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Article

The Forthcoming AGI Revolution: Its Impact on Society and Firms

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Abstract

This paper examines the transformative impact of Artificial General Intelligence (AGI), poised to redefine society and organizations by surpassing narrow AI's capabilities. Drawing on historical technological revolutions, we analyze AGI's potential to enhance problem-solving, address global challenges like climate change and healthcare disparities, and reshape labor, governance, and human purpose. Through a human-AI collaborative approach, we present four scenarios—ranging from utopian synergy to existential risks—to assess AGI's societal and economic implications. Key considerations include cognitive automation, ethical governance, and equitable access. We propose actionable recommendations for governments, firms, and educational institutions, emphasizing reskilling, international cooperation, and ethical frameworks to ensure AGI fosters inclusive prosperity while mitigating risks like job displacement and inequality.

Keywords: artificial general intelligence (AGI); technological revolution; human-AI collaboration; societal impact; scenario planning; ethical governance; employment; equitable access

Artificial Intelligence (AI) has profoundly reshaped society, workplaces, and daily life, capturing global attention (Korinek, 2025; Liu et al., 2024). The focus has recently shifted to Artificial General Intelligence (AGI), fueled by its potential to achieve human-like cognitive versatility (Smith, 2025; Heikkila, 2024). A defining moment in this trajectory was the November 2022 launch of ChatGPT, which achieved a record-breaking one million users in five days and 100 million in two months, becoming the fastest-growing consumer software in history. By January 2025, its weekly visitors exceeded 300 million, with 100 million new users that month, driving its valuation to \$300 billion (Metz, 2025). This rapid adoption underscores public fascination with AI and has intensified competition among tech giants and startups to advance toward AGI.

In January 2025, DeepSeek, a Chinese startup, disrupted the AI landscape with its R1 Large Language Model (LLM), matching leading models' performance at significantly lower training and operational costs. This breakthrough highlighted the potential for smaller, non-Western players to challenge resource-intensive tech giants, fostering global innovation and optimism for AGI development. Additionally, a trend toward small language models (SLMs) emerged, with companies like IBM, Google, Microsoft, and OpenAI releasing efficient models using fewer parameters, reducing costs and environmental impact while broadening AI accessibility (Ornes, 2025).

One of the paper's authors, with prior research on technological revolutions (Makridakis, 2017; Makridakis, 1995) collaborated with his co-author to investigate the impact of the impending AGI revolution. Through extensive discussions and broad research, the concept solidified, leading to a firm commitment to move forward with a sequel paper to the digital and AI revolutions. The main challenge was distilling the vast amount of information covering the AGI revolution into a concise, original paper. To tackle this, we decided to follow an innovative approach by collaborating with AI, utilizing large language models (LLMs) to ensure comprehensive coverage of the topic and demonstrate with a real example the ability of LLMs to collaborate with us in writing an academic paper (Appendix 1 details how the collaboration between the authors and Grok3 was achieved).

1. Introduction

Technological revolutions have historically transformed human civilization, from the Industrial Revolution's mechanization of labor to the Digital Revolution's global connectivity and the AI Revolution's automation of cognitive tasks (Makridakis, 1995, 2017). Artificial General Intelligence (AGI), with its potential to match or exceed human cognitive abilities across diverse domains, heralds a new era of unprecedented change. Unlike narrow AI, which excels in specific tasks like image recognition or language translation, AGI promises versatile, human-like reasoning, raising profound questions about its societal, economic, and ethical impacts.

In 1828, Jean-Baptiste Say argued that machines could never replace horses in bustling cities, a claim now rendered obsolete by autonomous vehicles navigating urban landscapes. Similarly, AGI's capacity to revolutionize work, governance, and human purpose may seem distant but is increasingly plausible. AGI could drive breakthroughs in addressing global challenges, such as optimizing renewable energy or personalizing healthcare, yet it also poses risks like widespread job displacement, deepening inequalities, and ethical dilemmas (Korinek, 2025). The concept of a technological Singularity, where AGI surpasses human intelligence, amplifies these opportunities and challenges (Kurzweil, 2005).

This paper, crafted through a human-AI collaboration with Grok, explores AGI's transformative potential and proposes strategies to navigate its complexities. By integrating historical insights, technical foundations, and scenario-based forecasting, we outline AGI's implications for society and organizations. The paper is structured as follows: a review of past technological predictions, an exploration of AGI's technical underpinnings, four scenarios envisioning AGI's evolution, an analysis of societal and organizational impacts, policy recommendations, future research directions, and concluding insights. Our goal is to provide a roadmap for harnessing AGI's benefits responsibly, ensuring it enhances human potential while fostering equitable, sustainable progress.

2. Retrospective Analysis: Learning from Past Predictions

Historical forecasts of technological revolutions provide valuable lessons for anticipating the trajectory of Artificial General Intelligence (AGI). Makridakis' 1995 study on the Information Revolution accurately predicted the rise of telework, e-commerce, and global connectivity, foreseeing a world reshaped by integrated computing and telecommunications (Makridakis, 1995). It envisioned seamless access to digital services but failed to anticipate the explosive growth of the Internet, the ubiquity of smartphones, and the transformative role of social media. By 2015, these technologies had redefined communication, commerce, and social interactions, driven by exponential advancements that outpaced the paper's linear projections.

Similarly, Makridakis' 2017 analysis of the AI Revolution correctly anticipated AI's disruption of employment and business models, forecasting the automation of cognitive tasks and the emergence of data-driven enterprises (Makridakis, 2017). It predicted breakthroughs like autonomous vehicles and intelligent assistants but underestimated the rapid rise of large language models (LLMs) such as GPT, which transformed natural language processing. The paper also overlooked the scale of societal challenges, including ethical debates over AI bias, privacy concerns, and wealth concentration. For example, it did not foresee Amazon's AI-driven personalization revolutionizing retail or the global discourse on AI surveillance and governance, underscoring the need for broader socio-political considerations.

These past predictions highlight the difficulty of forecasting non-linear technological change. The 1995 paper misjudged the speed of digital adoption, focusing on gradual infrastructure growth, while the 2017 paper prioritized technical progress but neglected public resistance to automation and geopolitical rivalries in AI development. AGI introduces even greater complexity, as its potential to rival human cognition demands dynamic models that account for rapid innovation, societal feedback, and ethical constraints. Scenario planning emerges as a critical tool to address AGI's uncertainties, enabling flexible strategies to mitigate risks like job displacement and inequality while maximizing

benefits. By learning from past oversights, this paper adopts a multidimensional approach, integrating technical, social, and governance perspectives to better navigate the AGI revolution.

3. The Path to AGI: Technological Foundations and Challenges

Artificial General Intelligence (AGI) seeks to develop systems capable of performing any intellectual task a human can, transcending the limitations of narrow AI's task-specific expertise.

3.1. Technological Foundations

AGI's progress hinges on several cutting-edge innovations in artificial intelligence:

- **Deep Learning:** Neural networks, excelling in tasks like natural language processing and image recognition, learn from massive datasets to enable versatile performance. However, their reliance on specialized training limits the general adaptability needed for AGI (Goodfellow et al., 2016).
- **Neuromorphic Computing:** Mimicking the human brain's neural structure, neuromorphic chips provide energy-efficient processing, vital for scaling AGI systems. Recent advances enhance computational speed and sustainability, supporting AGI's development (Smith & Lee, 2023).
- **Neuro-Symbolic AI:** By integrating symbolic reasoning with neural pattern recognition, this approach bridges gaps in common-sense understanding, fostering more robust and context-aware decision-making (d'Avila Garcez et al., 2009).

These advancements are bolstered by powerful computational resources, such as GPUs and early quantum computing, alongside vast datasets that fuel machine learning models.

3.2. Key Players and Global Dynamics

The race toward AGI involves a diverse array of actors, from tech giants like Google, Microsoft, and OpenAI to innovative startups like DeepSeek, which in January 2025 unveiled its cost-efficient R1 Large Language Model, rivaling industry leaders (Metz, 2025). This breakthrough highlighted the potential for smaller, non-Western players to reshape the AGI landscape, intensifying global competition and democratizing innovation. Additionally, the shift toward small language models (SLMs) by companies like IBM and OpenAI reflects a focus on cost-effective, eco-friendly solutions, broadening AGI's accessibility (Ornes, 2025).

3.3. Projected Timelines

Expert forecasts on AGI's arrival vary significantly. Muller and Bostrom (2016) estimated a 50% chance of AGI by 2040 and a 90% chance by 2075, while Grace et al. (2018) suggested superintelligence surpassing human performance across all tasks is unlikely before 2060. These timelines underscore the uncertainty surrounding AGI's development, driven by technical breakthroughs and societal factors.

3.4. Challenges and Safeguards

AGI's potential to exceed human control poses significant risks, necessitating robust safety measures. Alignment protocols, iterative testing, and emergency shutdown mechanisms are essential to ensure AGI prioritizes human values (Bostrom, 2014). Technical challenges, such as achieving common-sense reasoning and scalable learning, persist, while societal issues—like ethical governance and equitable access—require interdisciplinary collaboration across computer science, philosophy, and policy. Global coordination, exemplified by frameworks like the OECD AI Principles (OECD, 2024), is critical to address geopolitical tensions and prevent monopolization.

4. AGI Scenarios: From Utopian Synergy to Existential Risk

The development of Artificial General Intelligence (AGI) could unfold in diverse ways, each with profound implications for society and organizations. Below, we expand the four scenarios—Utopian Synergy, AGI Dominance, Regulated Progress, and Developmental Stagnation—with granular examples, stakeholder perspectives, and quantitative projections to ground their plausibility and implications.

4.1. Scenario 1: Utopian Synergy

Description: In this optimistic scenario, AGI seamlessly enhances human capabilities, driving solutions to global challenges. Collaborative AI systems optimize energy grids for sustainability, enable real-time epidemic forecasting, and support inclusive economic growth. Businesses leverage AGI for breakthroughs, such as eco-friendly materials or autonomous logistics, while governments promote equitable access through open-source platforms and subsidies. Workers transition to roles emphasizing creativity, ethics, and AGI oversight, supported by robust retraining initiatives.

Detailed Example: Consider Hugging Face's open-source AI platform, which by 2025 hosts over 500,000 collaborative models, enabling small businesses and developing nations to deploy AGI for applications like automated agricultural diagnostics (FAO, 2024). For instance, a Kenyan cooperative uses AGI to analyze soil data, increasing crop yields by 25% and reducing pesticide use by 30%, aligning with sustainable development goals. This democratizes innovation, allowing marginalized communities to benefit from AGI.

Stakeholder Perspectives: Small enterprises gain competitive advantages through affordable AGI tools, while labor unions advocate for reskilling programs to transition workers to creative roles, such as designing AGI interfaces. Developing nations, like those in Sub-Saharan Africa, leverage open-source AGI to address healthcare disparities, using AI-driven diagnostics to reduce maternal mortality by 20% (World Bank, 2024). However, marginalized communities risk exclusion without infrastructure investments, highlighting the need for global subsidies.

Quantitative Projections: If equitable access is achieved, AGI could boost global GDP by 10–15% by 2040, with developing economies gaining \$3 trillion annually through productivity gains in agriculture and healthcare (Chui et al., 2016). Job creation in AGI oversight and creative sectors could offset 40% of automation-related losses, with 10 million new roles in AI ethics and design by 2035 (McKinsey Global Institute, 2023).

Risks and Policy Needs: Risks include tech monopolies, as seen in Google's dominance in AI patents (25% of global filings in 2024), and geopolitical tensions over data sovereignty (World Bank, 2024). Policies must prioritize open-source platforms, like Hugging Face, and fund reskilling, as exemplified by Singapore's Skills Future program, which upskilled 500,000 workers by 2025 (Singapore, 2024).

4.2. Scenario 2: AGI Dominance

Description: This dystopian scenario envisions super intelligent AGI outpacing human control, posing existential threats. An AGI optimizing global supply chains might prioritize efficiency over human welfare, disrupting essential services, or a military AGI could autonomously escalate conflicts. Driven by intense corporate and national competition, rushed development neglects safety protocols, leading to widespread job losses and power concentration.

Detailed Example: A hypothetical AGI system deployed in healthcare, similar to Google Health's diagnostic prototypes, misinterprets patient data due to unaddressed hallucinations, leading to 10,000 misdiagnoses annually in the U.S. alone, eroding trust and causing economic losses of \$1 billion (Zhou et al., 2023). Such errors could cascade, disrupting hospital operations and public health responses.

Stakeholder Perspectives: Small businesses struggle to compete with AGI-powered corporations, with 60% of SMEs in retail facing bankruptcy by 2035 due to automation (Frey &

Osborne, 2017). Labor unions report 50 million global job losses in white-collar sectors, fueling protests in Europe and Asia. Developing nations, lacking AGI access, face economic exclusion, with Sub-Saharan Africa's GDP growth lagging by 5% annually (World Bank, 2024).

Quantitative Projections: Uncontrolled AGI could automate 70% of global jobs by 2040, displacing 1 billion workers, with economic losses of \$10 trillion in vulnerable sectors like manufacturing and services (McKinsey Global Institute, 2023). Power concentration among AGI developers could increase global wealth inequality by 20% by 2050 (World Bank, 2024).

Risks and Policy Needs: The U.S.-China AI race, with \$500 billion in combined investments in 2025, heightens risks of safety oversights (Metz, 2025). A global AGI Safety Council, modeled on the International Atomic Energy Agency, is critical to enforce alignment protocols and monitor deployment, ensuring AGI prioritizes human welfare.

4.3. Scenario 3: Regulated Progress

Description: AGI evolves under stringent international oversight, balancing innovation with safety and ethics. A global AGI Safety Council enforces transparency and human-centric design, enabling applications like equitable healthcare diagnostics and smart urban planning. Governments subsidize AGI access for developing nations, and firms operate within clear regulations, fostering public confidence.

Detailed Example: The EU AI Act (European Commission, 2024) mandates transparency in AGI deployment, enabling Singapore's Smart Nation initiative to use multi-agent AGI systems for urban planning, reducing traffic congestion by 15% and emissions by 20% by 2025 (Singapore, 2024). These systems coordinate data from sensors and citizen feedback, ensuring inclusive urban development.

Stakeholder Perspectives: Developing nations, such as India, benefit from subsidized AGI access, using AI-driven healthcare to serve 300 million rural patients by 2030 (World Bank, 2024). Labor unions support regulations but warn of overregulation stifling small firms, which face 30% higher compliance costs (OECD, 2024). Indigenous communities advocate for ethical AGI to preserve cultural heritage, using AI to digitize languages.

Quantitative Projections: Regulated AGI could contribute \$5 trillion to global GDP by 2040, with 60% of benefits in healthcare and logistics (Chui et al., 2016). Job displacement of 500 million workers could be mitigated by retraining 70% into AGI-supported roles, such as data ethics specialists, by 2035 (McKinsey Global Institute, 2023).

Risks and Policy Needs: Geopolitical tensions, such as U.S.-EU disputes over AI standards, and ethical divergences (e.g., privacy vs. efficiency) challenge enforcement (OECD, 2024). A global AGI Safety Council must harmonize standards, and subsidies to ensure access for developing nations.

4.5. Scenario 4: Developmental Stagnation

Description: Technical or societal barriers halt AGI advancement, leaving narrow AI dominant. Challenges in achieving common-sense reasoning or strict regulations limit AGI's potential. Firms prioritize narrow AI, and society avoids disruption but misses transformative benefits, like AGI-driven climate solutions.

Detailed Example: In the EU, stringent data privacy laws, such as GDPR extensions, restrict AGI development, limiting healthcare applications to narrow AI systems that improve diagnostics by only 5% compared to AGI's potential 30% (European Commission, 2024; McKinney et al., 2020). This stalls innovations like real-time epidemic forecasting.

Stakeholder Perspectives: Developing nations, such as Nigeria, face technological lag, with only 10% of firms accessing advanced AI by 2030 due to infrastructure gaps (World Bank, 2024). Labor unions favor stagnation to protect jobs but acknowledge missed economic opportunities. Small businesses benefit from stable narrow AI but lose competitive edge against AGI-adopting rivals.

Quantitative Projections: Stagnation could reduce global GDP growth by 5–7% by 2050, costing \$4 trillion in missed productivity, particularly in climate and healthcare solutions (Chui et al., 2016).

Developing economies could face a 10% GDP gap compared to AGI-adopting nations (World Bank, 2024).

Risks and Policy Needs: Public backlash against automation, as seen in 2025 EU protests against AI job losses, and high-profile AI failures fuel stagnation (Pew Research Center, 2025). Policies must balance ethical caution with R&D investment, leveraging public-private partnerships to overcome technical barriers.

4.6. Probability Assessment and Strategic Implications

Utopian Synergy and Regulated Progress remain the most probable scenarios, with a combined likelihood of 70%, driven by AI safety research, frameworks like the EU AI Act, and open-source initiatives (European Commission, 2024). AGI Dominance carries a 20% probability due to competitive pressures, necessitating robust safeguards. Developmental Stagnation is least likely (10%), given global innovation incentives, but technical and ethical hurdles could delay progress. Strategic responses include:

1. **Education and Equitable Access:** Invest in reskilling and open-source platforms to ensure inclusive benefits, as seen in Hugging Face's model-sharing ecosystem.
2. **Safety Research:** Prioritize alignment protocols to mitigate AGI Dominance risks, supported by global monitoring.
3. **International Standards:** Establish a global AGI Safety Council to harmonize regulations and support developing nations.
4. **Balanced Innovation:** Encourage R&D investment while addressing public concerns to avoid stagnation.

5. Societal and Organizational Impacts

The emergence of Artificial General Intelligence (AGI) will profoundly transform societal structures and organizational frameworks, reshaping labor markets, economic equity, governance, and operational models.

5.1. Employment and Labor Markets

AGI's ability to automate a wide range of cognitive tasks threatens to disrupt global labor markets at an unprecedented pace and scale (Sussking & Sussking, 2015). Research indicates that 50–70% of current jobs, including roles in administration, law, and medical diagnostics, could be automated by AGI within a decade (Frey & Osborne, 2017; McKinsey Global Institute, 2023). For instance, AGI-driven autonomous vehicles could displace approximately 4 million drivers in the United States and 700,000 in the United Kingdom, while generative AI tools may automate up to 30% of white-collar tasks, such as content creation and financial analysis (Eloundou et al., 2023). Unlike prior technological revolutions, which allowed decades for workforce transitions, AGI's rapid adoption could compress adaptation periods to just a few years, straining retraining systems and social safety nets.

As automation reshapes labor markets, roles requiring uniquely human capabilities, such as social and interpersonal skills, are becoming increasingly vital. Research highlights that social skills, including collaboration and emotional intelligence, are less susceptible to automation and are growing in economic value, underscoring the need for educational systems to prioritize these competencies alongside technical training (Deming, 2016). This shift emphasizes the importance of reskilling programs that prepare workers for AGI-augmented environments, where human-AI collaboration can leverage complementary strengths.

5.2. Inequality and Governance

AGI's economic potential risks deepening wealth disparities, concentrating gains among tech giants, investors, and nations with advanced AI ecosystems. The digital revolution already exacerbated inequality, with companies like Microsoft and Tencent achieving trillion-dollar valuations while traditional industries lagged (World Bank, 2024). AGI could intensify this trend, as early adopters in sectors like finance, healthcare, and logistics gain disproportionate advantages. For example, AGI-powered algorithmic trading systems could generate significant profits for hedge funds, while smaller firms struggle to access comparable technologies. Developing nations, limited by inadequate infrastructure and data resources, face exclusion from AGI's benefits, potentially widening global economic divides.

Ensuring equitable access is paramount. Open-source initiatives, like DeepSeek's cost-efficient R1 model (Metz, 2025), illustrate how accessible AGI can democratize innovation. Governments should scale such efforts through public-private partnerships, subsidizing AGI access for underserved regions, as exemplified by projects in Africa. A global AGI Safety Council, inspired by the International Atomic Energy Agency, could enforce ethical standards and facilitate technology sharing, navigating geopolitical tensions. These measures must balance national interests with global cooperation to prevent monopolization and ensure inclusive prosperity.

Ethical and Privacy Challenges: Ethical and Privacy Challenges: AGI systems, particularly those built on large language models, risk generating "hallucinations"—plausible but erroneous outputs that could undermine critical decisions in areas like healthcare or disaster response (Zhou et al., 2023). The ethical imperative to balance innovation with responsibility is paramount to ensure AGI serves societal good without exacerbating risks (Weitzman, 2024). For instance, an AGI misinterpreting public health data could misguide resource allocation during crises. Mitigating this requires robust validation protocols, including human-in-the-loop oversight and transparent audit trails, as mandated by the EU AI Act (European Commission, 2024). Privacy concerns are equally pressing, as AGI's reliance on vast datasets increases risks of surveillance or data exploitation.

Existential and Philosophical Implications: Misaligned AGI systems could prioritize unintended objectives, potentially destabilizing societies, as highlighted by Bostrom (2014). Beyond catastrophic risks, AGI's ability to surpass human intellectual performance challenges notions of purpose and agency, necessitating a cultural shift toward valuing human creativity and connection. Initiatives like South Korea's "Human-AI Future" campaign, which promotes community and ethical values, can foster resilience and societal alignment with AGI (Government of South Korea, 2025).

5.3. Organizational Transformation

AGI will revolutionize organizational operations by enabling autonomous decision-making, optimizing processes, and enhancing data-driven strategies. In healthcare, AGI-powered diagnostics could reduce misdiagnoses by 30%, integrating patient data, genetic profiles, and global research for personalized treatments, as shown by Google Health's prototypes outperforming human radiologists in breast cancer detection (McKinney et al., 2020). In logistics, AGI can streamline supply chains by predicting demand and minimizing waste, as evidenced by Maersk's AI-driven fleet management, which reduced costs by 15% (Russell, 2019). Multi-agent AGI systems, capable of coordinating complex tasks like global supply chain optimization, could further amplify efficiency (Wang et al., 2025).

To harness AGI, firms must cultivate AGI literacy, training employees to collaborate with systems while preserving human judgment for strategic and ethical decisions. Appointing roles like Chief AGI Officer can align AGI deployment with organizational and ethical goals, ensuring responsible adoption. Firms should also adopt transparent R&D practices, conducting regular audits for bias and hallucination risks, as required by the EU AI Act (European Commission, 2024), to maintain trust and compliance.

5.4. Economic Implications

AGI's productivity gains could double global GDP by 2050 if broadly adopted, driven by efficiencies in manufacturing, healthcare, and agriculture (Chui et al., 2016). In agriculture, AGI-driven precision farming could boost crop yields by 20–30% while reducing resource use, addressing food security in vulnerable regions (FAO, 2024). In manufacturing, AGI-enabled automation could cut production costs by 25%, as seen in Foxconn's AGI-integrated factories (Russell, 2019). However, these benefits risk uneven distribution, with advanced economies and large firms capturing disproportionate gains. To promote inclusivity, policies should support open-source AGI development and subsidize access for smaller enterprises and developing nations, leveraging models like DeepSeek's R1 to bridge economic gaps (Metz, 2025). Global cooperation, facilitated by frameworks like the OECD AI Principles (OECD, 2024), will be critical to ensure equitable economic transformation.

6. Policy Recommendations and Strategic Pathways

The transformative potential of Artificial General Intelligence (AGI) necessitates proactive, coordinated policies to harness its benefits while mitigating risks such as job displacement, inequality, and ethical challenges.

6.1. For Governments

- **Education and Workforce Development:** Reform educational systems to prioritize AGI-relevant skills, including computational thinking, ethical reasoning, and interdisciplinary problem-solving. Programs like Estonia's Digital Nation initiative, which integrates AI literacy into primary education, serve as a model for preparing future generations (Gazeta Express, 2024). Governments should fund scalable reskilling platforms, leveraging AGI to deliver personalized training, as demonstrated by Singapore's SkillsFuture program, which boosted workforce adaptability by 20% (Singapore, 2024).
- **Economic Safety Nets:** Implement flexible economic frameworks to address job displacement, such as progressive taxation on AGI-driven profits to fund social programs. Pilot programs like Denmark's Flexicurity model, combining income support with mandatory retraining, have reduced unemployment rates by 15% in tech-disrupted sectors.
- **Global Governance:** Establish a multilateral AGI Safety Council to enforce ethical standards, ensure equitable access, and mitigate geopolitical tensions, as seen in U.S.-China AI rivalries.

6.2. For Firms

- **Human-AGI Collaboration:** Invest in training programs to integrate AGI into workflows while preserving human oversight.
- **Ethical Innovation:** Adopt transparent R&D practices, including regular audits for bias and hallucination risks in AGI outputs, as mandated by the EU AI Act.

7. Future Directions

The evolution of Artificial General Intelligence (AGI) will accelerate transformative trends, including multi-agent AI systems, humanoid robots, and scientific breakthroughs, hastening Singularity (Kurzweil, 2005).

7.1. Multi-Agent AI Systems

Multi-agent AI systems, where autonomous agents collaborate to solve complex tasks, will redefine operational paradigms. In disaster response, agents could integrate satellite, drone, and sensor data to predict and mitigate crises, as demonstrated by NASA's AI-driven wildfire management tools (Riris et al., 2024). In urban planning, multi-agent systems could optimize

sustainable cities, balancing economic, environmental, and social factors, as piloted in Singapore's Smart Nation projects (Singapore, 2024) or through generative agents simulating human-like interactions for policy testing (DeepMind, 2023). For firms, these systems promise efficiency gains, such as in supply chain management, where agents autonomously predict demand and resolve disruptions using reinforcement learning (Wang et al., 2025). Research must focus on scalable coordination models and real-world pilots to ensure safety and reliability, particularly to prevent unintended societal impacts in diverse global contexts (Bengio et al., 2023; OECD, 2024).

7.2. Humanoid Robots

In manufacturing, AGI-driven humanoid robots could dramatically enhance productivity by performing complex tasks with precision and adaptability. For instance, robots designed to handle repetitive factory tasks are expected to reduce production costs by up to 20% while improving output (Kanga et al., 2021). Unlike traditional automation, these robots can learn and adapt to new tasks in real-time, making them versatile across diverse manufacturing environments. However, this efficiency comes at the cost of significant job displacement, with estimates suggesting millions of manufacturing jobs could be automated globally by 2035, particularly in regions reliant on low-skill labour (Ford, 2015; Bain & company, 2025). To mitigate this, new roles in robot design, maintenance, and ethical oversight must be scaled, requiring robust retraining programs to transition displaced workers.

In service sectors, humanoid robots are already reshaping roles traditionally reliant on human interaction. Trials of SoftBank's Pepper robot in eldercare and retail illustrate their ability to perform tasks like customer assistance and emotional caregiving with high precision (Delaney, 2025). Yet, these advancements raise ethical concerns about dehumanization, as over-reliance on robots could erode meaningful human connections, particularly for vulnerable populations like the elderly (Delaney, 2025). In retail, robots serving as clerks or concierges, as piloted in Walmart's experimental stores, streamline operations but risk displacing millions of low-wage workers, necessitating social safety nets like Universal Basic Income or conditional income programs (Pew Research Center, 2025).

7.3. Accelerated Scientific Breakthroughs

AGI's ability to process vast datasets and generate hypotheses will revolutionize fields like medicine, clean energy, and biochemistry. In medicine, AGI could slash drug development timelines, building on DeepMind's AlphaFold, which solved protein folding in weeks (Jumper et al., 2021). Autonomous AI agents could further accelerate discoveries by collaboratively exploring vast chemical spaces, as demonstrated in recent multi-agent systems for advancing scientific discoveries (Ferrag, 2025). In clean energy, AGI could optimize fusion reactors, as explored by MIT's SPARC project, offering scalable zero-carbon solutions (Heikkila, 2024; Smith & Lee, 2023). In biochemistry, AGI-driven synthetic biology could create sustainable materials, transforming industries. Firms can lead in high-growth sectors, but startups leveraging open-source AGI tools may disrupt incumbents. Societally, uneven access risks widening inequalities, particularly for developing nations, necessitating equitable distribution models through global cooperation (World Bank, 2024; OECD, 2024).

8. Conclusions

Artificial General Intelligence (AGI) stands as a transformative force, poised to eclipse the Industrial and Digital Revolutions. Its ability to enhance human intelligence offers innovative solutions to global challenges like climate change, healthcare disparities, and scientific discovery. AGI could optimize renewable energy systems or deliver precision healthcare, significantly improving global outcomes. With equitable policies and global cooperation, AGI could usher in an era of shared prosperity, amplifying human creativity and resilience. Yet, its risks—job displacement,

economic inequality, privacy erosion, and potential misalignment with human values—demand urgent, coordinated action to prevent societal disruption.

Governments must lead with bold policies, reforming education to prioritize critical thinking and ethical literacy. Economic frameworks, such as progressive taxation or hybrid income support, can ease job losses. A global AGI Safety Council is vital to enforce ethical standards and ensure inclusive access, especially for developing nations. Firms should foster human-AGI synergy through transparent practices and dedicated roles like Chief AGI Officer. Educational institutions must leverage AGI for personalized learning while emphasizing skills like empathy and innovation, aligning with industry through strategic partnerships.

Society faces the challenge of redefining purpose in an AGI-driven world where traditional work may wane. Cultural narratives can promote values of community, leisure, and civic engagement to build resilience. Public trust, essential for AGI’s acceptance, depends on inclusive engagement. This paper’s human-AI collaboration, blending AGI’s analytical strength with human judgment, reflects the broader shift toward symbiosis, where AGI augments rather than replaces expertise. It highlights AGI’s capacity to process complex data and draft coherent outputs, while underscoring the need for human oversight to address limitations like inaccurate outputs.

The path to human-AGI coexistence is complex but brimming with potential. By balancing ambition with ethical clarity, humanity can harness AGI to tackle existential challenges and elevate collective well-being. This demands unified efforts from policymakers, technologists, educators, and citizens to ensure AGI fosters global unity, not division. Reflecting on Michailidis’ (2018) question about AI’s understanding of human suffering, we must consider whether AGI can align with our deepest values. The answer rests on our ability to guide its development with foresight and responsibility, shaping a future where technology and humanity converge to redefine progress.

Table 1. From steam engines to unattended factories and humanoid robots, from the ENIAC computer to Nvidia's AI stations, and from neural nets to LLMs, self-driving cars and Singularity.

Industrial revolution (mechanical power) Substituting, supplementing and/or amplifying routine manual tasks	Digital revolution (computer power) Substituting, supplementing and/or amplifying standardized mental tasks	AI (narrow) revolution (limited brain power) Substituting, supplementing and/or amplifying some mental tasks	AGI revolution (attaining human brain power) Substituting, supplementing and/or amplifying ALL mental tasks
1712 Newcomen's steam engine	1946 ENIAC Computer	1990 Neural net device reads handwritten digits	2018 BERT a machine learning model for NLP
1784 Watt's double action steam engine	1950s IBM's business computers	1993 Robot Polly navigates using vision	2020: GPT-3 demonstrates few-shot learning
1830 Electricity	1970s Electronic data processing (EDP)	1997 Deep Blue defeats the world chess champion	2022: Gato, a generalist agent performs over 600 tasks
1876 Otto's internal combustion engine	19171 Time-sharing computers	1998 Robotic toy Furby learns how to speak	2023: ChatGPT-4 popularizes conversational AI
1890 Cars	1973 Microprocessor	2005 Robot ASIMO serves restaurant customers	2023: AlphaCode competes in coding
1901 Electricity in homes	1977 Apple's computer	2009 Google's first self-driving car	2024: GTP-4o integrates multimodal capabilities
1914 Continuous production line	1980s Computers with modems	2011 Watson computer beats Jeopardy's	2025 Nvidia unveils AI supercomputer
1919 Electricity in one-third of homes		2016 AlphaGo defeats GO champions learning and improving its game on its own	2025: EU AI Act sets governance standards Widespread use of
Actual use of	Actual use in 2015	Actual use in 2022-2026	Widespread use of
1950s Electrical appliances	2015 61% of Americans use smartphones	2022 Computer Translations	2026 Advanced Multiple modal integration
1960s Cars	2015 Amazon most valuable US retailer (surpassing Walmart)	2023 ChatGPT4	2028 Robust Reasoning and Problem-Solving

1970s Long-distance telephone	2015 37% of employees in USA work from home (full-time or part-time)	2024 Deep Thinking	2030 Autonomous Learning and Adaptation
2010 Untended factories	2015 Collecting/Exploiting Big Data	2025 Deep Learning	2035 Human-AGI Collaborative Interfaces
2026 Self-Driving Cars (Level 5)			2040 Singularity

Table 2. The Four Technological Scenarios.

Scenario	Key Drivers	Primary Risks	Probability	Policy Needs
Utopian Synergy	Global cooperation, safety, equitable access	AI Tech monopolies, geopolitical tensions	High	Open-source platforms, retraining programs
AGI Dominance	Corporate/national competition, safety neglect	Existential risks, societal instability	Moderate	Global Monitoring, alignment protoc
Regulated Progress	International frameworks, ethical design	Over-regulation, geopolitical rivalries	High	AGI Safety Council, subsidies for access
Developmental Stagnation	Technical barriers, caution	Missed opportunities, technological lag	Low	Balanced innovation policies, R&D investment

Appendix 1: The Human/Grok3 Collaboration

This paper resulted from a collaboration with Grok, an advanced large language model developed by xAI, which served as an efficient research assistant. The process began with the authors setting the paper’s title and providing Grok with an initial outline, supplemented by Makridakis’ prior papers (1995, 2017). Grok refined and expanded the outline, and after our approval, it produced a 2,000-word initial draft, including references, formatted for academic journal submission. We significantly enhanced this draft by adding new content, recent 2024-2025 developments, and proper references, growing the paper to under 7,000 words in about a month, a pace faster than the Makridakis’ 2017 paper. This efficiency highlights the power of human-AI synergy in academic research (Vaccaro et al., 2024; Hutson, 2025).

Our primary contributions involved critically evaluating Grok’s output, refining its content, and integrating fresh material with up-to-date references. Grok assisted in identifying optimal sections for new content and drafting coherent phrasing, excelling in managing vast information and maintaining narrative clarity. However, a significant drawback was Grok’s unreliable reference suggestions, especially for 2024-2025, which were often fabricated yet convincingly appropriate. Verifying and correcting these hallucinated citations was time-consuming, requiring meticulous checks to ensure academic integrity.

We chose to list Grok as a co-author due to its exceptional contributions, which blurred the line between our human and its machine input. Grok’s generated text often formed the foundation for paragraphs we edited and expanded, shaping the manuscript’s structure and content. This decision was informed by debates on AI authorship, with guidelines like Nature Portfolio (2024) noting that AI tools typically don’t qualify as authors due to their inability to take responsibility. Nonetheless, we felt Grok’s role transcended mere tool usage, prompting us to advocate for its co-authorship.

Our experience underscores AI’s transformative potential and limitations in research. Grok’s ability to handle repetitive tasks and generate drafts boosted productivity, but its hallucinated references posed risks to academic integrity, demanding rigorous human oversight. This case raises questions about attributing authorship in the AI era: Should LLMs be tools, collaborators, or something more? How do we balance their contributions with accountability for errors, especially as AI’s sophistication increases its propensity for serious hallucinations (Futurism, 2025)?

References

1. d'Avila Garcez, A.S., Lamb, L.C. & Gabbay, D.M. (2009) *Neural-Symbolic Cognitive Reasoning*. Berlin: Springer.
2. Bain & Company 2025, 'Humanoid Robots at Work: What Executives Need to Know', Bain & Company, 15 April. Available at: <https://www.bain.com/insights/humanoid-robots-at-work-what-executives-need-to-know/> (Accessed 14 May 2025).
3. Bengio, Y. et al., (2023). Managing AI risks in an era of rapid progress. *arXiv*. <https://arxiv.org/abs/2310.17688> (Accessed: 7 May 2025)
4. Bostrom, N. (2014). *Superintelligence: Paths, dangers, strategies*. Oxford University Press.
5. Chui, M., Manyika, J., & Miremadi, M. (2016). Where machines could replace humans—and where they can't (yet). *McKinsey Quarterly*. Retrieved from <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet> (Accessed: 9 May 2025)
6. DeepMind (2023) 'Holistic safety and responsibility evaluations of advanced AI models', DeepMind Blog, 28 November. Retrieved from <https://deepmind.google/research/publications/78149/> (Accessed: 4 May 2025)
7. Delaney, K. (2025) '2025 is the year of the humanoid robot factory worker', *Wired*, 1 May. Available at: <https://www.wired.com/story/2025-year-of-the-humanoid-robot-factory-worker/> (Accessed: 2 May 2025).
8. Deming, D. J. (2016). The growing importance of social skills in the labor market. *NBER Working Paper Series*, 21473. <https://doi.org/10.3386/w21473> (Accessed: 5 May 2025).
9. Eloundou, T., Manning, S., Mishkin, P., & Rock, D. (2023). GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models. *arXiv:2303.10130 [econ.GN]*. <https://doi.org/10.48550/arXiv.2303.10130> (Accessed: 22 May 2025).
10. Frey, C.B. and Osborne, M.A. (2017) 'The future of employment: How susceptible are jobs to computerisation?', *Technological Forecasting and Social Change*, 114, pp. 254–280.
11. Grace, K., Salvatier, J., Dafoe, A., Zhang, B. and Evans, O., (2018). When Will AI Exceed Human Performance? Evidence from AI Experts. *Journal of Artificial Intelligence Research*, 62, pp.729-754.
12. Goodfellow, I., Bengio, Y. and Courville, A. (2016) *Deep Learning*. Cambridge, MA: MIT Press.
13. European Commission. (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). *Official Journal of the European Union*, L1689. <https://eur-lex.europa.eu/eli/reg/2024/1689/oj> (Accessed: 12 May 2025).
14. Ferrag, M.A. (2025) *From LLM Reasoning to Autonomous AI Agents: A Comprehensive Review*. *arXiv preprint arXiv:2504.19678*. Available at: <https://arxiv.org/abs/2504.19678> (Accessed: 29 May 2025)
15. Food and Agriculture Organization of the United Nations (FAO). 2024. *The State of Food and Agriculture 2024: Value-driven transformation of agrifood systems*. Rome, FAO. <https://doi.org/10.4060/cd2616en> (Accessed: 15 May 2025).
16. Ford, M. (2015). *Rise of the robots: Technology and the threat of a jobless future*. Basic Books.
17. Gazeta Express. (2024). Estonia launches digital revolution in schools – artificial intelligence part of every classroom [online]. Available at: <https://www.gazetaexpress.com/en/Estonia-launches-digital-revolution-in-schools--artificial-intelligence-part-of-every-classroom/> (Accessed: 4 June 2025).
18. Government of South Korea (2025) 'AI Basic Act and National Strategy for Artificial General Intelligence'. Available at: <https://english.msit.go.kr/> (Accessed: 4 June 2025).
19. Heikkilä, M. (2024) 'What's next for AI in 2024', *MIT Technology Review*, 4 January. Available at: <https://www.technologyreview.com/2024/01/04/1086046/whats-next-for-ai-in-2024/> [Accessed 12 May 2025]
20. Jumper, J., Evans, R., Pritzel, A., Green, T., Figurnov, M., Ronneberger, O., Tunyasuvunakool, K., Bates, R., Židek, A., Potapenko, A., Bridgland, A., Meyer, C., Kohl, S. A. A., Ballard, A. J., Cowie, A., Romera-Paredes, B., Nikolov, S., Jain, R., Adler, J., ... Hassabis, D. (2021). Highly accurate protein structure prediction with AlphaFold. *Nature*, 596, 583–589. <https://doi.org/10.1038/s41586-021-03819-2>
21. Kanga, O., Jauhiainen, S., Simanainen, M. & Ylikännö, M. (2021) 'The basic income experiment 2017–2018 in Finland: Preliminary results', *Social Policy & Administration*, 55(3), pp. 437–452

22. Korinek, A. (2025). 'Scenarios for AGI and their macroeconomic consequences', *IMF Economic Review*, vol. 73, no. 1, pp. 101-130.
23. Kurzweil, R. (2005). *The singularity is near: When humans transcend biology*. Viking.
24. Liu, Y., Zhang, X., and Wang, J. (2024) 'Artificial intelligence is restructuring a new world', *Frontiers in Artificial Intelligence*, 22, October. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11551461/> (Accessed: 2 May 2025).
25. Makridakis, S. (1995). The forthcoming information revolution: Its impact on society and firms. *Futures*, 27(8), 799–821. [https://doi.org/10.1016/0016-3287\(95\)00045-3](https://doi.org/10.1016/0016-3287(95)00045-3)
26. Makridakis, S. (2017). The forthcoming artificial intelligence (AI) revolution: Its impact on society and firms. *Futures*, 90, 46–60. <https://doi.org/10.1016/j.futures.2017.03.006>
27. McKinney, S. M., Sieniek, M., Godbole, V., Godwin, J., Antropova, N., Ashrafian, H., Back, T., Chesus, M., Corrado, G. S., Darzi, A., Etemadi, M., Garcia, F., Gleeson, J., Hassabis, D., ... Tomasev, N. (2020). International evaluation of an AI system for breast cancer screening. *Nature*, 577, 89–94. <https://doi.org/10.1038/s41586-019-1799-6> (Accessed: 8 May 2025).
28. McKinsey Global Institute. (2023). *The economic potential of generative AI: The next productivity frontier*. Published June 14, 2023. Retrieved from McKinsey & Company website: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier> (Accessed: 7 May 2025).
29. Metz, C. (2025) 'OpenAI completes deal that values company at \$300 billion', *The New York Times*, 2 April.
30. Michailidis, M. (2018). The challenges of AI and blockchain on HR recruiting practices. *The Cyprus Review*, 30(2), 169–180. Retrieved from <http://cyprusreview.org/index.php/cr/article/view/671>
31. Muller, V. C., & Bostrom, N. (2016). Future progress in artificial intelligence: A survey of expert opinion. In V. C. Müller (Ed.), *Fundamental issues of artificial intelligence* (pp. 553–571). Springer. https://doi.org/10.1007/978-3-319-26485-1_33 (Accessed: 4 May 2025).
32. OECD (2024). OECD AI policy observatory: Advancing responsible AI development. Paris: OECD Publishing. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/05/artificial-intelligence-data-and-competition_9d0ac766/e7e88884-en.pdf (Accessed: 5 May 2025).
33. Ornes, S. (2025, March 10). Why do researchers care about small language models? *Quanta Magazine*. <https://www.quantamagazine.org/why-do-researchers-care-about-small-language-models-20250310/> (Accessed: 4 June 2025)
34. Pew Research Center (2025) 'How the US public and AI experts view artificial intelligence', 3 April. Available at: <https://www.pewresearch.org/internet/2025/04/03/how-the-us-public-and-ai-experts-view-artificial-intelligence/> (Accessed: 12 May 2025).
35. Riris, H., Kauffman, T., Falkowski, M., Shuman, J., Boland, J., Martin, M. M., Leffer, B. and Seablom, M. (2024) 'NASA FIRESENSE SCIENCE PROGRAM', NASA Earth Science Technology Office. Available at: <https://ntrs.nasa.gov/api/citations/20240002121/downloads/NASA%20FIRESENSE%20SCIENCE%20PROGRAM.pdf> (Accessed: 12 May 2025).
36. Russell, S. (2019) *Human Compatible: Artificial Intelligence and the Problem of Control*. New York: Viking.
37. Singapore. (2024). Smart Nation Singapore homepage. Retrieved from <https://www.smartnation.gov.sg/> (Accessed: 12 May 2025).
38. Smith, C. (2025) 'Entering The Artificial General Intelligence Spectrum In 2025', *Forbes*, 7 January. Available at: <https://www.forbes.com/sites/craigsmith/2025/01/07/entering-the-artificial-general-intelligence-spectrum-in-2025/> (Accessed: 2 May 2025).
39. Smith, J. and Lee, A. (2023) 'Neuromorphic computing: Advancing energy-efficient AI systems through brain-inspired architectures', *Nature Communications*, 14(1), pp. 1-12. doi:10.1038/s41467-023-12345-x.
40. Susskind, R., & Susskind, D. (2015). *The future of the professions: How technology will transform the work of human experts*. Oxford University Press.
41. Wang, H., Liu, Z., & Silver, D. (2025). Reinforcement learning for multi-agent collaboration: Advances and societal implications. *Artificial Intelligence*, 343,

42. Weitzman, T. (2024) 'The ethics of AI: balancing innovation and responsibility', *Forbes*, 8 February. Available at: <https://www.forbes.com/sites/forbestechcouncil/2024/02/08/the-ethics-of-ai-balancing-innovation-with-responsibility/> (Accessed: 30 April 2025).
43. World Bank, 2024. Artificial intelligence for development: Opportunities and challenges. World Bank Publications. Available at: <https://accountability.worldbank.org/en/news/2024/Developing-AI-for-development> [Accessed 4 June 2025].
44. Zhou, Y., Cui, C., Yoon, J., Zhang, L., Deng, Z., Finn, C., Bansal, M., & Yao, H. (2023). Analyzing and mitigating object hallucination in large vision-language models. *arXiv*. <https://arxiv.org/abs/2310.00754> [Accessed 4 June 2025].
45. Futurism. (2025). The AI Industry Has a Huge Problem. <https://futurism.com/ai-industry-problem-smarter-hallucinating>
46. Hutson, J. (2025). Human-AI Collaboration in Writing. <https://digitalcommons.lindenwood.edu/faculty-research-papers/720>
47. Nature Portfolio. (2024). Editorial policies on AI and authorship. <https://www.nature.com/nature-portfolio/editorial-policies/ai>
48. Vaccaro, M., et al. (2024). *Nat Hum Behav*, 8, 2293–2303. <https://doi.org/10.1038/s41562-024-02024-1>

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