From Tool to Teammate: Positioning Generative AI for Collaborative Industrial Workflows

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Abstract

Generative AI (Gen AI) holds great potential to transform industrial operations. This position paper explores this potential, drawing on insights from interviews with experts in industrial AI. The study reveals a range of use case categories and examines the dynamics of human-AI collaboration through the lenses of communication, coordination, and collaboration. However, realizing this potential requires addressing both technical and non-technical challenges. The paper argues that successful integration of Gen AI requires a human-centered design mindset and a holistic system approach, emphasizing transparent communication, well-defined coordination mechanisms, and fostering trustworthy collaboration. It reflected upon the importance of carefully considering human-AI interaction, organizational restructuring, and the development of appropriate policies and interfaces to ensure that Gen AI empowers workers and contributes to a safer, more efficient, and innovative industrial future.

Keywords

Generative AI, Human-AI Collaboration, Automation, AI Ethics, AI Adoption, Human-Centered Design, Communication, Coordination, Collaboration, Trust, Explainability, Organizational Change

1. Introduction

The integration of Artificial Intelligence (AI) into industrial contexts has evolved significantly over the past few decades, driven by advancements in technology and a growing understanding of its potential applications. In the early stages of AI development, the focus was primarily on automating simple tasks and processes within manufacturing environments [1]. This era saw the introduction of basic algorithms and rule-based systems that could handle repetitive tasks, thereby reducing labor costs and improving productivity. However, the capabilities of these early systems were limited, often requiring substantial manual input to function effectively.

With more advancements in technologies of machine learning and data contextualization, we see that AI has becoming a cornerstone in enhancing industrial operations in the recent decades, where it is primarily serving as an analytical tool for better prediction. For instance, machine learning models can process sensor data to predict machinery breakdowns which allows for proactive maintenance scheduling and minimizes unexpected downtimes. Another area is process optimization where AI systems identify potential bottlenecks, or anomalies and recommend adjustments by scrutinizing production workflows. This can lead to improved resource allocation and reduced operational costs.

Now, the advent of Generative AI (Gen AI) in recent years marks a transformative shift from AI as a mere analytical tool to a collaborative teammate in industrial contexts [2]. Unlike conventional industrial AI that focused primarily on data analysis and anomalies detection, Gen AI leverages large language models to create new contents in various forms that closely mimic human communication [3] or provide clinical reasoning in medical education [4]. This evolution may introduce a new

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paradigm in human-automation interaction, where AI systems not only assist but can collaborate or reason with human counterparts [5, 6].

However, this shift brings forth numerous challenges to traditional industrial operations and business [7-9]. The collaborative and knowledge-based nature of Gen AI may demand new strategies for human-AI teaming which is under-explored, as it is vital to ensure that Gen AI systems complement human expertise rather than complicate it. Some big questions are how we can accommodate these generative AI entities into industrial workflows to increase safety and efficiency, and how humans and machines can effectively communicate, plan, coordinate, and collaborate. Understanding the value, capabilities and limitations of Gen AI is therefore crucial, especially in industries where domain-specific knowledge and operational constraints prevail. Without these more in-depth understandings, we may face the risk of misalignment between novel AI functions and human expectations that potentially lead to operational disruptions.

To delve deeper into these questions, we conducted interviews with 12 industrial AI experts. Our study aims to deepen the understanding of Gen AI, discovering core use case categories and associated core value, and elucidating limitations and adoption barriers, as well as showing future development implications. These insights aim to inform the evolving role of AI beyond its traditional function as a tool, outlining the necessary developments for this transition from various perspectives, and thereby contributing to the guidance for Gen AI's successful integration into collaborative industrial workflows.

2. Interview study on generative AI

In our generative AI study, we conducted a series of 12 semi-structured interviews to gain a broad view of how industrial AI experts understand and envision Generative AI. 7 participants were internal to ABB, occupying roles within corporate research, business development while 5 were external experts, including AI strategists, renowned scientists, and a former partner at a global consulting firm. This mix allowed for a diverse range of perspectives, from hands-on AI use and development in different contexts, to broader strategic outlooks. Each interview lasted approximately 60 minutes covering key topics such as current trends in AI, real-world applications of Gen AI, and the challenges and barriers to its adoption. Participants were encouraged to discuss areas they found most relevant. Informed consent from all interviewees were received for ethical and legal considerations. Following data collection and transcription, we performed a thematic analysis to systematically extract recurring themes, patterns, and insights related to how Gen AI is perceived, its potential industrial applications, and the hurdles that might impede its adoption. Discussions among the research team were also held to reflect upon participants' shared thoughts and concerns, yielding a consolidated representation of the diverse viewpoints captured in the interviews.

3. Key findings

3.1. Experts' Perceptions and Understandings of Gen AI

A clear theme across the interviews was the perception of Gen AI as a powerful, multifaceted technology that extends beyond traditional, analytics-focused AI. Some experts characterized Gen AI as an "*all-knowing oracle*" capable of integrating vast amount of information and responding with human-alike answers. Some interviewees believed that it could act as a "*multi-domain person*" or "*integration layer*" bridging different automation systems and human stakeholders. In comparing Generative AI with more classical "analytical AI", participants mainly emphasized three primary differences:

1. Gen AI often requires more advanced models and greater volumes of diverse training data.

2. Unlike analytical models designed for narrower tasks, Gen AI excels at generating human-like contents and summarizing information from multiple domains.
3. The shift from fine-tuning AI for narrowly defined business objectives towards broader, more generalized applications opens opportunities but it simultaneously raises critical societal and ethical challenges.

Overall, quite a few interviewees perceived Gen AI as a sort of "next-level AI", something that has the potential to transform how organizations operate in industrial contexts.

3.2. Main use cases and core value

Despite participants coming from different roles, they consistently identified a wide array of use case categories in which Gen AI can bring substantial value to industrial applications. These often overlapped and reinforced each other:

- Automating the "boring" tasks: Using Gen AI for routine documentation, administrative work, or even customer service work. Many saw a "low-hanging fruit" opportunity to streamline mundane activities so that workers can focus on higher-level tasks.
- Operational guidance and troubleshooting: Experts highlighted the technology's ability to integrate real-time data, reference expensive technical documentation, making it act as a "manuals killer" to guide workers in tasks such as maintenance and troubleshooting.
- Context-aware communication: Participants described new ways of conveying alarms or process information to operators. Gen AI could integrate data from different sources, contextualize alarms, address user questions, thus improving operational clarity.
- Supporting for data analysis and business decision making: Acting as a "junior consultant", Gen AI could analyse large datasets from operations in factory production or supply chains, offering deeper business insights without requiring for in-depth data science expertise.
- Innovation and development work: In R&D contexts, Gen AI boosts productivity by assisting with tasks such as prototyping, PLC code generation, and even integrating with digital twin systems. This may potentially lead to faster innovation cycles.
- Energy optimisation: Leveraging its ability to synthesize multiple data sources like sensor logs and operational records, Gen AI can be useful in optimizing energy consumption. This is especially valuable in sectors such as process industries.
- Multi-agent interaction: Several experts highlighted the potential of multi-agent flows and systems to delegate and manage tasks within complex industry operations such as manufacturing. Gen AI can help balance priorities such as production, maintenance needs, and business goals through coordinated efforts across different agents.
- Coordination among different human roles: Gen AI offers an intriguing potential for coordinating and enhancing collaboration among diverse human roles and organizations, fostering shared understanding and mitigating potential conflicts.
- Emotional value: A less expected but interesting notion was Gen AI's ability to contribute a form of "emotional value", supporting inclusivity and potentially influencing user motivation.
- Knowledge democratization: Gen AI can serve as an "organizational dictionary" to truly empower the workforce across the whole organisation by storing, extracting, consolidating, and presenting domain knowledge.

During the interviews, participants consistently returned to the core value themes of knowledge democratization, productivity, efficiency, transparency, creativity, visibility, traceability, accessibility, and inclusive decision-making. This suggests that Gen AI has the potential to fundamentally transform industrial operations - not merely by automating routine "boring" tasks with generated contents, but by reconfiguring the way industrial information is accessed, shared, and acted upon. In essence, Gen AI can break down traditional information silos and serve as a

catalyst for a more open and collaborative industrial ecosystem where every stakeholder can get empowered to contribute to and benefit from a collective pool of knowledge.

3.3. Limitations and adoption barriers

Participants mentioned issues with transparency and explainability with AI, as well as the technical challenges to allow AI to have contextual understanding. They described Gen AI's limitation in producing outputs that may be making sense in form but inaccurate in facts ("hallucinations") – this can be risky because in industrial environments, even subtle errors can escalate into fatal consequences. How to enable Gen AI to continuously learn from human user expertise is another challenge to cope with. Some interviewees also emphasized the lack of high-quality labeled data, integration challenges with legacy systems, and the significant computational resources needed to deploy and maintain Gen AI solutions at scale. A few noted the difficulty of creating a "one-size-fits-all" model to particular industrial domains. Lastly, concerns about data security and corporate confidentiality surfaced repeatedly, questioning how sensitive industrial information may feed into model training.

Beyond technical hurdles, participants pointed to a lack of trust towards Gen AI solutions. There were also concerns on level of responsibility and accountability that should be given to generative AI. Some felt organizations struggle to identify real valuable use cases (often starting with "*we have this cool technology. Let's go and find a problem for it*"), which may lead to fragmented or ineffective implementations. Additionally, ethical and regulatory considerations around data ownership, bias, and environmental impact emerged as significant barriers. Overall, the path to deploying and scaling Generative AI in industry isn't just about the technology itself. It's a tangled weave of technical obstacles, cultural shifts, and regulatory landscapes, all demanding careful navigation.

3.4. Future development implications

When asked about the future of Gen AI, a few participants mentioned the need for researching new collaboration patterns between humans and AI. They saw Gen AI as an emerging force in reshaping how individual and organizations communicate, coordinate, and collaborate with automation systems. Many advocated for interdisciplinary and inter-organizational cooperation, uniting diverse perspectives coming from industrial domain experts, machine learning scientists, human factors and UX specialists, and business decision makers to ensure that technology truly augments human abilities. Beyond these broad thoughts, participants also mentioned personalizing AI interactions to adapt to different user roles and preferences can become more outstanding. Additionally, the mentioned rising agentic AI would have the potential to truly disrupt established workflows, organizational structure and even business models. However, harnessing this potential will require addressing multiple technical and organizational factors.

4. Discussion

Our interviews reveal that Gen AI holds the promise of creating new dynamics between humans and technical systems, moving beyond the conventional framing of "AI as a tool" toward a view of "AI as a teammate". We now turn to three key areas - communication, coordination, and collaboration - to explore how our findings illuminate the nature of hybrid human-AI teams and some relevant design implications.

Many participants spoke of Gen AI's ability to enhance communication by aggregating data from multiple sources and presenting it in ways that feel both natural and contextually rich, whether it is supporting field maintenance work or offering operational summaries for management. However, this very strength also accentuates the need for transparency and explainability. When an AI system provides confident-sounding answers, people may assume it is accurate and thus trust by default. This could be dangerous in industrial contexts. Designing for responsible communication may be a key to this challenge, meaning that the design shall consider embedding mechanisms that, for

example, can show how information was derived, highlight underlying assumptions, and clearly distinguish between fact-based output and speculative contents.

During the interview, participants mentioned scenarios in which Gen AI could integrate into existing workflows, acting much like a high-level coordinator for improved efficiency and stronger cross-team collaboration. Nevertheless, it is important to realize that the success of such a setup depends on structuring interactions so that every actor - human or AI – "understand" their role, responsibilities, and decision-making boundaries. Notably, this shift toward AI as a teammate raises questions of accountability: if a recommendation leads to an error, does responsibility lie with the human operator who ultimately "approved" it, or with the developers and managers who designed or deployed the AI system? Our findings suggest that industrial organizations may have to formalize how AI-driven suggestions are validated, how disputes or conflicting insights are resolved, and how to log and trace such outcomes. Additionally, this new paradigm requires rethinking organizational structures and processes. This is because, Gen AI can provide insights with impacts on cross-functional teams that traditional workflows might not be designed to handle, and thus leaders may need to adjust processes to incorporate these new AI-driven inputs. This reconfiguration could be subtle in the beginning, e.g., training operators to interpret and act upon AI-enabled recommendations, but over time, it may also involve more fundamental changes to hierarchical decision-making. Ultimately, these transformations may point to a deeper shift in organizational culture.

Collaboration with Gen AI goes beyond chatting with messages. It taps into a different approach to problem-solving and innovation. Several experts imagined a future where engineers "brainstorm" with Gen AI systems that can quickly produce drafts of potential solutions and challenge conventional assumptions. AI can become part of a team's creative process, rather than a mere "after-the-fact review tool".

However, embracing AI as a true collaborator demands user trust, which hinges on many factors including system performance such as reliability, predictability, usefulness etc. [10]. Designing for trustworthy collaboration thus involves offering ways for humans to monitor AI's actions, effect and understand the rationale behind [11]. Even if AI is involved in generating ideas, analyzing data, or making recommendations, the ultimate responsibility and decision-making power should remain with humans.

Admittedly, as Gen AI systems become more embedded in the future, the boundaries of responsibility could become blurred sometimes. But the point is not to avoid these ambiguities, but rather to design infrastructures, policies, and interfaces that actively foster transparent and trustworthy interaction between humans and AI. This approach will eventually lead to more empowering automation experiences, where humans and AI truly work collaboratively to address the complexities of modern industry.

5. Conclusions

Generative AI is clearly more than just the latest tool in the industrial AI toolkit. It represents a step change in how people and automated systems can work together. Our interview study with AI experts highlighted the technology's potentials in many aspects including optimizing operations, democratizing knowledge, and facilitating new forms of collaboration, while revealing various technical, organizational, and ethical challenges. Through the lenses of communication, coordination, and collaboration, the interview findings imply that effectively integrating Generative AI into industrial settings calls for a human-centred design mindset and a holistic system perspective. Simply rolling out an advanced large language model with impressive generative capabilities does not ensure meaningful or safe usage. Instead, organizations need to consider how the systems will interface with existing workflows, how it will foster trust and accountability, and how new roles or processes might be adapted or created to harness its insights.

Declaration on Generative AI

During the preparation of this work, the authors used Microsoft Copilot in order to: Grammar and spelling check. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

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