhibit a radically altered ontological anatomy compared to work teams grounded in human intelligence. Within these teams, the demarcations between diverse modalities of intelligence will progressively dissolve, on account of the co-development and co-evolution of human intelligence, AI and QTs, and the emergence of new modalities of multi-HI. Depending on the nature of multi-HI, which is directly conditioned by a specific matrix wherein human intelligence and diversified forms of non-biological intelligence converge, work teams grounded in multi-HI will function as fluid, collaborative multi-networks within which human agents will retain their pivotal, foundational role, consistent with that in work teams grounded in human intelligence.

Keywords: Fusion, Human intelligence, Artificial intelligence, Quantum technologies, Work teams

1. Introduction

The twentieth century remains synonymous with the first quantum revolution, a historical epoch characterised by the intensive accumulation of theoretical knowledge regarding quantum systems. In contrast, the second quantum revolution represents the structural transformation of this knowledge into scalable QTs, specifically quantum computing, quantum cryptography, and quantum sensing. The quantum era, defining the horizon beyond 2025, marks a pivotal turning point in the advancement of frontier technologies, initiating an evolutionary trajectory poised to sustain its momentum well into the post-quantum era.

The deployment of these technologies will be realised in successive phases, given that quantum architectures have not yet attained the requisite technical maturity necessary to catalyse widespread adoption across corporate contexts. From 2026 onwards, global experts anticipate a fundamental strategic shift within this domain, transitioning from QTs as laboratory discoveries to their institutionalisation as an indispensable component of business reality. "As quantum computing accelerates from theory into meaningful action, 2026 will be remembered as the year organizations moved from curiosity to capability… Quantum power is coming, and the businesses that lean in early will be best placed to unlock its value" (Marr, 2026).

Prior to their institutionalisation as an indispensable component of business reality, these quantum architectures must be transformed into proactive drivers of organisational transformation. Within the quantum era, frontier technologies – specifically QTs and AI – will no longer constitute a limiting structural factor for corporations; rather, the ultimate differentiator will be the strategic responsiveness and adaptive capacity of enterprises navigating these technological advancements within a highly uncertain environment.

Experimentation with QTs represents a new business reality for proactively-thinking enterprises. Furthermore, this technological experimentation falls within the ambit of high-priority research imperatives. On the one hand, researchers and practitioners focus on resolving ethical dilemmas, complex issues regarding the trust of human agents in frontier technologies, and the intra-team division of labour. On the other hand, careful consideration is dedicated to challenges in the realm of managerial theory and practice, business and political

leadership, and the overarching systemic transitions necessary to facilitate successful deployment. Regardless of the complexity and scope of current inquiries, these quantum architectures are predominantly conceptualised as an exogenous factor of organisational transformation and a revolutionary mechanism for corporate change within this emerging technological epoch.

The methodological approach applied in this paper is fundamentally distinctive. Within this framework, QTs are simultaneously conceptualised as an organisational resource for incumbent enterprises, an endogenous systemic factor of internal organisational transformation, and an evolutionary milestone for these enterprises, spanning from the basic organisational unit (the work team) to the enterprise as a whole (characterised as a fusion of distinct work teams).

Propelled by this paradigm shift in research approach, the multi-decadal development of QTs within the work teams of incumbent enterprises marks the critical juncture at which these teams reach their developmental zenith—signifying their evolutionary endgame. Concurrently, through the operationalisation of the triple-fusion model, these teams initiate a comprehensive process of self-adaptation. This mechanism is purposefully designed to guide the internal systemic transition that enterprises must undergo, ultimately enabling them to achieve a total transformation in value creation and profitability tailored specifically to the imperatives of the quantum era.

2. Conceptualising HI Within Work Teams

There is no universal definition of work teams in organisational theory. When synthesizing the literature in the domain of work teams, it becomes evident that a work team is a fusion of human agents. "Work teams are defined as interdependent collections of individuals who share responsibility for specific outcomes for their organizations" (Sundstrom, De Meuse and Futrell, 1990).

Kozlowski and Bell (2003) deem that work teams and groups come in a variety of types and sizes, cutting across different contexts, functions, internal processes, and external linkages; can assume a wide variety of different forms – they are not unitary entities… As organisations and work continue to evolve, new modalities of work teams will be developed and classified. Given the interrelated nature of these diverse team categories, a work team is conceptualised as a distinctive, multi-iterative organisational entity with human intelligence at its ontological core.

Within collaborative units, human intelligence constitutes a dynamic, biological paradigm of organisational capability characterised by versatile dimensions. Serving as a distinct input for conceptualising ideas, generating practical solutions, executing frameworks, and implementing strategy to achieve collective objectives, human intelligence simultaneously acts as a catalyst for engineering synthetic cognitive models. Furthermore, human intelligence drives the development of frontier cognitive architectures through integration with these synthetic cognitive models.

AI represents a novel synthetic cognitive model, signifying the evolutionary culmination of human collaboration within work teams. "AI refers to the study and advancement of intelligent agents, systems capable of perceiving their environment and taking actions to achieve specific goals or perform tasks that typically require human intelligence" (Acampora et al, 2025). Shichkina, Ha and Ma (2026) consider AI systems to be agents with intelligence, which have their own dynamics and internal structure, as well as an ability to evolve. However, given that, according to the stated authors the existence of AI systems is closely connected with human existence, their evolution is inseparable from human evolution.

As a product of human cognitive evolution, AI constitutes a non-biological paradigm of organisational capability. Its integration within collaborative units triggers a fundamental paradigm shift at their socio-cognitive core, radically reconfiguring the team's dynamic architecture.

Beyond human intelligence, AI serves as an essential input within collaborative units, constituting an ontological core component of their collective dynamic intelligence. Operating as a non-biological modality of this collective capability, AI simultaneously acts as a catalyst for generating novel cognitive architectures and synthesising frontier configurations via integration with human capabilities. Concurrently, it represents the definitive evolutionary culmination for work teams historically anchored in purely anthropogenic intelligence. Belk, Belanche and Flavián (2023) posit that AI possesses the capacity to synthesize perception, reasoning, learning, and actuation within autonomous, non-biological systems that replicate or exceed human capabilities. This paradigm shifts the technological landscape towards intensified human-machine

collaboration, coopetition, and socio-technical integration. Leveraging these capabilities, AI generates a novel paradigm of intelligence – specifically HI – through its fusion with human intelligence.

HI, defined as "the ability to achieve complex goals by combining human and artificial intelligence, thereby reaching superior results to those each of them could have accomplished separately, and continuously improve by learning from each other" (Dellermann et al, 2019), constitutes a modality of intelligence "wherein human cognition and AI systems are not only integrated but mutually co-evolve" (Oyelere, 2026). Furthermore, Oyelere (2026) posits that HI is distinguished from traditional AI by its explicit emphasis on cognitive augmentation, collaboration, and adaptability, rather than automation or labour substitution. Thus, "a feedback loop is established, which ensures that humans and AI systems evolve in alignment with organizational goals and values" (Tan et al, 2025). "In the context of the constant evolution and proliferation of AI technology, hybrid intelligence is gaining popularity in reference to a balanced coexistence between human and artificial intelligence" (Pileggi, 2024).

From a team perspective, HI represents a structural framework of organisational capability, emerging from the synthesis of two operational forces: human intelligence and AI. The embedding of HI triggers a fundamental paradigm shift within the collective unit's adaptive capacity. Consequently, this hybrid architecture functions as both an operational input and an intrinsic component of the team's ongoing dynamic intelligence.

The integration of HI into the ontological core of work teams fundamentally establishes:

- The prerequisite conditions for embedding QTs within collaborative units, thereby driving the systemic transformation of incumbent organisations
- A catalytic impetus for the emergence of novel, non-biological cognitive paradigms and the architecture of multi-HI configurations, engineered through the tripartite fusion of human intelligence, AI, and QTs
- The initiation of a co-evolutionary trajectory encompassing human intelligence, synthetic cognitive models, and collective team intelligence, wherein work teams are conceptualised as the holistic synthesis of these forces
- A novel evolutionary epoch for frontier technologies, uniquely characterised by the reciprocal advancement of AI and QTs.

3. The Triple-fusion Model and the Reconfiguration of HI

QTs constitute the definitive output of human intelligence-grounded work teams. At the core of QTs lies a repository documenting the co-evolution of human and AI; this represents the dynamic intelligence of HI-grounded work teams, materialised within the configuration of frontier technology. Upon integration into work teams, QTs transform into an input, thereby becoming an integral component of the dynamic intelligence inherent within these socio-cognitive configurations.

QTs represent technologies characterised by transformative feedback, serving as both the evolutionary culmination of HI-grounded work teams and the catalyst for a novel evolutionary wave; this trajectory necessitates the perpetual reconfiguration of the dynamic intelligence within work teams. The initial reconfiguration pertains to HI, executed operationally through the triple-fusion model.

The triple-fusion model signifies the primary phase in integrating QTs into HI-grounded work teams, executed sequentially across three distinct stages. Designed to unlock the full potential of AI and QTs, this model drives an exponential increase in human intelligence. The ultimate outcome of the triple-fusion model is the emergence of multi-HI, which serves as the interface bridging two distinct evolutionary cycles of HI-grounded work teams.

3.1 Phase one of the Triple-fusion Model: Establishing QAI

Phase one conceptualises the fusion of two frontier technologies – AI and QTs – thereby establishing the architectural foundation of QAI. Through this integration, AI – traditionally conceptualised as a linear technology – interacts with non-linear QTs to facilitate its adaptation for operational deployment beyond laboratory constraints. Concurrently, QTs transition into a higher evolutionary echelon, effectively dissolving the traditional boundaries between intelligence as an intrinsic technological essence and technology that strives to autonomously generate its own distinct intelligence modalities.

QAI simultaneously signifies:

- Multi-intelligent hybrid configuration: as noted by Hoffmann and Flöther (2024), "Quantum AI technology is developing so quickly that plausible future scenarios today may already be replaced by new ones tomorrow. Increasingly, the technologies are intersecting, and a natural symbiosis is developing where progress in one accelerates progress in the other".
- A bidirectional co-evolutionary architecture: this is evidenced by Jiang et al (2026), who observe that "the bidirectional nature of QAI illustrates how these technologies can mutually enhance each other: AI accelerates quantum computing development through improved hardware design, circuit optimization, and error correction, while quantum computing offers theoretical pathways to enhance AI through potential computational advantages for specific tasks".
- An evolutionary watershed for both technologies: as synthesised by Acampora and Vitiello (2025), "the potential boost in computational speed from quantum computing could enhance the efficiency of artificial intelligence in mimicking human abilities, thus revealing an entirely new landscape for the creation and evolution of intelligent systems".

3.2 Phase two of the Triple-fusion Model: Advancing Quantum-human Augmentation

Based on scientific discoveries within the domain of the first quantum revolution, Graca and Gojakovic (2021) argue that human agents possess a unique modality of quantum intelligence, and that both machine and human quantum intelligence are governed by the same principles of quantum physics and the science of microstructures, albeit manifested through distinct modalities. Consequently, QTs embody quantum intelligence manifested through frontier technology, whereas human agents possess biological quantum intelligence that is inherently fluid and multidimensional.

The result of the fusion of human intelligence and QTs is Quantum-Human Augmentation, a unique hybrid biological-machine configuration characterised by multidimensional, quantum-driven socio-technical dynamics. From sociotechnical view this system uses "combinations of hardware, people (and usually other elements) to accomplish tasks that humans cannot perform unaided by such systems – to extend human capacities" (Kline, 1985). Pluzhnikova, Korableva and Bokova (2018) deem that the development of technical sciences has filled the concept of "intelligence" with a qualitatively new content. In accordance with their hypothesis, fusion of human intelligence and QTs, as the mere notion of "intelligence", can be considered a complex cognitive computational model – an informational system that creates and constructs informational space (informational environment) on the mental principle.

Consequently, the objective of this integration is not to marginalise human intelligence, but to ensure that human agents retain a central position within these work teams, thereby stimulating further technological advancement. Through the synthesis of human intelligence and QTs, human cognition will perpetually evolve. This continuous cognitive evolution will, in turn, enhance the intelligence capacities of QTs. Ultimately, synthetic cognitive configurations may achieve the capacity to autonomously generate distinct intelligence modalities, effectively offering a comprehensive solution to the primary research enquiry "how quantum computing can be applied to many current challenges and open up new opportunities with innovative ways that align better with human thinking" (Griffin et al, 2021).

3.3 Phase Three of the Triple-fusion Model: Realising Multi-HI

Multi-HI emerges as the direct product of the synthesis between QAI and Quantum-Human Augmentation. Representing an entirely unprecedented manifestation of intelligence, this construct possesses distinct emergent properties that were absent in its individual constituents.

Although it structurally aligns with co-evolutionary HI – which similarly represents "a symbiosis of artificial and natural intelligence mutually evolving, learning and complementing each other in a process of co-evolution… [to facilitate the] co-evolutionary cognitive development of human and machine agents" (Krinkin, Shichkina and Ignatyev, 2023) – multi-HI simultaneously encompasses three distinct dimensions:

- "The generic capability of agents (human or machine) to treat problems in multiple scale domains allows thinking to be reconceived as an operation of multiplicity, simultaneity, and portability, i.e. a general learning and problem-solving capacity which can operate on any variety of biological, machinic, and hybrid platforms" (Swan and dos Santos, 2023)
- A co-emergent configuration, composed of diverse intelligence and technology modalities

- A transition to a higher echelon of technological convergence, which implies the erosion of distinct boundaries between individual technologies, wherein they permanently coalesce into a new, unified whole.

In the near future, multi-HI will undergo cycles of development and evolution that intertwine through novel intelligence and technological modalities. These modalities will emerge as multi-HI will evolve into a constituent of the dynamic, HI-grounded intelligence of work teams. Precisely this distinctiveness of multi-HI will catalyse the transformation of the internal organisational environment, initiating a novel evolutionary trajectory. This evolution will be most pronounced within HI-grounded work teams, which are poised to undergo radical structural differentiation.

4. Situating Work Teams Within Multi-HI Dynamics

Stimulated by the development and evolution of HI, the evolutionary trajectory of HI-grounded work teams provides an idiosyncratic operational context for systemic corporate evolution, serving as a strategic catalyst for the future deployment of QTs.

There are several reasons why conceptualising a universal definition for a multi-HI-grounded work team remains unfeasible. These include the accelerated dynamism of technological shifts within the AI and QTs domains; the continuous evolution of human intelligence under the influence of these technological modifications; the rapid proliferation of emerging frontier technologies; and the development of unprecedented multi-HI modalities originating from the multi-fusion model.

Typically, a work team grounded in multi-HI can be defined as an open and integrated socio-cognitive entity. This configuration represents a fusion of human agents – specifically, new-generation professionals possessing transdisciplinary knowledge, frontier capabilities, quantum-augmented intelligence, intuition, and contextual know-how – who are capable of exploiting the full evolutionary potential of multi-HI and frontier technologies. Within this multi-HI context, work teams, operating as a manifestation of a socio-cognitive configuration, will "embody the fusion of human cognition and machine intelligence, leveraging the unique strengths of each component to achieve superior problem-solving outcomes" (Venigandla, Vemuri and Vemuri, 2024).

Multi-HI-grounded work teams will possess a radically altered ontological core, characterised by multi-HI operating as a fluid, dynamic form of intelligence. Mirroring classical HI frameworks, multi-HI ensures that "human's and AI's capabilities are augmented, leveraging the strengths of the individual actors, and compensating for their weaknesses. Another essential aspect is that the human-AI system improves, with both agents (human and artificial) learning from each other and their surrounding environment" (Van Zoelen et al, 2023).

Within multi-HI-grounded work teams, human agents will retain a central position, as they will execute complex tasks that remain fundamentally beyond the architectural boundaries of machine intelligence. "Neither technology nor the disruption that comes with it is an exogenous force over which humans have no control. In the end, it all comes down to people and values. We need to shape a future that works for all of us by putting people first and empowering them" (Schwab, 2016).

Compared to human intelligence-grounded work teams, the multi-HI-grounded work team will exhibit a transformed structural anatomy, which is conceptually predicated upon:

- A network of causal relationships operating between various intelligence modalities
- An autonomous combinatorics of diverse intelligence modalities at the ontological core of the team, dictated by the outcomes of the multi-fusion model
- A novel form of dynamic intelligence, namely multi-HI, calibrated precisely to the requirements of specific operational tasks.

Owing to the multi-fusion of permanently recombining intelligence modalities, the multi-HI-grounded work team will operate as a unique processing matrix that continuously strives towards dynamic homeostasis.

In essence, team dynamics will be characterised by a perpetual feedback loop governing the relationship between human agents and novel modalities of multi-HI. This will form an interconnected architecture wherein human agents will transform multi-HI, while multi-HI will initiate the cognitive evolution of human agents; both elements will jointly generate the conditions for driving frontier technologies, novel intelligence modalities, business innovations, and corporate added value through the multi-fusion model.

Consequently, in the short term, the multi-HI-grounded work team will become synonymous with an integrated organisational matrix; owing to the continuous development and evolution of multi-HI, the necessity for highly fragmented, narrow-specialisation work teams will be eliminated. "By forming a unified cognitive team, it enhances decision-making robustness, adaptability, and alignment with human context, ultimately leading to more effective and trustworthy intelligent systems" (Trappey et al, 2026).

Unlike human intelligence-grounded work teams, which historically epitomised dynamic intelligence within enterprises, the multi-HI-grounded work team will evolve into a platform for 'organisational technology' derived from the integration of three core pillars:

- Frontier technologies structured as a fluid, multidimensional, and self-organising network
- Multi-HI and novel frontier intelligence modalities that simultaneously enhance the adaptive capacity of organisations and facilitate the establishment of fluid, multidimensional, and self-organising networks, wherein information flows omnidirectionally and organic connections emerge naturally between diverse intelligence modalities
- Human agents, who will remain fundamentally responsible for organisational engineering, team architecture, systemic stability, and operational safety within the team.

Operating as a unique platform for 'organisational technology', the multi-HI-grounded work team will generate its own original 'organisational intelligence', thereby enabling enterprises to continuously adapt to the systemic disruptions inherent in the quantum era.

The multi-HI-grounded work team will constitute an essential component of corporate equity – namely, the internal organisational identity – serving as a primary driver of market differentiation. The authenticity of human agents, coupled with the unique ontological core of multi-HI resulting from the multi-fusion of diverse intelligence modalities, will provide a distinct competitive advantage and unparalleled market prominence in the quantum era, a period wherein most enterprises will leverage highly standardised or homogenous digital assets.

Looking forward, multi-HI-grounded work teams will transition into cohesive, stable, and self-sustaining multi-network architectures, given that "networked teams are an important anchor for organisations in times of change" (Cameron and Green, 2004). Concurrently, these architectures will need to remain highly dynamic, fluctuating, and recombinant to mitigate destructive forces, specifically the limiting factors arising from the multifaceted challenges of QT implementation.

5. Conclusion

QTs herald a fundamental shift in corporate strategic positioning regarding innovations within the domain of frontier technologies and emerging modalities of intelligence. Indeed, QTs pose an immediate challenge yet offer a profound developmental opportunity for organisations striving to navigate institutional disruptions before these technologies transition into an indispensable component of the business environment.

The triple-fusion model functions as a proactive, resilient framework for enterprises seeking to embed dynamic capabilities under the highly volatile and ambiguous conditions that characterise the inception of the quantum era. The overarching objective of the triple-fusion framework is to catalyse the emergence of a novel modality of HI – specifically, multi-HI.

This novel modality of HI signifies a pivotal turning point for the co-evolution of diverse cognitive structures and the underlying technological infrastructure. This convergence crystallises into an ontological core – namely, the configuration of fluid, agile work teams grounded in multi-HI – which subsequently facilitates the emergence of successive intellectual architectures and frontier technologies. This wave of exponential endogenous growth, driven by the manifestation of these next-generation frameworks, will transform incumbent enterprises in a groundbreaking manner.

Novel intelligence modalities – primarily multi-HI, emerging as a direct trajectory of the triple-fusion model – will trigger the evolution of work teams. Work teams grounded in multi-HI constitute a tangible outcome of the inaugural phase of internal systemic transitions within the quantum era, representing a unique active projection of a new organisational architecture complementary to the deployment and subsequent evolution of QTs. This shift denotes an evolutionarily superior level of team structures calibrated to the challenges of the quantum era, ultimately heralding the obsolescence of the organisation of work teams grounded in human intelligence. Consequently, the organisation of work teams grounded in multi-HI will serve as a foundational

platform for the cultivation of progressive capabilities among human agents, enabling them to interface seamlessly with both existing and emerging multi-HI modalities.

In the ensuing years, the evolutionary potential of multi-HI – operating as a dynamic modality of frontier intelligence – will mature into a pivotal driver of institutional transformation. In the near term, this trajectory is poised to reshape the organisation of work teams into fluid, collaborative multi-networks, wherein the historical demarcations between cognitive intelligence and technological infrastructure will progressively dissolve.

In addition to restructuring the team-based corporate architecture, multi-HI and its systemic implications within the quantum era will catalyse a series of complementary, fundamental scientific investigations, alongside frontier research and development initiatives, across the following domains:

- The conceptualisation of pioneering training programmes designed for a new generation of experts qualified to operate within work teams grounded in multi-HI
- The generation of novel organisational configurations for constructing and maintaining fluid, collaborative multi-networks, thereby establishing a stable yet flexible organisational architecture
- The formulation of strategic mechanisms for the continuous recombination of the work team's knowledge base – specifically multi-HI – ensuring that diverse cognitive modalities can be precisely fine-tuned for specific tasks
- The configuration of resilient organisational frameworks engineered for sustainable development within the quantum era
- The development and implementation of a new systemic model for managing the evolution of HI within the novel organisational environment, overseeing: the dynamics of multi-HI and team multi-networks; the operationalisation of the triple-fusion model; the manifestation of successive multi-HI modalities; the emergence of hybrid technologies emanating from these cognitive frameworks; the commercialisation of new products and services based on the fusion of multi-HI with hybrid technology; and the protection of hybrid modalities of intellectual property triggered by the convergence of next-generation human agents and multi-HI…

Ethics Declaration: Ethical clearance was not required for the research.

AI Declaration: No AI tools were used in the creation of this paper, but AI tools were used in proofreading.

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