EMERALD STUDIES IN SUSTAINABLE INNOVATION MANAGEMENT

THE GENERATIVE AI IMPACT

REFRAMING INNOVATION IN SOCIETY 5.0

EDITED BY

ANTONIO CRUPI

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The Generative AI Impact

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Series Editors: Vincenzo Corvello, University of Messina, Italy; Orlando Troisi, University of Salerno, Italy

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The Generative AI Impact: Reframing Innovation in Society 5.0

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Introduction to Generative AI and Its Applications

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Chapter 1

Generative AI and Society 5.0: Enabling a Collaborative, Inclusive Future

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Abstract

This chapter delves into the transformative potential of Generative Artificial Intelligence (GenAI) within the Society 5.0 framework, a concept originating from Japan that envisions a human-centric society where technology addresses pressing global challenges. Building on advancements from Industry 4.0, Society 5.0 transcends economic productivity by focusing on inclusivity, sustainability, and quality of life. GenAI, with its capacity for autonomous content creation, enhanced decision-making, and predictive analytics, aligns with these goals by fostering innovation, improving efficiency, and driving human–machine collaboration. This chapter examines the ethical dimensions associated with GenAI, emphasizing the need for transparency, accountability, and inclusivity to prevent potential risks such as data privacy breaches, algorithmic bias, and unequal access to Artificial Intelligence (AI) benefits. Through a synthesis of theory and practice, this work explores how GenAI can support sustainable development, bridge social divides, and enhance human potential in alignment with the principles of Society 5.0. Finally, it outlines avenues for future research and managerial implications, addressing the ongoing need to balance technological advancement with ethical governance in an increasingly AI-driven world.

Keywords: Society 5.0; Generative AI; Agentic AI; human-centric innovation; ethical governance; technological inclusivity

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1. Society 5.0: A Human-Centric Vision

Society 5.0 represents an advanced socioeconomic paradigm that seeks to integrate the digital and physical worlds to create a more inclusive, human-centered society. Originating from Japan, this concept envisions a future where technology and humans collaborate seamlessly to address the most pressing societal challenges, including aging populations, environmental sustainability, and economic inequality (Huang et al., 2022). Unlike previous industrial revolutions, which focused on technological and economic growth, Society 5.0 prioritizes human well-being and inclusivity, aiming to harmonize the relationship between humans and machines.

The foundation of Society 5.0 builds on the technological advancements of Industry 4.0, such as automation, Artificial Intelligence (AI), and the Internet of Things (IoT). However, it shifts from a purely industrial and efficiency-driven model to one that integrates technological innovation with societal values like sustainability, inclusivity, and quality of life. Society 5.0 emphasizes the fusion of the physical, digital, and biological worlds to create a society where technology works to enhance human life without compromising fundamental values (Renda et al., 2022). This vision marks a significant departure from previous paradigms that prioritized productivity over people, envisioning a more balanced and inclusive future.

A key tenet of Society 5.0 is its focus on technological inclusivity, ensuring that advanced technologies such as AI, robotics, and big data benefit everyone, not just the technologically savvy or economically privileged. The goal is to democratize access to technological advancements, enabling individuals across society to benefit from the efficiencies and innovations brought by these technologies. For instance, AI can be used to enhance decision-making processes, automate mundane tasks, and facilitate creative problem-solving, thereby increasing access to advanced technologies for a broader range of users (Huang et al., 2022).

Society 5.0 also stresses the importance of addressing social and environmental challenges. For example, AI and IoT can improve healthcare by providing personalized treatments, assist aging populations with smart home technologies, and promote sustainable practices by optimizing energy consumption in urban areas (Maier et al., 2022). The human-centered approach of Society 5.0 ensures that while technology drives innovation, it also supports societal well-being, equality, and environmental sustainability.

By embedding humans at the center of technological development, Society 5.0 marks a radical departure from the productivity-driven focus of previous industrial revolutions. It acknowledges that human creativity, empathy, and ethical considerations cannot be replaced by technology. Instead, technology should augment human capabilities and enable individuals to achieve their full potential in an environment that fosters inclusivity and innovation (Shiroishi et al., 2018).

2. Generative Artificial Intelligence (GenAI): Transforming Innovation and Creativity

At the heart of Society 5.0 lies GenAI, one of the most promising technologies enabling this human-centric vision. Unlike narrow AI, which is designed to perform

specific tasks, GenAI has the capacity to generate new content, predict outcomes, and solve problems across a variety of applications. Examples of GenAI include models such as ChatGPT, DALL-E, and BERT, which are capable of producing text, images, designs, and even molecular structures in healthcare and scientific research (Sai et al., 2024). GenAI is transforming industries by offering tools for innovation, efficiency, and creativity, which are critical for addressing human-centric challenges such as decision-making, collaboration, and creativity.

GenAI differs from traditional AI in that it does not simply analyze data but actively creates novel outputs. This capability has broad implications for sectors like design, healthcare, and manufacturing, where creativity and adaptability are key drivers of success (Sai et al., 2024). For instance, in the field of design, GenAI models like DALL-E can produce multiple versions of a product, allowing designers to explore various creative options in a fraction of the time it would take using traditional methods. In healthcare, GenAI can assist researchers in developing new drugs by generating molecular structures that have the potential to treat diseases, significantly speeding up the drug discovery process (Paul et al., 2021). GenAI's ability to generate solutions across various fields positions it as a central tool in the realization of Society 5.0's human-centric goals.

One of the key applications of GenAI is in predictive analytics, where it can optimize industrial processes such as predictive maintenance, supply chain management, and resource allocation. By analyzing large datasets, GenAI can detect patterns and provide recommendations to improve operational efficiency, thus enhancing productivity and reducing waste (Serradilla et al., 2022). These capabilities align with the sustainability goals of Society 5.0 by fostering more resilient production systems that minimize waste and downtime while promoting efficiency.

As a transformative technology, GenAI is crucial for realizing the vision of Society 5.0. It serves as a powerful enabler of creativity, innovation, and human-centric solutions across various sectors. Its potential to autonomously generate content, solutions, and ideas positions it as a key driver of innovation in fields as diverse as healthcare, education, design, and manufacturing (Ghobakhloo et al., 2024). In doing so, GenAI helps ensure that technological advancements align with the broader human-centered goals of Society 5.0.

3. The Emergence of Agentic AI

The most recent technological advancement in GenAI is happening as we write this book. On October 22, 2024, Anthropic – a US-based artificial intelligence public-benefit startup founded in 2021 – announced a groundbreaking development in artificial intelligence with the new "computer use" feature in Claude Sonnet 3.5, Anthropic's most performing model, incorporating state-of-the-art agentic capabilities, and computer use. The computer use feature introduces the ability to perform tasks autonomously on users' computers. Among the key capabilities demonstrated by this model is the ability to autonomously create complete websites and address bugs within code without requiring human intervention. While this

feature is currently in an experimental phase, Anthropic intends to make it broadly available in the near future. This innovation represents a significant step in the evolution of AI, aligning with an industry shift toward "Agentic AI" (Gartner, Top Strategic Technology Trends for 2025).[1]

Anthropic's announcement exemplifies a growing trend in GenAI development focused on expanding the autonomy and functionality of AI systems and the rise of Agentic AI. Agentic AI refers to AI systems designed not just to execute specific, predetermined tasks but to operate with a degree of agency, adapting to various contexts and performing complex tasks with minimal human oversight. Traditional AI, particularly earlier language models, were designed to respond passively to user inputs, constrained to reactive responses based on predefined programming. In contrast, Agentic AI represents a shift toward systems that can independently analyze data, conduct research, execute actions, and engage with both digital and physical environments. This evolution signifies an important transformation as AI systems begin to transition from passive tools to autonomous agents capable of acting purposefully and dynamically across a wide range of contexts.

Agentic AI is a conceptual spectrum of AI agency capabilities. At one end of this spectrum are traditional systems with "limited agency," which perform tasks only within narrowly defined conditions and parameters. These systems lack the flexibility to adapt beyond their predefined programming and require significant human supervision and intervention to function effectively. On the other end of the spectrum lies the vision of fully autonomous AI systems capable of independently learning from their environment, making decisions, and acting without human intervention. Such systems, though experimental at present, would represent a level of autonomy wherein the AI could not only adapt to its surroundings but also engage in self-directed learning and problem-solving.

Claude Sonnet 3.5, with its capacity to autonomously run tasks, exemplifies an intermediate stage in the conceptual spectrum of agency. This level of functionality, in which AI can operate autonomously within certain technical domains, highlights how Agentic AI is advancing from reactive systems to proactive agents with meaningful operational capabilities. These systems can not only respond to user commands but take initiative in solving complex, multi-step problems, setting a precedent for AI's role in future digital ecosystems.

The operational capacity of autonomous AI models, like Claude Sonnet 3.5, to perform tasks on a user's computer independently opens new technical avenues across industries. These AI systems are equipped to not only process vast amounts of data but also interface with digital infrastructures, application programming interfaces, and, potentially, physical robotic systems. Such capabilities could revolutionize fields ranging from software development, where autonomous debugging and code optimization might streamline production processes, to healthcare and industrial automation, where AI-driven robotic systems could operate with high degrees of adaptability and precision. Agentic AI holds the

[1] https://www.gartner.com/en/articles/top-technology-trends-2025

potential to address complex challenges autonomously, fundamentally altering workflows by reducing dependency on human intervention and enhancing the efficiency of repetitive tasks, although the road ahead probably spans across a decade.

The trajectory of Agentic AI, as projected by Gartner, suggests, in fact, that this technology is in the early stages of development but is expected to mature within the next 5 to 10 years. During this time, advancements in machine learning, natural language processing, and robotics will likely play critical roles in expanding the capabilities and applications of Agentic AI. As AI systems evolve, we can anticipate the development of more sophisticated models that bridge the current gap between traditional, reactive AI and the envisioned fully autonomous agents capable of independently navigating complex environments.

Potential impacts on workforce and employment are expected, not only for jobs characterized by routine decision-making, repetitive and transactional tasks (such as customer service, sending invoices, managing orders, reservations, etc.) but also for cognitively intensive tasks such as strategic planning. The ability to independently analyze large amounts of data, simulate scenarios, and make decisions in real time can substantially challenge the role of middle management, which, in some areas or sectors, is likely to be significantly downsized. As a result, management roles would refocus toward interpreting, evaluating, and calibrating the results produced by agency AI systems, rather than on tout-court coordination activities of decision-making processes.

As a concluding remark, we must acknowledge that Anthropic's Claude Sonnet 3.5 signifies a pivotal advancement in AI's journey toward autonomy. Nevertheless, we also need to be aware that this evolution not only challenges traditional paradigms of human–computer interaction but also signals the need for a comprehensive understanding of the technical, ethical, and regulatory dimensions associated with autonomous AI. As the capabilities of these systems continue to expand, Agentic AI will likely reshape industries and redefine the role of AI in society, reflecting a future where digital agents not only serve but also actively collaborate with humanity.

4. The Role of Generative AI in Society 5.0

The integration of generative AI into Society 5.0 represents a natural evolution in the relationship between humans and technology. In this future society, GenAI is not just a tool for enhancing productivity but a partner in solving complex societal challenges. The collaborative nature of GenAI aligns with Society 5.0's goal of human-machine co-creation, where AI systems support human creativity and decision–making (Maier et al., 2022). This human–machine partnership is essential for addressing some of the most pressing global challenges, such as aging populations, healthcare inequality, and environmental degradation.

In healthcare, for example, GenAI can revolutionize patient care by generating personalized treatment plans based on individual genetic profiles, significantly improving medical outcomes and promoting health equity (Treppner et al., 2022). These personalized treatments allow for more effective healthcare interventions, particularly in the management of chronic diseases and age-related conditions. The same technology can be applied to education, where GenAI can create

customized learning experiences tailored to individual students' needs, ensuring that education becomes more inclusive and accessible to all (Sun et al., 2025).

GenAI also plays a pivotal role in optimizing industrial processes, particularly in manufacturing and Industry 5.0, a concept closely related to Society 5.0 that focuses on smart and sustainable industrial practices. In these settings, GenAI can analyze real-time data to predict machine failures, suggest maintenance schedules, and optimize production processes, thus improving overall efficiency and reducing downtime (Ghobakhloo, 2020). The capacity for real-time data analysis and decision-making enables industries to become more agile, responsive, and sustainable – key goals of Society 5.0.

In addition to enhancing industrial efficiency, GenAI also contributes to environmental sustainability by generating models for optimizing resource use and minimizing waste. This capability aligns with Society 5.0's emphasis on sustainability, ensuring that technological advancements do not come at the cost of environmental degradation. For instance, GenAI-powered predictive analytics can be used to optimize energy consumption in smart cities, helping to reduce carbon emissions and promote environmental conservation (Ziatdinov et al., 2024). This integration of GenAI into sustainable practices demonstrates the technology's potential to support a more harmonious relationship between human societies and the natural world.

4.1 Ethical Considerations of Integrating Generative AI Into Society 5.0

While generative AI offers immense potential for driving innovation and solving societal problems, its integration into Society 5.0 is not without challenges. One of the central concerns in deploying GenAI systems is the ethical implications, particularly around issues such as data privacy, algorithmic bias, and transparency (Shahriari & Shahriari, 2017). As GenAI becomes more integrated into decision-making processes across various sectors, it is crucial to address these ethical concerns to ensure that AI technologies are developed and used responsibly.

Data privacy is a key issue, particularly in sectors like healthcare and education, where sensitive personal information is involved, and particularly in the case of autonomous AI agents where the security risks associated with autonomous AI that operates on users' personal systems must be carefully managed to prevent misuse or unauthorized access to sensitive information.

Ensuring that GenAI systems are transparent and that individuals have control over their data is essential for maintaining trust and accountability. Similarly, algorithmic bias is another concern, as biased AI systems can perpetuate existing social inequalities or even create new ones. Therefore, it is important to develop ethical frameworks that prioritize fairness, inclusivity, and accountability in the deployment of GenAI systems (Shahriari & Shahriari, 2017).

These considerations particularly apply, for instance, to the shift toward autonomous AI agents discussed above, which presents numerous challenges, both technical and ethical. As these systems become more autonomous in fact,