From Human–AI Collaboration to Smarter Organisations: A Multi-Level Framework for Organizational Augmented Intelligence (AI+)*

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Abstract

Despite rapid advances in artificial intelligence (AI), access to increasingly intelligent technologies does not necessarily make organizations smarter. The challenge lies in understanding how human expertise, intelligent technologies, organizational knowledge, and contextual intelligence can work together to create meaningful value. Addressing this challenge, this conceptual paper proposes an integrative framework for Organizational Augmented Intelligence (AI+), drawing on Information Systems research, theories of human–AI collaboration and knowledge augmentation. The framework brings together two complementary dimensions. The first explains how augmented intelligence develops through four interconnected stages: Intelligence Readiness, Intelligence Orchestration, Organizational Intelligence Institutionalization, and Intelligence Value Realization. The second examines how these stages operate across three interdependent levels: individual, organizational, and societal. By connecting these dimensions, the framework explains how human–AI collaboration can evolve from technological readiness into an enduring organizational capability, supporting better decision-making, organizational learning, innovation, and resilience. Real-world business examples illustrate how these mechanisms operate in practice and how their benefits can extend beyond organizational boundaries. The paper contributes to a more integrated understanding of augmented intelligence as a multi-level socio-technical capability and provides a foundation for future research on how organizations can become smarter through human–AI collaboration.

Keywords

Organizational Augmented Intelligence (AI+), Human–AI Collaboration, Knowledge Augmentation, Organizational Intelligence, Decision-Making, Socio-Technical Systems

1. Introduction

Recent developments in machine learning, generative AI, agentic AI, and immersive technologies have significantly improved organizations' ability to process data, automate tasks, and make informed decisions [1, 2, 3]. However, despite this progress, organizations still face a fundamental paradox: having access to increasingly intelligent technologies does not necessarily make organizations more intelligent. Even the most advanced algorithms cannot, on their own, ensure better decision-making, improved organizational performance, or greater value for society [4]. What matters increasingly is how effectively organizations bring together

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artificial intelligence (AI) and human expertise [5], contextual understanding [6], and organizational knowledge [7]. This perspective highlights an important shift in how intelligence is understood within organizations. Rather than being generated by AI alone, intelligence develops through the interaction and collaboration between people and intelligent systems. This approach is known as *Augmented Intelligence*.

Augmented Intelligence, also known as Intelligence Amplification (IA) or Cognitive Augmentation, builds on Engelbart [8] and Engelbart & English [9] pioneering vision of using technology to extend human intellectual capabilities. Rather than replacing human intelligence, it emphasizes collaboration between humans and intelligent systems to enhance cognition, creativity, judgment, and decision-making [10, 11, 7]. This complementarity combines human reasoning, contextual understanding, and ethical judgment with AI's analytical power, speed, and scalability to achieve outcomes neither could produce independently [8,10, 6].

At the organizational level, *Organizational Augmented Intelligence (AI+)* emerges from the dynamic interaction of people, intelligent technologies, organizational processes, and contextual knowledge [12]. By combining human mindfulness with algorithmic mindlessness [13]. organizations can transform technological capabilities into collective intelligence, resilience, and sustained innovation[6]. Augmentation is thus not merely a technological capability but a socio-technical strategic process through which human and AI are integrated to create organizational value [7].

Despite the growing interest in Organizational Augmented Intelligence (AI+), research remains fragmented across different technologies, disciplines, and application domains [14]. Most studies focus on specific AI applications or their outcomes, but little is known about how organizations can effectively combine technologies, human capabilities, organizational knowledge, and contextual intelligence to create value. As a result, we still lack a clear understanding of how AI+ works, what makes it different from other AI approaches, and how it can benefit individuals, organizations, and society. To address this gap, this paper explores the following research question: ***How can Organizational Augmented Intelligence (AI+) integrate technological, human, organizational, and contextual dimensions to create value for individuals, organizations, and society?***

To answer this question, the Integrative Framework for Organizational Augmented Intelligence in Smarter Organisations proposes two complementary dimensions. The first explains how organizations develop augmented intelligence through four stages. It begins with Intelligence Readiness, where organizations prepare the technological, human, and organizational resources needed for augmentation. This is followed by Intelligence Orchestration, where human capabilities, intelligent technologies, and organizational knowledge are brought together to work effectively. The third stage, Organizational Intelligence Institutionalization, focuses on embedding this collaboration into everyday practices, processes, and decision-making. Finally, Intelligence Value Realization explains how these capabilities translate into value for organizations and society.

The second dimension considers where augmentation takes place, distinguishing three levels: individual, organizational, and societal. By combining these two dimensions, the framework provides a clearer understanding of how augmented intelligence develops, how it operates at different levels, and how it creates value for individuals, organizations, and society.

The remainder of this paper is organized as follows. Section 2 explains how Organizational Augmented Intelligence (AI+) develops through four interconnected stages, from intelligence

readiness to value creation. Section 3 examines how these stages unfold at the individual, organizational, and societal levels and brings them together into an integrative framework. Finally, Section 4 concludes by highlighting the main contributions of the framework and its implications for future research.

2. Understanding Organizational Augmented Intelligence (AI+): The Four Stages of Augmentation

Understanding how Organizational Augmented Intelligence (AI+) develops requires examining how technological, human, and organizational capabilities work together. Information Systems research has explored different aspects of this process, including technological capabilities and organizational value [15, 16], technology acceptance and use and human–AI collaboration [10]. Building on these contributions and the Recursive Theory of Knowledge Augmentation [7], AI+ can be understood as a socio-technical process in which intelligent technologies complement human expertise, judgment, and contextual understanding to improve decision-making, strengthen organizational resilience, and foster innovation and value creation [11]. Building on [12], this process develops through four interconnected stages: *Intelligence Readiness*, *Intelligence Orchestration*, *Organizational Intelligence Institutionalization*, and *Intelligence Value Realization*.

The first stage, *Intelligence Readiness*, concerns the resources and conditions organizations need to develop augmented intelligence. These include intelligent technologies such as machine learning, generative AI, agentic AI, and automation, together with human expertise, experience, creativity, and judgment. Organizational knowledge also plays an important role, whether it is formally documented in databases and procedures or acquired through everyday practices and experience [5]. These resources must be supported by contextual intelligence, which helps organizations understand their strategic priorities, culture, and operating environment. Governance mechanisms, including ethics, transparency, accountability, explainability, and compliance, are equally necessary to ensure responsible and trustworthy use [17, 6]. Together, these elements form the foundation of organizational intelligence. However, simply having access to these resources does not guarantee better decisions or performance. Their value depends on how effectively they are combined.

A practical example of Intelligence Readiness can be found at IKEA. The Ingka Group, IKEA's largest retailer, launched an AI literacy initiative to prepare employees and managers for the responsible use of artificial intelligence. By investing in employee training, leadership development, and ethical awareness, the company strengthened the human and organizational foundations needed for AI adoption [18]. This initiative illustrates how organizations can prepare for augmented intelligence before integrating human–AI collaboration more widely into their activities.

The second stage, *Intelligence Orchestration*, explains how organizations bring these resources together. At this stage, human intelligence, AI systems, and organizational knowledge interact to support decision-making. Humans interpret situations, evaluate alternatives, and provide contextual and ethical judgment, while AI helps analyze information, identify patterns, and generate insights. This collaboration creates a continuous learning process in which

humans improve AI outputs and AI helps humans develop new knowledge and understanding. This recursive relationship is central to knowledge augmentation [7]. Over time, these interactions also support shared cognition and organizational sensemaking, allowing knowledge and intelligence to be distributed across people, teams, and intelligent systems [11]. Human oversight remains essential to ensure that AI-supported decisions are reliable and appropriate to their context [5]. Intelligence Orchestration therefore transforms available resources into coordinated capabilities for better decision-making.

A practical example of Intelligence Orchestration can be found at Morgan Stanley. The company introduced an AI-powered assistant that helps financial advisors access and synthesize its internal research and knowledge. While AI provides relevant information and insights, advisors use their professional expertise and understanding of clients' needs to interpret the results and make informed recommendations. Their feedback also helps improve the system over time. This example illustrates how human intelligence, AI, and organizational knowledge can work together to support decision-making [19].

The third stage, *Organizational Intelligence Institutionalization*, occurs when human–AI collaboration becomes embedded in organizational routines, structures, and decision-making practices rather than remaining limited to isolated applications. This requires organizations to manage the relationship between automation and augmentation and develop new ways of combining human and artificial intelligence [20]. Through repeated interactions, organizations can develop shared knowledge, improve coordination, and strengthen their ability to solve complex problems [21]. Over time, these practices support organizational learning and the development of AI-related capabilities that become part of everyday operations [22]. They also create opportunities for innovation and adaptation by allowing organizations to combine human expertise and AI capabilities in new ways [21]. Augmented intelligence thus evolves from an operational support activity into an enduring organizational capability.

A clear example of Organizational Intelligence Institutionalization can be found at UPS. Through its ORION route optimization system, the company has integrated AI-supported decision-making into its daily delivery operations. Rather than using AI as a separate tool, UPS combines algorithmic route planning with drivers' experience and operational knowledge. Drivers and other employees can also update the system's maps, allowing practical knowledge to inform future decisions. This approach has become part of the company's established working practices, illustrating how human–AI collaboration can develop into an enduring organizational capability [23, 24].

The fourth stage, *Intelligence Value Realization*, concerns the outcomes generated through augmented intelligence (AI+). When organizations effectively combine human expertise with artificial intelligence, they can improve decision quality and accuracy by drawing on the complementary strengths of human judgment and machine intelligence, while maintaining the human oversight needed for responsible decision-making [25, 26]. Better decisions can lead to greater efficiency, productivity, competitiveness, and customer value. Augmentation can also encourage sustainable innovation by supporting the development of new solutions, services, and business models that respond to changing needs. Beyond immediate performance improvements, it can strengthen organizational resilience, responsible innovation, and long-

term sustainability [6]. Value realization therefore reflects the organization's ability to translate augmented decision-making into meaningful and lasting results.

A compelling example of Intelligence Value Realization can be found at John Deere. Its AI-powered See & Spray technology helps farmers identify weeds and apply herbicides only where needed, combining intelligent automation with farmers' agricultural expertise. In 2025, the technology was used across more than five million acres, reducing non-residual herbicide use by nearly 50% on average and saving approximately 31 million gallons of herbicide mix [27]. This example shows how augmented intelligence can generate measurable economic and environmental value by improving resource efficiency, reducing costs, and supporting more sustainable agricultural practices.

These four stages are closely connected and form a recursive process rather than a simple linear sequence. Intelligence Readiness provides the necessary resources, Intelligence Orchestration brings them together, Organizational Intelligence Institutionalization embeds the resulting capabilities into everyday practices, and Intelligence Value Realization reflects the benefits of improved decisions and actions. The knowledge gained from these outcomes can, in turn, improve future readiness and collaboration. Decision-making is the central mechanism connecting all four stages.

3. A Multi-Level Integrative Framework for Organizational Augmented Intelligence (AI+)

The four stages explain how Organizational Augmented Intelligence (AI+) develops, but augmentation does not take place in the same way everywhere. Its resources, mechanisms, capabilities, and outcomes vary depending on the context in which it is applied. To understand these differences, the second dimension of the framework examines how the four stages operate at three interconnected levels: *individual, organizational,* and *societal*. Each level contributes to the development of augmented intelligence while influencing and being influenced by the others.

At the *individual level*, augmentation focuses on strengthening human cognition, creativity, learning, and decision-making through collaboration with intelligent technologies [11]. Intelligence Readiness begins with access to AI assistants, chatbots, and other intelligent tools that can support everyday tasks and decisions. However, individuals also need the skills, confidence, and willingness to use these technologies effectively. During Intelligence Orchestration, people interact with AI systems, assess their recommendations, and combine technological insights with their own knowledge and judgment. Technology acceptance, trust, personalized interaction, and human–AI collaboration become important conditions for effective augmentation [10]. As these interactions become part of regular activities, Organizational Intelligence Institutionalization is reflected in more established ways of learning, working, and making decisions. Individuals gradually develop new cognitive and behavioral routines, using AI to support problem-solving, creativity, knowledge acquisition, and decision-making. These interactions can also provide emotional and cognitive support and

help individuals become more confident in managing complex tasks. Intelligence Value Realization is then reflected in improved decision quality, individual performance, learning, and well-being. At this level, augmentation creates value by enabling people to make better use of their knowledge and capabilities rather than transferring their decisions entirely to intelligent systems.

At the *organizational level*, augmentation concerns how human and artificial intelligence are combined to develop collective intelligence and organizational capabilities [7]. Intelligence Readiness depends on strategic resources such as analytics, big data, AI platforms, cybersecurity, and the knowledge and expertise available within the organization. During Intelligence Orchestration, these resources are connected through human–AI collaboration, workflow integration, knowledge sharing, and coordinated decision-making. AI governance and organizational processes help ensure that these interactions support common goals and responsible technology use. As these practices develop, Organizational Intelligence Institutionalization takes place when augmented knowledge and decision-making become embedded in organizational structures, routines, and processes. Organizations progressively build collective intelligence, organizational learning, dynamic capabilities, and adaptive decision-making routines. Knowledge is no longer limited to individual employees or separate technological systems but becomes a shared organizational resource. These capabilities help organizations respond to uncertainty, improve coordination, and develop new solutions. Intelligence Value Realization is reflected in stronger innovation, productivity, resilience, sustainability, and organizational performance. At this level, augmented intelligence becomes a strategic capability that allows organizations to achieve outcomes beyond what individuals or technologies could produce separately.

At the *societal level*, augmentation extends beyond organizational boundaries and concerns the role of intelligent technologies in economic development, public governance, sustainability, and societal well-being [28]. Intelligence Readiness depends on broader conditions such as digital infrastructure, ICT ecosystems, national AI capabilities, and institutional support. These resources provide the foundation for the wider adoption and use of intelligent technologies across public institutions, businesses, and communities. During Intelligence Orchestration, different actors coordinate their technological resources, knowledge, and expertise through digital transformation, institutional collaboration, AI governance, and ecosystem coordination. These interactions can improve how information is shared, how public decisions are supported, and how complex societal challenges are addressed. Organizational Intelligence Institutionalization occurs when these practices become part of established institutional processes and governance systems. This supports collective intelligence, institutional learning, evidence-based governance, and the development of more adaptive public institutions. Intelligence Value Realization can then be seen in economic development, improved public services, societal resilience, sustainability, and the creation of public value [28].

The three levels are interdependent. Better individual decisions and learning can strengthen organizational knowledge and performance. Organizations that develop stronger augmented intelligence capabilities can contribute to innovation, economic development, and broader societal outcomes. At the same time, societal conditions such as digital infrastructure,

governance, regulation, and public trust influence how individuals and organizations adopt and benefit from intelligent technologies. Augmented intelligence therefore develops through continuous interactions within and across these levels.

A practical example of this multi-level perspective can be found in Zipline's medical delivery operations in Africa. By combining autonomous drone technology with healthcare professionals' expertise and coordinated logistics, Zipline supports decision-making and service delivery at different levels. At the individual level, doctors and nurses can access essential medical supplies more quickly to support patient care. At the organizational level, hospitals and distribution centers improve the coordination of medical inventories and deliveries. At the societal level, these improvements can strengthen access to healthcare, particularly in remote communities. In Ghana, an independent evaluation found that vaccine stockouts were 60% shorter at facilities served by Zipline than at comparison facilities [29]. This example illustrates how human expertise and intelligent technologies can create value that extends from individual decisions to organizational performance and broader societal outcomes.

The *Integrative Framework for Organizational Augmented Intelligence (AI+) in Smarter Organisations* brings these two dimensions together in a matrix. The four stages—Intelligence Readiness, Intelligence Orchestration, Organizational Intelligence Institutionalization, and Intelligence Value Realization—explain how augmentation develops, while the individual, organizational, and societal levels show where this process takes place and how its outcomes differ. By crossing these dimensions, the framework connects human cognition, organizational capabilities, and societal outcomes within a common theoretical perspective. It also helps explain how digital resources, human expertise, organizational knowledge, and contextual intelligence can be transformed into sustainable value through human–AI collaboration. The Table 1 summarizes these relationships by showing how each of the four stages is expressed at the three levels of analysis. Together, the framework and the matrix provide a basis for understanding AI+ as a multi-level socio-technical capability and for guiding future research on how augmented intelligence develops and creates value.

Table 1.
Integrative Framework for Organizational Augmented Intelligence (AI+)

Level	Organizational Intelligence Resources	Intelligence Orchestration	Organizational Intelligence Institutionali-zation	Intelligence Value Realization
Individual : Cognitive & Behavioral Foundations	AI assistants, chatbots	Acceptance, interaction, trust, human–AI collaboration, personalized	Cognitive augmentation, emotional support, decision augmentation, and individual learning	Wellbeing, performance, decision quality

		interaction, decision coordination		
Organisational : Collaborative Dynamics	Strategic Assets: Analytics, Big Data, AI platforms, cybersecurity	Human–AI collaboration, workflow integration, knowledge sharing, AI governance, process integration	Knowledge augmentation, organisational learning, dynamic capabilities collective intelligence,	Innovation, resilience, sustainability, productivity
Societal : Socio-Economic & Macro Context	ICT ecosystems, digital infrastructure, national AI capabilities	Institutional adoption, digital transformation, AI governance mechanisms and ecosystem coordination	Evidence-based governance, ecosystem augmentation, institutional learning and adaptive governance capabilities	Economic development, societal resilience, public value

4. Conclusion

The future of smarter organizations will depend not only on how intelligent their technologies become, but also on how intelligently they bring together people, technology, knowledge, and context. The proposed AI+ framework offers a way to understand how this collaboration develops, becomes part of organizational practices, and creates value beyond technological performance. The example of Zipline illustrates this broader perspective: when intelligent technologies support healthcare professionals and improve organizational coordination, their benefits can extend to communities and society. This highlights how value created at the individual level can contribute to stronger organizations and wider societal outcomes. The framework also opens new directions for research on how augmented intelligence can strengthen human capabilities, organizational resilience, and societal well-being. Ultimately, the real promise of AI is not to replace human intelligence, but to help individuals, organizations, and society become more intelligent together.

Declaration of Generative AI Use

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to improve English grammar, readability, and academic writing style, and to assess the clarity and

coherence of the proposed conceptual framework. The tool was used to support the presentation and communication of the authors' ideas. The authors reviewed and revised the AI-assisted suggestions and take full responsibility for the conceptual framework, arguments, and final content of the manuscript.

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