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Innovation Management in the Age of Generative AI: Strategic Challenges and Opportunities for Business Leaders

Rhythm Mittal[1], Kunal Saxena[2]

ABSTRACT

Generative artificial intelligence (GenAI) is a transformative shift in how organizations can navigate innovation processes and stay competitive in dynamic markets. This paper explores the synergy between innovation management theory and the capabilities of generative AI, offering a holistic perspective of its strategic challenges and opportunities to business leaders. Based on the concepts of dynamic capabilities theory, open innovation and recent empirical studies on the adoption of GenAI, we propose an integrated theoretical framework that conceptualizes GenAI as an enabler and disruptor of the existing innovation processes. Three specific areas of strategic challenges emerge from our analysis: organizational and cultural barriers, such as adaptation and resistance to change by the workforce; technical and governance issues, such as data quality and risk of AI hallucination; and ethical and regulatory issues, such as IP and algorithmic bias. At the same time, we pose three key strategic questions: how can innovation cycles be accelerated with automated ideation and prototyping? How can innovation be made accessible for everyone, by democratizing the process? And how can new business models emerge with content generated by AI? Finally, the paper offers practical managerial suggestions and a research agenda for scholars. The present work is a theoretically informed, but practically relevant, study at the intersection of artificial intelligence and strategic management, providing invaluable guidance for the innovation landscape in the era of GenAI.

Keywords: sap (socio-academic practitioner) programs on generative artificial intelligence, innovation management, dynamic capabilities, strategic leadership, digital transformation

INTRODUCTION

The world of business is changing fundamentally as generative artificial intelligence (GenAI) technologies are increasingly commercialized. The capabilities of GenAI, ranging from making human-like text to images, code, and multimedia (Bommasani et al., 2022), have been impressive. In contrast to earlier stages of automation focused on repetitive processes, GenAI has the unique ability to improve and at times, replace creative processes traditionally thought to be uniquely human (Autor, 2022). Business leaders need to think differently about how innovation is managed, resourced, and governed within their business at this technological inflexion point. Since Schumpeter (1942) came up with the notion of "creative destruction," and Teece, Pisano and Shuen (1997) introduced the concept of dynamic capabilities, there have been important developments in the field of innovation management. Closed innovation (Chesbrough, 2003), design thinking (Brown, 2008) and agile development (Rigby et al., 2016) have all assumed ideation, experimentation and iteration behaviors, normally associated with human-centric processes, as necessary steps in the model. However, GenAI questions these norms by making machine intelligence an active player and not just a mere instrument in the innovation process (Davenport & Ronanki, 2018). The business impact is significant. McKinsey Global Institute (2023) projects that GenAI will contribute. This is valued at $2.6-$4.4 trillion per year to the global economy, and Goldman Sachs (2023) estimates the global GDP to rise by 7% over 10 years. But achieving this potential is fraught with technical, organizational, and ethical problems and issues that go well beyond the easy adoption of technology (Brynjolfsson

[1] Amity Business School, Amity University, Noida, UP-201303, India, rhythm.mittal@gmail.com, https://orcid.org/0009-0006-7565-2208
[2] ✉Amity Business School, Amity University, Noida, UP-201303, India, kunalsaxena571995@gmail.com, https://orcid.org/0009-0004-0707-769X

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& McAfee, 2014). While practitioners have shown interest in using GenAI for innovation management, research has not yet been unified in analyzing the strategic implications of GenAI for innovation management. Though there are practitioners interested in utilizing GenAI for innovation management, the research on the topic is still not consolidated and examining the strategic implications of GenAI for innovation management. Previous research has been conducted on technical skills, productivity impacts, or specific applications rather than on any strategic approach (Fui-Hoon Nah et al., 2023). The lack is important as innovation is one of the cornerstones of sustainable competitive advantage (Barney, 1991). To fill this gap, this paper examines the impact that GenAI has on the concept of innovation management, using a theoretical approach. We aim to achieve three goals: (1) synthesis of existing knowledge on the nexus of GenAI and innovation management; (2) pinpoint and classify strategic challenges faced by business leaders; and (3) express strategic opportunities for improving innovation capabilities and building competitive advantage. This approach allows us to build an integrated conceptual approach that will help both science and management.

LITERATURE REVIEW

Innovation Management Foundations

The framework of Dynamic Capabilities, as presented by Teece, Pisano and Shuen (1997) and developed by Teece (2007), suggests that sustained competitive advantage is based on firm's capacity to integrate, build and reconfigure competencies to adjust to the changing environment. Dynamic capabilities are three interconnected clusters: sensing (identifying opportunities), seizing (mobilizing resources) and transforming (organizational renewal). This framework is especially relevant as it not only presents new sensing opportunities, but also new seizing approaches, as well as the need for organizational transformation (Teece, 2023). In open innovation, Chesbrough (2003) contends that both internal and external ideas and pathways to market should be embraced by companies. The economics of open innovation is getting significantly changed, especially the knowledge search, synthesis and integration cost, is going to be significantly reduced by GenAI (Chesbrough, 2023). An AI powered platform can also be used to search through massive scientific research databases, patent databases, and market indicators to uncover external knowledge that is relevant and relevant at a much faster rate than a human analyst. The idea of absorptive capacity, which describes the ability to learn, understand, and use external information (Cohen & Levinthal, 1990), is also reinforced by the ability of GenAI to handle multiple sources of information, bringing new issues such as information overload and algorithmic bias.

Generative AI: Capabilities and Business Applications

Generative AI is the use of machine learning models to create new content—such as text, images, audio and code—based on patterns learned from training data (Bommasani et al., 2022). The architecture of the transformer (Vaswani et al. 2017) allows the efficient processing of sequential data using self-attention mechanisms. These applications are used in business for creating marketing content, speeding up product development, aiding research, and automating software development (Davenport et al., 2020; Fui-Hoon Nah et al., 2023). Empirical research in recent years has measured the productivity effects of GenAI. Noy and Zhang (2023) found that access to ChatGPT boosted professional writing productivity by 37 percent and enhanced writing quality. According to Brynjolfsson et al. (2023), AI conversational assistants boosted the productivity of customer support by 14 percent and the most impactful benefits were the ones for novice employees. Dell'Acqua et al. (2023) confirm that GenAI increased consultant productivity by 40 per cent for creative tasks, but they also discovered a "jagged technological frontier" in which the use of AI assistance might fall short of performance at the boundaries of capabilities.

The Convergence of GenAI and Innovation Management

The field of innovation management and GenAI is a new but growing field. Girotra et al. (2023) has empirical evidence that LLM-generated ideas can be of higher quality and diversity than human generated ideas in some contexts, LLM-generated ideas are clustered around patterns that are statistically common. Organizational-wise, GenAI poses questions to the very definition of creativity and human judgment, shortens innovation cycles and levels the playing field in access to creative capabilities (Möllick, 2022). Chesbrough (2023) argued that GenAI is a "platform of platforms" that will redefine innovation ecosystems, and Teece (2023) highlighted its ability to redefine the value chain for industry, not only through productivity gains.

STRATEGIC CHALLENGES FOR BUSINESS LEADERS

Based on the technology-organization-environment (TOE) framework (Tornatzky & Fleischer, 1990) and on recent empirical research, we categorize nine critical challenges: three categories of challenges.

Organizational and Cultural Challenges

Workforce adaptation and skill gaps: Most organizations are missing out on essential new skills to integrate GenAI. To use effectively, prompt engineering skills and critical evaluation abilities to evaluate and critique AI-generated content are needed, as reported by Dell'Acqua et al. (2023). With the fast pace of GenAI evolution, skill requirements are constantly evolving, therefore training problems are still ongoing (Tambe et al., 2020).

Change resistance and cultural barriers: One is organizational culture. Employees might feel a threat to their creative freedom or sense of professional identity or job security by GenAI (Möllick, 2022). There may also be resistance from management in surrendering decision-making power to algorithmic systems or a lack of digital literacy to imagine GenAI applications. In this context the principles of change management by Kotter (1996) become even more relevant.

Structural and process reconfiguration: Traditional structures of innovation, such as R&D departments, stage-gate processes, portfolio management systems, were developed for human-centric innovation. New roles, newworking processes involving collaboration between humans and AI, and new measures of performance (Davenport & Ronanki, 2018) are also needed for GenAI adoption.

Technical and Governance Challenges

AI hallucination and output reliability: One of the issues with GenAI systems is that they can produce outputs that seem plausible but are actually factually incorrect, a phenomenon known as "hallucination" (Ji et al., 2023). In innovation situations, it can lead to significant investment and strategic ramifications if reliance is placed on inaccurate AI-generated insights. There is a need for robust validation processes and human oversight (Dell'Acqua et al., 2023).

Data quality and integration: The information, inaccuracies, and biases within GenAI models from the Internet can be outdated. There are issues of data quality, standardization, and governance that arise in an organizational deployment of proprietary data sources (Brynjolfsson & McAfee, 2014).

Intellectual property and legal uncertainty: The legal landscape of GenAI-generated content is still in flux. The uncertainty for business leaders regarding copyright status, training data infringement, and liability are significant (Henderson et al., 2023).

Ethical and Regulatory Challenges

Algorithmic bias and fairness: The biases in the models can be perpetuated and amplified in society through the models' training data (Bender et al., 2021). biased systems can be detrimental in innovation settings when they leave out segments of the customer base, when they fail to capture a diverse point of view, or when such a system perpetuates a negative stereotype. Fairness is a form of proactive monitoring and inclusive design (Mehrabi et al., 2021).

Transparency and explainability: There are challenges in accountability, debugging, and trust with the 'black box' nature of large GenAI models. There is a need to consider performance benefits and governance considerations for explainable AI (Rudin, 2019).

Regulatory compliance: There is an increasingly dynamic regulatory environment, and the EU's AI Act is the most comprehensive one. Organizations face complicated requirements concerning the risk classification, documentation, human oversight, and impact assessments (Veale & Zuiderveen Borgesius, 2021).

Table 1: Strategic Challenges of GenAI Adoption for Innovation Management

Category	Challenge	Key Issue	Primary References
Organizational	Workforce adaptation	Skill gaps in prompt engineering and AI evaluation	Dell'Acqua et al. (2023)
Organizational	Address resistance	Cultural barriers and fear of job displacement	Möllick (2022)
Organizational	Structural reconfiguration	Redesigning innovation processes and roles	Davenport & Ronanki (2018)
Technical	Technical AI hallucination	Plausible but incorrect outputs affecting decisions	Ji et al. (2023)
Technical	Data quality	Data quality, integration, and governance challenges	Brynjolfsson & McAfee (2014)
Technical	IP and legal uncertainty	Unsettled copyright and liability issues	Henderson et al. (2023)
Ethical/Regulatory	Algorithmic bias	Perpetuation of societal biases	Bender et al. (2021)
Ethical/Regulatory	Transparency	Black-box constraints on accountability	Rudin (2019)
Ethical/Regulatory	Regulatory issues	Changes in legal requirements (EU AI Act)	Veale & Zuiderveen Borgesius (2021)

STRATEGIC OPPORTUNITIES FOR BUSINESS LEADERS

Accelerating Innovation Cycles

With GenAI, innovation cycle times can be reduced by orders of magnitude. Large language models produce hundreds of novel ideas in minutes based on cross-domain knowledge (Girotra et al., 2023) during ideation. Developing generative design algorithms enables them to explore a wide range of solutions, and AI coding tools lower software development time by 30-50 percent (Dell'Acqua et al., 2023). For testing, synthetic datageneration and predictive market modelling allow for a fast and cost-efficient validation. The result is a more basic, rapid increase in the speed of innovation, which creates the capacity to adapt to market shifts more quickly.

Democratizing Innovation

GenAI opens up innovation potential to everyone. GenAI will take digital tools even further, by offering sophisticated creative capabilities to anyone, no matter how technically capable. Von Hippel (2005) highlighted the importance of user participation in the development process using digital tools. Marketers create campaigns without agencies, product managers create prototypes without engineers, scientists speed up literature reviews. This democratization opens up a variety of sources of creative input and increases the capacity of organizations to innovate (Möllick, 2022). Outside the walls of the organization, GenAI can help customers and suppliers become more engaged in innovation ecosystems.

Enabling Business Model Innovation

In addition to enhancing operations, GenAI presents opportunities for a revolution in business model. Mass customization value proposition is achieved through personalized content at scale. New business archetypes are "AI-as-creative-partner" in professional services, "hyper-personalization" that delivers experience-by-experience services, and "generative platforms" that bring in model providers and application developers (Chesbrough, 2023). Relevant is Christensen's (1997) theory of disruptive innovation, which sees GenAI emerging to serve niche markets, but with technologies advancing and applications growing, having the potential to radically change industries.

AN INTEGRATED FRAMEWORK FOR GENAI-DRIVEN INNOVATION MANAGEMENT

We introduce an integrated framework, which combines both challenges and opportunities, under three interacting mechanisms: capability augmentation, process transformation and ecosystem reconfiguration.

The framework is an extension of the dynamic capability's theory of Teece (2007). AI-driven market intelligence processes massive amounts of unstructured data to aid in sensing. Harnessing the advantages of rapid prototypes and more efficient use of resources. Transforming is most impacted, because GenAI requires constant organizational change, and the ability to learn how to learn with AI. The framework highlights that all three mechanisms need to be taken into consideration when working through the opportunities and challenges. If the intent is only to augment capabilities, without reshaping the process, then it will only get you incremental value — if at all; but if you do not look at the process and try to shape the ecosystem, you will not miss out on the transformative opportunities.

DISCUSSION AND MANAGERIAL IMPLICATIONS

Developing a GenAI innovation strategy

Leaders need to evaluate the capabilities of innovating through GenAI considering the sensing-seizing-transforming framework and determine the areas where GenAI provides a differential advantage. It is recommended to implement it in stages: first to use it in a few clearly defined use cases with clear metrics so as to build up organizational experience before embarking on transformative applications (Davenport & Ronanki, 2018).

Building human-AI collaboration capabilities

Successful applications of GenAI are those that require human-AI collaboration and not full automation. The study by Dell'Acqua et al. (2023) revealed that GenAI is a more effective collaboration tool than non-AI consultants and completely AI-driven consultants. Collaborative skills include quick and efficient question generation, assessment of results, embedding in context, and ethical considerations. They must be developed in a systematic way in training programs.

Ensuring responsible AI governance

There should be cross-functional AI ethics committees within the organisation to approve the applications, evaluate risks and guarantee compliance with the regulations. Data usage, output validation, bias monitoring, and accountability are all areas that need to be covered by governance frameworks. Stakeholder communication is crucial for fostering trust and an important differentiator.

Fostering an innovation culture embracing GenAI

It is crucial for leaders to foster a mindset that sees GenAI as a tool that empowers human creativity, not a replacement for it. It demands psychological safety in experimentation, a tolerance of failure in learning, and the recognition of effective human-AI integration. Rational (business cases, career opportunities) and emotional (job security concerns, validation of human judgment value) aspects of change management should be covered.

CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

Conclusion

The focus of this paper is to conduct a thorough analysis of the impact generative AI has on innovation management. In three aspects, we contribute: firstly, as a synthesis of the fragmented literature in a coherent framework based on dynamic capabilities theory; secondly, as a structured taxonomy of nine strategic challenges providing practical guidance; and thirdly, as a statement of three dominant opportunities, accelerated cycles, democratized innovation, and business model transformation. Our framework is based on an extension of innovation management theory that focuses on how GenAI impacts the capabilities of an organization.

Limitations

Certain of the challenges mentioned may change with the evolution of GenAI, but the framework is expected to be resilient to technological change. Our analysis is based largely on published work from the early adopters, which is not necessarily representative of all industries. The framework is not proven, and further research is needed to validate the propositions of the framework with large-scale studies.

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Future Research Directions

The framework would be supported by empirical research on the extent of GenAI adoption and innovation outcomes by industry. Follow-up studies addressing organizational capability development would shed light on the dynamics of learning. Variations among the sectors would be identified by industry specific studies. Research into normative/ethical aspects of regimes of intellectual property and/or competitive regimes would addnormative inputs. Lastly, the creation of measurement tools for GenAI innovation capacities would further the research and practice. The age of generative AI is a great challenge and a new golden opportunity for innovation management. Organizations that are prepared to embrace GenAI with strategic foresight, ethical consciousness, and adaptability will likely reap the most benefits from this change. The anchor principles are staying with technology, namely the development of dynamic capabilities, responsible governance, and human-centered AI collaboration, are still relevant points to address.

AUTHOR DECLARATIONS

Credit Author Statement / Author contributions

Rhythm Mittal: Conceptualization, Methodology, Formal Analysis, Investigation, Writing (Original Draft), Writing (Review and Editing), Visualization.

Kunal Saxena: Data Curation, Resources, Writing (Review and Editing, Supporting), Supervision, Project Administration.

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