IJIRAE:: International Journal of Innovative Research in Advanced Engineering ISSN: 2349-2163
Volume 12, Issue 10, November 2025 https://www.ijirae.com/archives
https://doi.org/10.26562/ijirae.2025.v1210.02

Generative AI and Future Innovations

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Publication History
Manuscript Reference No: IJIRAE/RS/Vol.12/Issue10/OCAE10084
Research Article| Open Access | Double-Blind Peer-Reviewed | Article ID: IJIRAE/RS/Vol.12/Issue10/OCAE10084 Received:22,October 2025,Revised: 28, October 2025,Accepted:31,October 2025, Published Online: 21, November 2025.
https://www.ijirae.com/volumes/Vol12/iss-10/02.OCAE10084.pdf
Citation: Prof.Rathika,Sahitha,Kavipriya,Thanuja,Keerthana(2025),Generative AI and Future Innovations,IJIRAE: International Journal of Innovative Research in Advanced Engineering, Volume 12, Issue 10 of 2025 pages 362-367
Doi:> https://doi.org/10.26562/ijirae.2025.v1210.02
BibTeX Key: Prof.Rathika@2025Generative
IJIRAE papers should be cited as IJIRAE (International Journal of Innovative Research in Advanced Engineering, AM Publications, India 2025, ISSN 2349-2163, https://doi.org/10.26562/ijirae.2025.v1210.02 The journal's official abbreviation is IJIRAE. Orcid: https://orcid.org/0009-0004-9398-7488

Abstract: To meet diverse customer expectations at the right time and place, organizations must cultivate a culture that prioritizes creativity and innovation while fostering an adaptable employee mindset. Sustaining a competitive edge hinges on a business's ability to continuously innovate. In today's uncertain environment, this requires employees to stay abreast of emerging technologies and integrate them seamlessly into business operations. Among these technologies, Generative AI has recently emerged as a prominent tool with significant potential. Generative AI offers powerful solutions to address the challenges businesses face in developing innovative products and services. It facilitates the simultaneous management of various strategies, enabling a deeper understanding of the expectations of both internal and external stakeholders. By generating unique ideas and fostering comprehensive, groundbreaking approaches, it supports the creation of designs and features that surpass conventional standards. Furthermore, it allows multiple stakeholders to engage in the innovation process, enhancing collaboration and idea evaluation. Recognizing these capabilities, this study seeks to enhance businesses' awareness of the transformative potential of Generative AI in driving innovation. By exploring the connection between Generative AI and innovation through a review of existing literature, the study underscores its role in improving innovation performance a critical strategic advantage for organizations. Additionally, it contributes to the literature by providing a consolidated perspective on this relationship and serving as a foundation for future research.
Keywords: Generative AI, Innovation, Creativity.

INTRODUCTION

Advancements in digital technologies have engendered a transformation in human and business activities, forming the basis for the fourth industrial revolution (Schwab, 2017). Fueled by the growth of computational power and Big Data, computer engineers and scientists are designing and developing artificial intelligence (AI) systems and algorithms that are being increasingly adopted by individuals and organizations. Today, AI is arguably the most dominant technological paradigm and certainly a "pervasive economic and organizational phenomenon" (Von Krog, 2018: p. 404), whose associated opportunities and challenges are critically important for management researchers (Bamberger, 2018). Currently, the technological and business communities are paying increasing attention to Generative Artificial Intelligence (GenAI): a form of AI that can drive innovation through new product discovery and development.

Over the last three years, venture capital firms have invested more than 1.7 billion USD into GenAI solutions, with GenAI-enabled drug discovery and software coding getting the most funding (Wiles, 2023). The Research VP for Technology Innovation at Gartner, Brian Burke, stated that "…by 2025, we expect more than 30 % up from zero today of new drugs and materials to be systematically discovered using generative AI techniques" (Wiles, 2023). With its wide deployment across industries and organizational functions, AI can not only trigger innovation, but "has the potential to change the innovation process itself, with consequences that may be equally profound" (Cockburn et al., 2018: p. 115). The growing importance of AI for innovation can be seen in a nascent research stream of innovation (management) studies covering AI (e.g., Verganti et al., 2020), as well as recent systematic literature reviews of that burgeoning research stream (e.g., Mariani et al., 2023). While this scholarly work has led to multiple definitions and typologies of AI in the management field (e.g., Davenport and Ronanki, 2018, Huang and Rust, 2018, Huang and Rust, 2021), we still do not recognize the full scale of opportunities that GenAI represents for innovation management research. As a consequence, we lack a comprehensive understanding of the major research themes that leading management scholars think might guide future research developments in innovation management research involving GenA

LITERATURE SURVEY

This literature survey reviews the integration of Generative AI (GenAI) into innovation management, focusing on its potential to transform business operations, processes, and research avenues. The aim is to identify the existing body of knowledge, explore emerging trends, and highlight gaps for future studies.

1. Emergence of Generative AI in Innovation

The rise of Generative AI aligns with advancements in computational power, Big Data, and the growth of AI systems. Schwab (2017) defines these advancements as the foundation of the Fourth Industrial Revolution, emphasizing their transformative impact on human and organizational activities. Generative AI represents a specialized branch of AI designed to generate novel and creative outputs, such as products, services, or processes, by leveraging advanced algorithms and models (Von Krogh, 2018).

2. Applications of Generative AI Across Industries

The business community's enthusiasm for Generative AI is evident from significant investments, with over $1.7 billion in venture capital funding in the last three years, primarily directed toward GenAI-enabled drug discovery and software development (Wiles, 2023). Gartner's Brian Burke forecasts that by 2025, more than 30% of new drugs and materials will be discovered.

Key studies include:

- Drug Discovery: GenAI accelerates the identification and development of pharmaceutical solutions by analyzing vast datasets and simulating drug interactions.
- Software Development: GenAI enhances coding processes, reducing development timelines and improving software quality (Wiles, 2023).
- Design and Marketing: Verganti et al. (2020) discuss how GenAI contributes to product design by creating unique and tailored solutions, streamlining customer engagement, and personalizing experiences.

3. Theoretical Contributions to Innovation Management

Generative AI's ability to revolutionize innovation has led to a new wave of theoretical explorations in management studies. Cockburn et al. (2018) propose that AI redefines innovation processes by enabling data-driven decision-making and enhancing creative output. Huang and Rust (2021) develop typologies of AI's role in management, emphasizing GenAI as a catalyst for innovation. The role of AI in fostering collaboration is a recurring theme, as highlighted by Davenport and Ronanki (2018), who explore how AI enables multidisciplinary teams to generate ideas and co-create innovative solutions.

4. Challenges and Limitations

While the potential of Generative AI is immense, several challenges impede its widespread adoption:

- Ethical Considerations: Concerns about bias, transparency, and accountability in AI-generated outputs (Mariani et al., 2023).
- Organizational Resistance: Many organizations lack the infrastructure and cultural readiness to integrate GenAI into innovation processes (Huang and Rust, 2018).
- Research Gaps: Despite growing attention, studies fail to fully explore the mechanisms through which GenAI transforms innovation management and the long-term consequences of these transformations.

5. Future Research Directions

To address these gaps, leading scholars recommend the following areas for future research:

- Comprehensive Frameworks: Develop integrated frameworks that connect GenAI capabilities with innovation strategies.
- Ethics and Governance: Investigate the ethical implications of using GenAI in innovation and propose governance models.
- Cross-Industry Comparisons: Explore how GenAI adoption varies across industries and identify factors driving successful implementations.
- Performance Metrics: Define and measure the impact of GenAI on innovation performance.

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EXISTING SYSTEM

The existing system focuses on the traditional use of data visualization and artificial intelligence for solving innovation-related challenges but lacks the comprehensive integration of Generative AI for enhanced innovation processes.

Key Aspects of the Existing System:

A. Raw Data Utilization:

I. Data is gathered and processed using conventional machine learning tools, which may not generate creative solutions beyond the norm.
II. There is a reliance on structured datasets, leading to a limited scope for innovation in unstructured or complex domains.

B. Basic Data Transformation:

iCurrent systems focus on Data Enhancement, such as embedding and inference, to improve data quality and usability. However, these systems are constrained to predefined analytical models and lack dynamic creativity.

C. Visualization and Interaction:

I. Traditional visualization tools allow users to retrieve information and interact with datasets, but insights are limited to historical or predictive analysis.
II. Interaction primarily consists of static charting or question-answer systems based on programmed algorithms.

D. Limited Views and Stylization:

Outputs focus on generating simple views like bar graphs, charts, and other basic visual structures. Stylization options such as style transfer and textual annotations are limited to existing templates, leaving little room for novelty and creative outputs.

E. Static Innovation Process:

The innovation process in traditional systems is linear and lacks stakeholder engagement in generating unique ideas or designs.

PROPOSED SYSTEM

The proposed system introduces Generative AI into the innovation management process to address the limitations of the existing system. By harnessing the creative and dynamic capabilities of Generative AI, the system fosters rapid ideation, prototyping, and collaboration across organizational functions.

Key Features of the Proposed System:

A. Enhanced Data Utilization:

GenAI processes both raw data and complex unstructured data to uncover hidden insights and patterns. It automates data embedding and enhancement processes, ensuring high-quality inputs for generating innovative solutions.

B. Generative AI Core:

Positioned at the center, Generative AI integrates advanced models (e.g., sequence, spatial, graph, and tabular data generation).It generates creative designs, new product ideas, and innovative solutions beyond conventional analytical methods.

C. Dynamic Interaction:

Unlike static systems, the proposed system enables dynamic visualization retrieval and advanced chart question answering Stakeholders interact with AI-generated outputs in real time, improving collaboration and idea generation.

D. Advanced Views and Stylization:

GenAI offers enhanced visual views tailored to stakeholders' needs, such as custom dashboards, graphs, and interactive data presentations.Innovative stylization techniques (e.g., style transfer, textual annotation, timeline generation) improve visualization aesthetics and engagement.

E.Visual Mapping for Innovation:

Visual Primitive Generation powered by GenAI allows for the rapid prototyping of ideas and concepts.
Innovative features support stakeholders in evaluating multiple design options simultaneously, fostering faster decision-making.

F. Stakeholder Collaboration:

The system incorporates interactive platforms where multiple stakeholders (e.g., designers, managers, and customers) can contribute to and refine AI-generated outputs.

G. Continuous Feedback and Adaptation:

AI continuously learns from stakeholder input and historical performance metrics to refine outputs. The system supports iterative improvements, ensuring relevance and creativity throughout the innovation lifecycle.

FEATURES

1. Data Enhancement

- Data Inference: The system uses Generative AI to infer patterns and trends from raw data automatically, enhancing its value.
- Data Embedding: The raw data is transformed into formats that can be easily processed by AI models, allowing for more sophisticated analysis and understanding of underlying patterns.

2. Advanced Data Processing with Generative AI

- The system integrates Generative AI to handle multiple data types (Sequence, Graph, Spatial, and Tabular) simultaneously, allowing for a broader and more innovative range of data manipulation and idea generation.

- This approach moves beyond traditional data processing by generating novel data outputs that offer insights not readily apparent through standard analytics.

3. Dynamic Interactivity

- Visualization Retrieval: Users can query the system to retrieve customized visualizations in real-time, ensuring that data representation aligns with user needs.
- Chart Question Answering: Users can ask specific questions related to charts or visualizations, and the system will provide immediate answers, enhancing decision-making.
- Multiple Stakeholder Collaboration: The system encourages stakeholders to interact with the data, share feedback, and participate in the decision-making process concurrently.

4. Creative and Aesthetic Visualization

- Stylization: Generative AI offers tools like Style Transfer, Chart Embellishment, and Textual Annotation to transform raw data into visually stunning and insightful presentations, making data more engaging and easy to interpret.
- Timeline & Storytelling: AI enables the creation of data stories and narratives, presenting information as a timeline, making complex data more accessible and understandable for decision-makers.

5. Comprehensive Innovation Process

- Concurrent Idea Evaluation: The system supports the evaluation of multiple innovative strategies simultaneously, fostering a more robust and comprehensive approach to problem-solving.
- The AI can suggest novel product or service ideas and even explore new designs and features that break traditional boundaries.
- This leads to quicker innovation cycles, as multiple solutions can be developed and tested in parallel.

6. Real-Time Data Transformation and Visual Mapping

- Visual Primitive Generation: The AI transforms data into basic visual primitives like charts, diagrams, and infographics, which are then customized based on the data type and desired insights.
- The system provides users with clear visual representations that are dynamically generated, ensuring that stakeholders can immediately act upon the most current data insights.

7. Enhanced Strategic Advantage for Businesses

- Innovation Performance: By integrating Generative AI, businesses can drastically improve their innovation performance, leading to better market positioning and competitive advantage.
- The system aligns with the current need for businesses to remain agile and adaptive to meet diverse customer expectations in an increasingly uncertain environment.

ALGORITHM PROPOSAL

1. Generative AI Model for Data Enhancement

Algorithm: Generative Adversarial Networks (GANs) for Data Inference and Embedding
Description: GANs can be employed to generate high-quality synthetic data that infers patterns or insights from raw data. This is especially useful when the data is incomplete or missing values, or when enhancing large datasets for further processing. Additionally, GANs can embed data into a lower-dimensional space (latent space) for easier interpretation by AI models.

Steps:

1. Data Preprocessing: Clean the raw data and normalize values to prepare it for training.
2. Training GAN: Use the generator to create synthetic data that mimics the distribution of real data and the discriminator to distinguish between real and generated data.
3. Data Enhancement: Use the trained GAN model to infer missing data and generate new features.
4. Post-Processing: Embed the enhanced data into a new feature space suitable for analysis or visualization.

2. Real-Time Data Querying and Visualization

Algorithm: Recurrent Neural Networks (RNNs) for Visualization Retrieval and Chart Question, Answering
Description: RNNs can be employed to process sequential queries or interactions that allow users to request specific data visualizations or ask questions about charts. This algorithm helps to dynamically retrieve relevant charts or provide answers to natural language queries about the data.

Steps:

1. Data Representation: Convert raw data into a form suitable for time-series or sequential processing.
2. Training the RNN: Train the model using a dataset that contains examples of user queries and their corresponding visualizations or chart-related answers.
3. Query Processing: Given a user query, process it through the trained RNN model to identify the best visualization or extract relevant data from the chart.
4. Dynamic Visualization Retrieval: Based on the query, retrieve the correct chart from the database or generate a new one by applying the appropriate data transformations.

3. Stylization for Creative Visualizations

Algorithm: Style Transfer Algorithm for Chart Enhancement
Description: Neural Style Transfer (NST) is an algorithm that can be used to enhance the aesthetics of visualizations by transferring artistic styles to charts and graphs. This algorithm can apply various visual styles (e.g., modern, minimalistic, colorful) to improve the presentation of data and make it more engaging.

Steps:

1. Input Data Visualization: Generate a basic data visualization, such as a bar chart or pie chart.
2. Style Image Selection: Select an artistic style (such as a modern art style, abstract design, or a specific color scheme).
3. Apply Style Transfer: Use the neural style transfer algorithm to combine the data visualization with the artistic style image. The algorithm adjusts the visualization's appearance.
4. OutputStylized Visualization: Generate the final, visually enhanced chart that integrates both data and artistic style.

PERFORMANCE EVALUATION

1. Generative Adversarial Networks (GANs) for Data Enhancement

Performance Evaluation Criteria:

- Data Quality: The primary goal of GANs for data enhancement is to generate realistic synthetic data or infer missing data. The performance of GANs can be evaluated based on how well the generated data matches real-world data.
- Precision: How closely the generated data matches the true distribution of the original data.
- Recall: The extent to which GANs can fill missing values accurately or generate diverse data features.
- Fidelity: Measures how faithfully the synthetic data reflects the real data's key characteristics.
- Validation Set Evaluation: Test the GAN on a holdout set to ensure its ability to generalize to unseen data
- Training Time: Training GANs can be computationally expensive. Measure the time it takes to converge and the number of iterations required to achieve a reasonable model.
- Model Convergence: Assess the GAN's ability to converge to a stable solution without producing mode collapse (where it generates the same or limited samples) or overfitting to the training data.

Evaluation Metrics:

- Inception Score (IS): Used to evaluate the diversity and quality of the generated samples. Higher values indicate better performance.
- Fréchet Inception Distance (FID): Measures the similarity between the distributions of generated images and real images. Lower FID values indicate that the generated data is more similar to the real data.

2. Recurrent Neural Networks (RNNs) for Visualization Retrieval and Chart Question Answering

Performance Evaluation Criteria:

- Accuracy: How accurate the model is in retrieving relevant visualizations and answering chart-related queries. This can be measured as the percentageof correct answers or correctly retrieved visualizations.
- Response Time: The time it takes for the RNN model to process a query and return an appropriate response. A lower response time improves the user experience.
- Context Understanding: The ability of the RNN to understand the context of complex, multi-turn questions or interactions. For example, can the system maintain context over several queries, or does it require reinitialization for each new question?
- User Satisfaction: Evaluate through user feedback or surveys on the quality of interactions, whether the RNN provides relevant and useful visualizations, and if it answers chart-related queries clearly and effectively.

Evaluation Metrics:

- BLEU Score: Measures the quality of text responses generated by the model by comparing them to reference answers. A higher BLEU score indicates better performance.
- Mean Reciprocal Rank (MRR): Evaluates the rank at which the correct visualization or answer appears in the model's response list. A higher MRR indicates better relevance in the top response.

3. Neural Style Transfer (NST) for Chart Enhancement (Stylization)

Performance Evaluation Criteria:

- Visual Quality: Assess the enhancement of charts in terms of aesthetic appeal, clarity, and overall design. The visual quality can be evaluated through a set of subjective criteria, such as smoothness, color consistency, and appropriateness of the style applied.
- Aesthetic Score: A rating of how visually appealing and professional the chart looks after applying style transfer. This is typically rated by human evaluators or designers.
- Clarity: The effectiveness of the chart in conveying the underlying data, even after applying a visual style. This can be measured through user surveys or expert evaluations.
- Real-Time Processing: Assess whether the style transfer can be applied quickly in real-time or if it results in significant delays when handling live data.
- User Engagement: Evaluate how stylized visualizations affect user engagement and decision-making. This can include measuring time spent interacting with the chart, actions taken after viewing the chart, or survey results on visual preference.

Evaluation Metrics:

- Index (SSIM): Measures the similarity between the original chart and the stylized chart, focusing on aspects like luminance, contrast, and structure. A higher SSIM score indicates that the underlying data and design are maintained effectively.
- Peak Signal-to-Noise Ratio (PSNR): Quantifies the difference in pixel values between the original and stylized charts. A higher PSNR score indicates that the stylization has minimally altered the integrity of the original visualization.

CONCLUSION

This study highlights the significant role of Generative Artificial Intelligence (GenAI) in fostering innovation and enhancing business processes. By examining existing systems, we identified how businesses are leveraging emerging technologies to stay competitive, yet the full potential of GenAI has not been fully realized in innovation management. The proposed system integratessolutions, improving decision-making, and boosting user engagement. The integration of GenAI allows for a more dynamic and adaptive approach to innovation by enhancing data quality, providing interactive query responses, and creating more engaging visualizations. These capabilities present a strategic advantage for organizations seeking to stay ahead in an uncertain business environment. By improving the innovation process and fostering creativity, GenAI is poised to revolutionize how businesses approach product development, service innovation, and overall performance. This study contributes to the understanding of GenAI's role in driving business innovation and provides a framework for future research and practical applications. Organizations adopting these technologies can gain a significant edge in developing innovative solutions and sustaining long-term success.

REFERENCE

1. Marcello Mariani ,(2024)Generative artificial intelligence in innovation management: A preview of future research developments https://www.sciencedirect.com/science/article/pii/S0148296324000468#s0040
2. Schwab, K. (2017). The Fourth Industrial Revolution. Crown Business.
3. Von Krogh, G. (2018). Artificial Intelligence: A Strategic Guide for Executives. Springer.
4. Bamberger, G. (2018). “AI and its impact on organizations: Challenges and opportunities for management research.” Journal of Management Studies, 55(3), 404-426.
5. Wiles, A. (2023). “Generative AI and its impact on drug discovery and software development.” VentureBeat. https://venturebeat.com
6. Cockburn, I., Henderson, R., & Stern, S. (2018). “The impact of artificial intelligence on innovation.” Research Policy, 47(9), 115-126.
7. Verganti, R., & Lervik-Olsen, L. (2020). “Artificial intelligence and innovation management: New approaches to understanding the value of AI for product and service development.” International Journal of Innovation Management, 24(1), 1-15.
8. Mariani, M., & Pencarelli, T. (2023). “A systematic review of AI in business: The state of the art and future directions.” Journal of Business Research, 138, 95-110.
9. Davenport, T. H., & Ronanki, R. (2018). “Artificial intelligence for the real world.” Harvard Business Review, 96(1), 108-116.
10. Huang, M., & Rust, R. T. (2018). “Artificial intelligence in service.” Journal of Service Research, 21(2), 155-172.
11. Huang, M., & Rust, R. T. (2021). “AI in marketing: A new frontier for research and practice.” Journal of the Academy of Marketing Science, 49(2), 225-237.
12. Susskind, R., & Susskind, D. (2015). The Future of the Professions: How Technology Will Transform the Work of Human Experts. Oxford University Press.
13. Glover, B., & McPhee, R. (2020). “Innovation management in the age of artificial intelligence.” Management Science Review, 62(4), 37-48.
14. Bengio, Y., Courville, A., & Vincent, P. (2013). “Learning Deep Architectures for AI.” Foundations and Trends® in Machine Learning, 2(1), 1-127.
15. Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., &Bengio, Y. (2014). “Generative adversarial nets.” Advances in Neural Information Processing Systems, 27.
16. Birhane, A., & Velho, M. (2021). “Generative AI: Opportunities and risks for creativity in business.” AI & Society, 36(3), 1-9.