Unveiling the Potential of Generative Artificial Intelligence: A Multidimensional Journey into the Future

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Abstract:

Purpose: The launch of ChatGPT has brought Large Language Model (LLM) based Generative Artificial Intelligence (GAI) into the spotlight, triggering the interests of various stakeholders to seize the possible opportunities implicated by it. Nevertheless, there are also challenges that the stakeholders should observe when they are considering the potentials of GAI. Given this backdrop, this study presents the viewpoints gathered from various subject experts on six identified areas.

Design/methodology/approach: Through an expert-based approach, this paper gathers the viewpoints of various subject experts on the identified areas of tourism and hospitality, marketing, retailing, service operations, manufacturing, and healthcare.

Findings: The subject experts first share an overview on the use of GAI, followed by the relevant opportunities and challenges in implementing GAI in each identified area. Afterwards, based on the opportunities and challenges, the subject experts propose several research agenda for the stakeholders to consider.

Originality: This paper serves as a frontier in exploring the opportunities and challenges implicated by the GAI in six identified areas that would be considerably influenced by this emerging technology. It is believed that the viewpoints offered by the subject experts would enlighten the stakeholders from the identified areas.

Keywords: generative artificial intelligence; artificial intelligence; large language model; ChatGPT; hospitality; tourism; marketing; retailing; service operations; manufacturing; healthcare.

Article classification: Viewpoint.

1.0 Introduction

The explosion in interest in Artificial Intelligence (AI) from the launch of ChatGPT in November 2022 and the subsequent launch of further Large Language Model (LLM) based Generative AI (GAI) products from Google and Microsoft has generated significant debates within academia and mainstream discourse on the impact from AI. OpenAI's ChatGPT – the most widely adopted LLM, trained on a diverse dataset including internet pages, academic articles, books, and social media content, uses a generated pre-trained transformer model to develop interactions and text responses that are close to human levels of creativity and ability, capable of a wide range of applications (Dwivedi et al. 2023a). The disruptive impact of ChatGPT is demonstrated by its rapid global adoption. A recent report from UBS highlighted that ChatGPT reached an estimated 123 million active monthly users in just over three months, averaging 13 million daily visitors as of January 28th, 2023, making it the fastest-growing internet application in history (AIBusiness, 2023). The recent announcement in May 2023 by Google on their AI language model, PaLM2 will be integrated with over 25 products, including Google Maps and Gmail, articulating a vision of the eventual ubiquitous nature of LLM-based tools that will "become an unremarkable part of day-to-day life". The company also announced that its own LLM – Bard will soon allow people to use image-based prompts and text (Heikkila 2023), highlighting the rapid advances in GAI technology.

The widespread adoption of GAI has spawned a plethora of potential use cases that are predicted to radically disrupt a wide range of tasks that are currently undertaken by humans, including software coding, image creation, music production, and content creation for multiple applications (Dwivedi et al. 2023a). However, the literature has significant debate on the disruption potential within the industry and the wider societal implications of the widespread adoption of GAI tools and applications. Studies have identified how creative industries such as art, music and film, and healthcare in terms of medical diagnosis, finance, manufacturing design, gaming development, and supply chain management all are likely to be disrupted by GAI technology (Jo 2023). Although only limited studies have empirically analysed the impact of GAI within organisations, researchers have identified that GAI assistance within organisations has led to a reduction in managerial intervention, increased customer satisfaction and demonstrable improvements in problem-solving and productivity (Brynjolfsson et al., 2023). However, increases in productivity are likely to come at a cost, as many commentators and researchers have highlighted the increasing concerns about significant job losses and AI encroachment on what has been traditionally seen as human cognitive and creative tasks and skills (Pavlik, 2023).

Although the research within the academic discourse on the impact of GAI is still at the embryonic stage, studies have started to explore the implications for organisations and institutions from this transformative technology. A number of researchers, whilst outlining the implications from increased adoption, have also highlighted the current limitations of GAI, in particular – overreliance on a single "source of truth", incomplete, inaccurate, or inconsistent results, lack of transparency and explainability and inherent bias within the data and algorithms used (Dwivedi et al. 2023a). However, the existing literature has yet to fully explore the full range of perspectives on how this new and rapidly changing technology can fully impact industry and the implications for wider society (Beerbaum, 2023; George & George, 2023). GAI's versatility and value across various applications are demonstrated in its capacity to process and analyze large datasets for predictive insights. This similar base highlights the important commonality across domains of GAI as a flexible instrument. Meanwhile, the paper acknowledges the importance of delving into each industry's unique characteristics, with a clear demonstration of stakeholder perspectives and goals, and their interaction with GAI. For example, GAI in marketing aims to understand, predict, and create demands but its application in service operations strives to improve efficiency in service

processes. Based on Foerster's (2003), initial suggestion and various subsequent studies that have adopted an expert-based approach on several topics related to technology innovation, and as set out in Dwivedi et al. (2023a; 2022), this study aims to investigate the significant viewpoints on the challenges and implications of the widespread implementation of GAI technologies within tourism and hospitality, marketing, retailing, service operations, manufacturing and healthcare (table 1). We followed a multi-perspective approach and format, as recommended by Koohang et al., (2023) and Tan (2023) which includes the overview, opportunities, challenges and future research suggestions for each sub-sections of GAI.

The remainder of this article is structured as follows. In the next section, we set out the individual expert contributions specific to the various disciplines that are impacted by GAI, we then synthesize a number of the key aspects of the contributions within the Discussion section. We develop a recommended research agenda in the penultimate section and conclude the study in the final section.

Table 1: Authors' Contributions

Contributions	Contributors
Formal analysis, supervision, project administration, review, re-write, and editing	Keng-Boon Ooi & Alex Koohang
Introduction	Laurie Hughes, Anubhav Mishra & Yogesh K Dwivedi
GAI in Hospitality and Tourism	Marianna Sigala & Tat-Huei Cham
GAI in Marketing	Ian Phau & Eugene Cheng-Xi Aw
GAI in Retailing	Garry Wei-Han Tan & Charles Dennis
GAI in Service Operations	Cihan Cobanoglu & Heather Linton Kelly
GAI in Manufacturing	Lai-Wan Wong & Ramakrishnan Raman
GAI in Healthcare	Jun-Jie Hew & Chieh-Yu Lin & Yun-Chia Tang

2.0 GAI in Tourism and Hospitality

2.1 Overview

In the current era of Industrial 4.0, technology has been viewed as a game-changer for many businesses, given its potential to transform how they perform their trade activities. In particular, the advancements in technology have revolutionized the way businesses operate, interact, and communicate with their prospects and stakeholders. Similar to other industries, the impact of this transformation resulting from the effect of technology is also evident in the hospitality and tourism industry (Law *et al*., 2022; Sharma *et al*., 2021). Technology has a profound impact on the tourism and hospitality industry, boosting corporate operating efficiency and revolutionizing how travelers plan and experience their trips. It has been reported that technology plays an important role in tourism and hospitality businesses (e.g., hotels, online booking platforms, restaurants, entertainment venues, tour operators, etc.) by assisting them in responding effectively to market needs and requirements, improving service delivery, enhancing online booking and reservations, promoting smart tourism, creating sustainable tourism, and enhancing customers' experience, to name a few.

Among all technologies available across the tourism and hospitality industry, the recent buzz of generative artificial intelligence (GAI) has been regarded as a core element that drives the success of the tourism and hospitality industry (Dwivedi *et al*., 2023a; Gursoy *et al*., 2023). Common applications of GAI within the tourism and hospitality industry include ChatGPT, Alphabet (Google), Jasper, Cohere, and many more. From the tourists'

perspective, GAI tools could help them in various ways, starting from the booking process, making their trips more personalized, enjoyable, and convenient, ultimately enhancing their overall travel experience. In particular, GAI can be incredibly helpful for tourists in choosing attractions to visit, providing them with virtual tours and previews of destinations, personalized trip planning, real-time assistance and information during travel, language translation, and much more. From a business standpoint, GAI, among the available technologies, has contributed to various aspects of business processes, including customer engagement and communication, improved productivity and efficiency, enabling global reach, fostering new business models and innovation, data analytics, cost reduction, supply chain optimization, and improved customer service, among others.

2.2 Opportunities

Grounded on the convergence of computerization and artificial intelligence, GAI has been regarded as one of the examples of effective smart technologies that significantly contribute to the tourism and hospitality stakeholders. For example, GAI helps virtual tourism providers effectively promote virtual travel experiences, allowing virtual tourists to explore information about destinations through prompts on the system. From a marketing standpoint, as an advanced artificial intelligence technology, GAI is argued to have the capability to boost marketing strategies of tourism and hospitality businesses and destination marketing organizations (DMOs), thereby significantly enhancing customers' overall service experience and engagement (Gursoy *et al.*, 2023; Paul *et al.*, 2023). In particular, GAI is often used in tourism and hospitality businesses in the form of Chatbots, which are used to interact with customers in real time. Besides serving as an essential communication tool, GAI is used for content creation for hotels' and restaurants' marketing materials. It is also utilized to analyze data and generate market insights, offer personalized products/services based on customers' needs, create advertising campaigns, and develop personalized marketing programs. Moreover, the hyper-intelligence capability of GAI allows tourism and hospitality businesses to detect real-time changes in customers' experience quality and needs, as well as service failures. This enables them to make swift adjustments and ensure optimized performance. This advantage helps businesses increase the efficiency of service experience design and delivery while offering clients excellent experiences. In summary, GAI is claimed to be an effective tool for tourism and hospitality businesses to reach out to potential customers while maintaining the loyalty of the existing ones.

2.3 Challenges

Although GAI has been considered the "new game changer" in the hospitality and tourism industries, its acceptance is still in its early stage. Hence, there is no doubt that this technology does possess weaknesses in its operation. Firstly, the ethical aspect is one of the main concerns for GAI, as the operating nature of this software involves collecting and processing users' information. Retrieving personal information without users' knowledge, especially from travellers' passports or biometric identification, could lead to privacy infringement, scams, and identity hijacking, among other issues. Apart from that, the generation of unintended or false outputs from GAI is another major drawback of this innovation. It is often reported that the content generated by AI may contain inappropriate material or diverge from the intended theme (Paul et al., 2023). This is a common issue surrounding GAI until today, as there is no fact-checker or proof checker within the system and its algorithm. Another significant drawback of GAI is the cost of implementation. It is reported that implementing GAI requires considerable investment, especially in terms of staffing and high-performance computer resources (George et al., 2023). Hence, this situation

may present significant challenges for small and medium-sized tourism and hospitality businesses.

2.4 Research Agenda

Being regarded as a disruptive technology, GAI is indeed considered a powerful tool for the tourism and hospitality industry. Although GAI has an enormous impact on the hospitality and tourism context, the existing literature addressing GAI and its impact is still relatively limited to date. This scenario represents a significant research deficiency that needs to be addressed in comprehending the effect of GAI on the hospitality and tourism industry. Hence, the proposed research agenda for exploring these areas further are as follows:

- How may the usage of GAI influence consumers' (i.e., tourists) decision-making process and willingness to travel to a destination before their trip?
- What data security concerns could influence GAI adoption among consumers (i.e., tourists)?
- What are the ethical concerns that could influence GAI adoption among consumers (i.e., tourists)?
- How metaverse marketing and advertising can influence the customers' (i.e., tourists') decision-making process and outcomes?
- How can GAI enhance customers' (i.e., tourists) experience at a destination?
- What are the grey areas associated with GAI adoption for the users (i.e., businesses or tourists)?
- How can the GAI help the restaurants, hotel, and tourism industries compete more effectively?
- What are the challenges for hospitality and tourism firms in adopting and embedding GAI into their business operations?
- How can the GAI add value to hospitality and tourism businesses and destinations?
- What are the grey areas associated with GAI adoption for the users (i.e., business or tourist)?

3.0 GAI in Marketing

3.1 Overview

According to Ma and Sun (2020), Artificial Intelligence (AI) has been and will persistently play a prominent role in revolutionizing the marketing landscape. The emergence of GAI, which is capable of generating new content, such as chat responses, synthetic data, or deepfakes, is expected to take the AI marketing environment to an unprecedented level. The disruption of GAI cuts across contemporary marketing practices, including digital search and advertising, social media engagement, online commerce transactions, and in-store shopping experiences. Major technology conglomerates have started to harness the power of GAI in their marketing offering, such as advertising. For example, Google is initiating a more extensive deployment of GAI features in its advertising business compared to its primary competitor, Meta, which disclosed earlier this month that it was initially extending invitations to a select group of advertisers to experiment with its proprietary GAI capabilities.

3.2 Opportunities

The advent of GAI plays a pivotal role in revolutionizing the domain for advertisers, content creators, and influencers, offering an array of novel opportunities. We contend that in marketing, the advertising field has rapidly gained prominence, as GAI can assist advertisers in producing highly advanced content, including text and images, in response to human inputs. Google has already incorporated artificial intelligence into its advertising sector,

generating straightforward and persuasive prompts influencing consumers' purchase decisions. From a business-to-business marketing perspective, Google has also employed its next-generation technology to provide a chatbot for advertising clients, which assists them in obtaining recommendations for valuable search keywords, with the ultimate aim of offering personalized support to a vast number of advertisers.

Another GAI prospect is manifested whereby influencers utilize GAI tools to engage with and respond to their audience in a more targeted manner. An instance of this is ChatGPT, which enables influencers to quickly generate complete blog articles or sponsored posts while also providing advice on creating high-quality content. In addition, ChatGPT empowers marketers to generate content that achieves high search engine rankings and attracts organic traffic by providing recommendations on keyword implementation, meta tags, and content structure. Interestingly, GAI has paved the way for the emergence of virtual influencers (i.e., computer-generated virtual personas imbued with humanistic personalities, values, and traits to render them convincingly life-like), which constitutes a compelling and innovative progression within the domain. (Tan et al., 2023). AI-generated virtual influencers provide brand marketers with complete control over their communication, visual representation, and brand image, paving the way for the future of influencer marketing.

3.3 Challenges

Marketers often prioritize a human-centered human-centred approach that focuses on establishing relationships, fostering emotional bonds, and capitalizing on human intuition. However, the approach could potentially be jeopardized due to the growing dependence on GAI. GAI models are capable of producing coherent responses, but they may fall short of comprehending and effectively responding to emotions due to the lack of emotional intelligence and contextual understanding that human marketers possess. In emotionally charged conditions, the restrictions of AI-generated content are magnified due to the fact that the content generation adheres to predetermined rules and patterns, which may impede their ability to manage distinctive or sensitive customer inquiries effectively. The absence of human warmth and empathy can result in negative customer responses, thereby eroding trust and causing harm to the customer-brand relationship.

Besides, human marketers typically rely on their intuition and creative thinking skills to develop unique marketing strategies. While GAI assists marketers in terms of enhancing efficiency and scalability, it has the potential to stifle marketers' creativity. This is because GAI operates based on pre-set algorithms and rules, limiting the range of creative possibilities available to marketers. In the long run, using human GAI in marketing can create a landscape that becomes more formulaic and less inventive. This highlights the challenges of preserving and enhancing human marketers' creativity autonomy in the AI marketing process, as they are essential for setting a brand apart from its competitors while leveraging GAI to free up marketers' time to focus on more creative activities.

3.4 Research Agenda

The rapid progress of GAI has sparked a burgeoning interest in investigating its potential implications for consumer behaviour. It is undeniable that in the near future, an increasing volume of advertisements and marketing content generated by GAI will be exposed to consumers, with or without their conscious awareness. Therefore, it is pivotal to comprehend consumer perception and acceptance of AI-generated content by considering the dilemma resulting from personalization, transparency, and user control. In particular, it is interesting to see how marketers can preserve brand authenticity by creating AI content that aligns with brand meaning, image, and personality and resonates with target audiences. The next step is

investigating effective human-AI collaboration to find a sweet spot that balances the strengths of GAI with human creativity to formulate AI marketing strategies.

While GAI possesses the capacity to augment customer experiences by offering tailored purchase information and suggestions. Nonetheless, further research is essential to investigate whether AI-generated content improves consumer decision-making procedures or limits options by perpetuating pre-existing preferences or engendering filter bubbles. Moving forward, research endeavours must be directed to explore how consumers engage with AI-generated content (e.g., product recommendations by virtual influencers) and evaluate the degree to which it facilitates well-informed decision-making, suggesting more work to be done in consumer studies.

4.0 GAI in Retailing

4.1 Overview

According to McKinsey (2023), GAI could contribute to about USD$ 400–600 billion yearly in retail. As such, many retailers (e.g., Amazon, Walmart, Macy's Sephora, Burberry, Uniqlo, etc.) have started leveraging GAI within their daily operations. It is important to differentiate marketing and retailing on this note. The fundamental goals of marketing are to generate demand, understand consumer behavior, and create strategies for brand awareness and product placement. On the other hand, retailing is geared towards optimizing the sale of goods or services and enhancing the shopping experience at the point of sale (Dupuis and Tissier-Desbordes, 1996).

4.2 Opportunities

GAI serves as a new way to improve customer service. Improving customer service has been a priority for many retailers and is important in a customer's shopping journey. GAI chatbots, for example, can provide individualized support, such as answering queries, explaining products, and troubleshooting issues instantly in multiple languages. Macy's, for example, has implemented an AI shopping experience to enhance customer satisfaction by automatically answering inquiries about product availability and location (Forbes, 2023). This can reduce the workload customer service representatives spend on drafting answers and focusing on more complicated customer issues. Additionally, GAI can also help improve revenue for retailers. For example, GAI has allowed customers to search for a product using everyday language, known as the conversational search experience. Customers, for example, can be guided to express their intentions by prompting relevant questions and making suggestions rather than just relying on the search bars to find the products they are looking for. Given that the experience is closer, like a person-to-person conversation, this would accelerate the search process and provide more opportunities for cross-selling and up-selling. Additionally, GAI can help provide more intelligent shopping suggestions, such as personalized recommendations based on search history across online stores. GAI can also be applied to analyze different datasets such as customer feedback, sales data, market trends, and more, enabling retailers to predict consumer behaviour better and design targeted marketing campaigns effectively. This helps retailers reach the right consumers with the right message instead of generic marketing communications, thus improving return on investment.

4.3 Challenges

There are challenges when adopting new emerging technologies. Security and privacy remain one of the main drawbacks. GAI may collect and store sensitive data such as account information of customers during sign-up, information that a customer types into the chatbot, etc. (Koohang et al., 2023). Most GAI software also uses cookies to track the customer's browsing activity for analytics. The information is potentially at risk of theft or misuse if not

adequately protected. Hackers, for example, could exploit the data to gain more knowledge about consumer behaviour for targeted advertising, thereby compromising the privacy of many customers. GAI could also infringe on copyright and lead to legal challenges. While GAI, for example, can produce product page descriptions, images, and videos for a particular brand or retailer, the copyright surrounding the contents remains unclear (Dwivedi et al., 2023a). Can the output generated by AI be copyrighted? If someone possesses the copyright to the input used in training an AI, does this grant legal rights over the contents it generates? As GAI analyzes data from different web pages, there is a tendency for the retailer's chatbot or visuals to create sexist, racist, or politically biased responses, which may lead to damage to the retailer's brand. Bloomberg (2023), for example, found that AI-generated images from Stable Diffusion produce stereotypical images. Retailers must be careful, as it may lead to reputation damage. Finally, GAI, for example, can produce highly plausible yet inaccurate responses known as coherent nonsense, where the chatbots provide false statements. GAI can misinterpret information if the system learns incorrect data. This may lead to fabricated responses, giving misinformation. Consequently, this may confuse customers and lead to a loss of trust, thus diminishing its usefulness.

4.4 Research Agenda
While GAI can bring advantages to customers, many areas would require further investigation. As AI generates output information, it is essential to understand the behaviour of consumers (Tan et al., 2023). What factors drive consumers' acceptance and resistance towards GAI contexts during retail activities? How will the application of GAI transform consumers' retail experiences and brand perceptions? In what ways will GAI influence post-purchase outcomes such as product reviews and ratings? While GAI can also help optimize the supply chain by analyzing sales data and making recommendations for inventory, the question remains to what degree a retailer should integrate AI into their operation. They should also concentrate future research on data privacy and security. Retailers must explore ways to protect the data effectively to safeguard customers' information. Studies should also focus on how retailers can improve trust and customer relationships using GAI chatbots. Specifically, more studies should be concentrated on whether chatbots can replace humans in customer service, in the near future.

5.0 GAI in Service Operations
5.1 Overview
Few disruptive technologies have had the potential to significantly and immediately impact the hospitality industry, particularly service operations, as generative artificial intelligence (GenAI). Text-authoring tools like ChatGPT and visual image generators like DALL-E2 can be used to augment and enhance work and allow service providers to do their jobs better but need to be properly managed and understood. Service operations can benefit from GenAI with some additional understanding of its capabilities and limitations. Although this tool is relatively new, it is essential for service organizations to begin assessing how it can be implemented in a way that supports but does not entirely replace human interaction.

5.2 Opportunities
GenAI can aggregate and analyze data quickly and accurately, reducing human effort and potential errors. Service operations can be complicated, with data being stored in multiple sources, customer journeys incorporating multiple workflows, teams, and systems, and rules and regulations differing by customer location, need, or status. GenAI can quickly give insight into operational KPIs, help employees or teams structure their workday as efficiently as possible, create concise summaries of long documents, and more (Healy, 2023).

One way to dissect GenAI's potential impact on service operations is to consider the administrative, functional, and strategic implications. On an administrative level, repetitive tasks like scheduling appointments and managing calendars can be automated, standard business documents can be generated, and data entry and record keeping can be streamlined. From a functional standpoint, GenAI can automate some customer service interactions, help manage employees, and handle other mid-level tasks. On a strategic level, GenAI can help managers synthesize data to obtain logic-based recommendations and manage knowledge (Korzynski et al., 2023).

Regarding service providers interacting with guests, Daugherty et al. (2023) posited that customer service work can be broken down into 13 existing task categories, and then considered how GenAI might affect each of those tasks. Four human tasks remain unchanged by GenAI (human tasks, e.g., arranging customer-facing environments), four could be fully automated (automated tasks, e.g., collecting payments), five could augment the work so humans could work more effectively (augmented, e.g., responding to customer inquiries), and five new, high-valued tasks were identified (emergent) (Daugherty et al., 2023). This approach to segmenting tasks and analysing GenAI's impact on each category is a logical way to maximize the benefits that the tools can provide.

5.3 Challenges

While GenAI can remove some of the task burdens from humans, it can also introduce new challenges. The emergent tasks identified by Daugherty et al. (2023) involve the management of the tool itself: Pursuing continual improvement, making sure the system aligns with the customer, testing and evaluating avatars for customer interactions, monitoring data privacy and minimizing data bias, and assuring ethical machine behavior.3 These emergent tools management actions will require different skills than the original customer service tasks that GenAI is replacing. This means companies will need to revise their policies and procedures, and employees will need different training to meet the new job requirements.

Another possible downfall of GenAI is the lack of checks and accountability. The tools are free and easily accessible to most people with an internet connection, and very few regulations and best practices currently exist to control how they are used. GenAI has "absolutely no commitment to the truth," which has many potentially harmful ramifications (Bell, 2023). Fake online reviews, blatantly false AI-generated images, inappropriate or incorrect text responses, and copyright infringement are only a few things that come to mind when considering how this technology could affect service operations. A well-meaning employee could create a fake image or ask ChatGPT to write a description of a new product, and without a thorough review, this incorrect information could become public.

In particular, caution must be taken in service operations when implementing GenAI. While guests are often willing to use technology for transactions, such as paying a bill or making a reservation, they want a human to be available for additional support when needed. Users also expect a functioning system that can serve their needs quickly; much like the frustration that can be caused by voice menus on customer service lines, online chatbots can increase dissatisfaction from customers who need attention and resolution before their concerns escalate.

5.4 Research Agenda

Some questions and additional avenues for research on GenAI in service operations are as follows:

- What are users looking for in their interactions with service operations AI?
- How much human interaction do users want in different service operations scenarios?
- How can service employees contribute to the continuing improvement of GenAI?

- What knowledge do service employees have that would benefit AI algorithms and methodology?
- What potential biases can emerge in the use of GenAI, and how can these be identified and mitigated?
- What ethical and compliance issues might emerge in the use of GenAI in the service industry?

6.0 GAI in Manufacturing

6.1 Overview

In manufacturing, poor quality of manufactured product increases the cost associated with handling defects during warranty period and affects the reputation of the firm. According to Ko *et al.* (2017), statistical process controls that were conventionally used to oversee and monitor production processes are limited. Traditional univariate methods cannot detect defects resulting from interaction between multiple variables which result in abnormalities incorrectly classified as normal. Manufacturers often rely on current practices and domain expertise to select items for inspection, but they cannot be certain the selection is sufficient for ensuring quality. Selecting more items incur additional cost and resources leading to reduced production efficiency and longer production time. Additionally, manufacturers have limited information on product quality as the data are typically gathered separately. This lack of data integration hinders the setting up of quality assurance policies that addresses customer -perceived quality (Vo and Nguyen, 2015), which is important for making data-based decisions and uncovering new knowledge (Hull, Su and Vaculin, 2013). Industrial datasets are complex, include multi-subject domain and broad coverage of research-design-operation-management and it is difficult to understand and gain insights (Wang, Liu and Shen, 2023). Thus, during the production process, the accuracy, completeness, and consistency of data coupled with the ability to provide timely and relevant data that fits the intended purpose is the crux of manufacturing process.

6.2 Opportunities

To address these issues and build lasting values, firms need to consider innovative practices to achieve a strong positioning in the current digital transformation era. Del Giudice *et al.*, (2021) highlighted the need for firms to adapt to market changes, adopt an experimental approach to learn and maintain a balance between knowledge and technological exploration and exploitation. According to Wang, Liu and Shen (2023), the main role of industrial GAI prompt is to guide, control and constrain output to assist the application of model to specific scenario-based task. GAI can address manufacturing issues by improving data integration, enhancing predictive maintenance, and optimizing manufacturing processes. GAI can aid manufacturing firms in predicting maintenance needs, reduce downtime and costs and optimise production processes for improved efficiency. For example, Strabag SE (2023) partnered with Microsoft to build a Data Science Hub for collect data from decentralized sources and develop use cases to prove the value of data. Used alongside high-performance computing, GAI provides manufacturers with an innovative way to effectively explore design options and find the most efficient solution (Wlodarczak, 2023). Companies like Monolith AI showcased its simulation for developing a model that allow creators rely on real-time data, and machine manufacturer. Technology leaders, Siemen and Microsoft demonstrated how cross-functional collaboration can be enhanced through AI-powered software development, and OpenAI's ChatGPT and Azure AI services can reduce the probability of errors in Programmable Logic Controllers code generation through natural language inputs (Microsoft, 2023).

6.3 Challenges

Overall, there are many concerns surrounding the ethical use of GAI in terms of urgency in standardization, governance, and policy (Fosso Wamba *et al.*, 2023). In manufacturing facilities, tools, equipment, and production systems may possibly run on legacy systems that are not compatible or interoperable with other systems. Without specific guidelines and clear frameworks, it is daunting to integrate newer production systems to employ the capability of GAI. Furthermore, industrial prompts to direct the GAI requires a diverse combination of domain expertise, evolving processes and emerging technologies, and complex heterogeneous data from the manufacturing processes (Wang, Liu and Shen, 2023). Specialised prompt engineers are required to build accurate and timely prompts to influence and improve expected performance outcomes. Further, manufacturing environments typically involve multiple data sources, and integrating these data can be challenging due to the complexity and variability of processes. Further, training GAI models can be computationally intensive and require significant resources to develop and fine-tune. Due to the sensitive nature of the information involved, data security and privacy are important and would require complex encryption and identification methods to be implemented. Combined, protecting them from unauthorised access and ensuring compliance with data privacy regulations would require strict information protection systems be established. Inconsistent and lack of robust mechanisms can all affect the manufacturing processes.

6.4 Research Agenda

Future research should focus on the issues raised in earlier section. Additionally, we call for studies investigating the suitability and scalability of GAI across various manufacturing sectors and their impact on performance outcomes. As with factors enabling or hindering the adoption of GAI. Additionally, studies that inform firms on ethical considerations surrounding the use of GAI such as data privacy and security, intellectual property and authorship, accountability, and fairness of the model are needed. The sustainability and environmental impact of GAI is a significant concern for the manufacturing industry, Finally, research on incorporating GAI in workplace, training and reskilling employees for acceptance are useful for workforce acceptance.

7.0 GAI in Healthcare

7.1 Overview

The use of AI in the healthcare industry has a prolonged history as AI could deliver numerous benefits to the healthcare industry, for example, accelerating drug discoveries, facilitating early detection of rare diseases, improving medical image diagnosis, and so on (Mannuru *et al.*, 2023). However, GAI is different from the general AI in a sense that it could create new content in the forms of text or images based on the training data; hence GAI should revolutionize the healthcare industry in a different manner (Varghese and Chapiro, 2023). In general, it is believed that GAI could benefit both patients and healthcare practitioners (Kuzlu *et al.*, 2023), delivering several opportunities yet imposing some challenges on the healthcare industry (Kuzlu *et al.*, 2023).

7.2 Opportunities

From the perspectives of patients, the use of LLM chatbots (e.g., ChatGPT) allows patients to receive relevant medical advice by inputting their queries into the chatbots, enabling patients to self-diagnose before they seek further legit medical advice from healthcare practitioners (Tan *et al.*, 2023). Moreover, patients who reside in remote areas could first consult with LLM chatbots anywhere and anytime for medical advice and information before making lengthy traveling to meet up physically with legitimate healthcare practitioners (Javaid *et al.*,

2023). Given its ability to assist patients with a preliminary self-diagnosis, GAI could also reduce the burden on healthcare practitioners, especially during a pandemic where healthcare is prioritized for patients who are severely infected with infectious diseases (Mesko, 2023). Besides, GAI could serve as an intimate friend to the emotionally unstable and acutely ill patients, letting them share their emotions and feelings, which might be discommoding for them to share with the already stressed family members (Kanbach *et al.*, 2023). On top of these, LLM chatbots could also play an essential role in assisting patients while they are at the healthcare facilities by responding to their queries, such as insurance coverage, billing details, making the next appointment, etc., in a timely manner (Javaid *et al.*, 2023).

On the other hand, healthcare practitioners such as physicians could utilize GAI to facilitate them in performing their jobs faster (Microsoft News Center, 2023). Specifically, physicians could rely on GAI as a digital intermediary between themselves and the cumbersome medical systems, allowing physicians to extract medical records easily, interpret highly jargoned reports faster, etc. (Varghese and Chapiro, 2023). In addition, LLM chatbots could be used as a decision-support tool that helps healthcare practitioners to make informed healthcare decisions and give more care choices to patients (Javaid *et al.*, 2023). This is especially true as LLM chatbots are generally good at extracting valuable insights from a vast number of unstructured data (e.g., clinical notes and scientific literature of medicine); hence assisting medical practitioners in the analysis of a large amount of information at a relatively short time (Mesko, 2023).

7.3 Challenges

Notwithstanding the opportunities offered by GAI to the healthcare industry, its use should be proceeded with caution by healthcare practitioners (Javaid *et al.*, 2023) as failure to do so would result in disastrous outcomes. This is especially the case in view that LLM chatbots tend to provide fabricated superficial answers that seem to be convincing whenever they encounter some questions that they do not know or could not answer (this situation is known as artificial hallucination) and GAI could be easily fooled to provide inaccurate information (Alberts *et al.*, 2023; Varghese and Chapiro, 2023). Besides, for patients to use GAI such as LLM chatbots, sometimes it is necessary to input personal information and data such as recent health status, medical reports, previous health records, etc.; hence it would be a challenge for healthcare practitioners to protect the personal data collected (Kanbach *et al.*, 2023). Moreover, for GAI to deliver accurate answers, a large amount of training data is needed for the AI models to learn and, therefore, it would be both costly and challenging for healthcare practitioners to acquire the training data required (Kuzlu *et al.*, 2023).

7.4 Research Agenda

Given the abovementioned opportunities and challenges, the following future research avenues are proposed:

- What drives or inhibits the use of GAI among both patients and healthcare practitioners such as physicians and doctors?
- What encourages or discourages healthcare facilities from embracing GAI in their daily operations?
- What are the light or dark sides of adopting GAI in the healthcare industry?
- How do the data privacy concerns of patients affect their use of GAI?
- What are the outcomes of using LLM chatbots among acutely ill patients, especially on their emotions?
- How healthcare practitioners such as doctors would react if GAI were to be implemented by force in their healthcare facilities?

- What are the views of healthcare practitioners on the current development of GAI in the healthcare industry?

8.0 Concluding Remarks

By examining the potential of GAI in a variety of industries, including hospitality and tourism, marketing, retailing, service operations, manufacturing, and healthcare, this paper adds to the multidisciplinary debate on GAI. While previous research in the fields of general technology management and information systems provides an understanding of GAI's potential, our analysis shows that specific, context-driven approaches are necessary due to each industry's distinct nature and issues encountered. For example, in service operations, the application of GAI prioritizes operational efficiency and cost savings, which is different from consumer-focused GAI applications in marketing that emphasize customer engagement. By highlighting industry-specific GAI application considerations and research agenda, our work lays the groundwork for a nuanced understanding of GAI's role across multiple disciplines, particularly in driving further exploration into how GAI can be optimally leveraged to meet the evolving needs of these different fields.

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