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ORIGINAL RESEARCH

Unravelling the Impact of Generative Artificial Intelligence (GAI) in Industrial Applications: A Review of Scientific and Grey Literature

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Abstract *The scope of application of generative artificial intelligence (GAI) in industrial functions is gaining high prominence in academic and industrial discourses. In this article, we explore the usage of GAI and large language models (LLMs) in industrial applications. It promises myriad advantages such as greater engagement, cooperation and accessibility. LLMs like ChatGPT are able to evaluate unstructured queries, assess alternatives and offer actionable advice to users. It is being used to produce fast reports, flexible responses, environment scanning capabilities and insights that can enhance organisation flexibility in making better and quicker decisions, improving customer experiences and thereby augmenting firm profitability. This article offers a comprehensive review of scientific and grey literature in GAI and language models. The synthesis of complementary sources of information brings exciting perspectives in this fast evolving field. We provide directions surrounding future use of GAI as well as research directions for management researchers.*

Keywords Artificial intelligence · ChatGPT · Generative artificial intelligence · Industrial innovations · Large language models · Literature review · Technology enabled flexibility

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Introduction

Digital transformation has provided researchers with new opportunities to collect a vast quantity of textual data for studying contemporary phenomena to deliver business transformation (Kang et al., 2020), and AI is considered to be one of the emerging technologies for nations' industrial and economic development (Kar et al., 2022). Ever since AI was in its infancy phase, the focus of algorithms was primarily on supervised and unsupervised learning, by which it drew ideas from biological organisms and the physical characteristics of nature to solve data-intensive problems by embracing new changes in technologies. Hence, digital business transformation stimulates new ways to work and interact with consumers, thereby directly influencing the development of novel business models by leveraging the AI (Akter et al., 2022).

In the past decade, AI technologies have developed at an accelerated pace (Luitse & Denkena, 2021). Firms embrace and support AI's ability to simulate human-like interaction to meet consumer demands in real-time (Yen & Chiang, 2021) and are operationally viable (Prentice & Nguyen, 2020). Additionally, the impact of AI in organisations, societies and individuals has been substantial (Dwivedi et al., 2023a). It provides systematic capacities of logic-based inputs and learning through various contexts and predicts results as it anticipates and progresses to change in its ecosystems and external stimuli (Dwivedi et al., 2023a). Moreover, industrial demands for text mining and natural

language processing (NLP) have grown with the expansion and development of algorithms that can operate on unstructured data.

For industrial automation, algorithms like Bidirectional Encoder Representations from Transformers (BERT), Long Short-Term Memory (LSTM), Chat Generative Pre-trained Transformer (ChatGPT) and large language models (LLMs) have gained prominence (Guan et al., 2019; Kushwaha & Kar, 2021). Over time, new AI language models like federated learning and small machine learning (ML) algorithms have been developed and implemented in industrial settings (Li et al., 2020a, 2020b). Consequently, a number of applications generated instances in which initial training data for these algorithms was unavailable, and that circumstance is known as the cold launch problem. How would these applications understand patterns and predict future trends in the absence of data? This initiated growth in reinforcement learning and the rise of industrial applications in marketing and financial management (Singh et al., 2022a, 2022b).

In recent years, generative AI (GAI) models like GPT-3 have made significant progress in NLP (Floridi & Chiriatti, 2020). These models are trained on vast quantities of text data and can generate human-like text, answer queries and perform other language-related actions with high accuracy (Kasneci et al., 2023). The addition of transformer architectures (Devlin et al., 2018) and the key focus system has made it much easier for autoregressive self-supervised language models to deal with long-range dependencies in natural language texts (Vaswani et al., 2017). The transformer architecture uses self-attention models to determine the significance of various input components while generating predictions from language models (Vaswani et al., 2017). This enables the model to comprehend the connections between words in a sentence irrespective of their position (Kasneci et al., 2023). Further the latest bloom in BERT AI LLMs is a pre-trained encoder model that can be fine-tuned to perform different NLP tasks such as sentence classification, question answering and name-related recognition or knowledge transfer learning (Brown et al., 2020). In addition, rapid developments in GPT-3 and ChatGPT which have been trained on much larger datasets, i.e. texts from an enormous web corpus and have proved state-of-the-art performance on an extensive variety of natural language tasks including translation, question answering, creating logical essays and computer programming (OpenAI, 2022). The GPT-4 extends GAI and is able to transcribe the text-to-image processing by leveraging Midjourney characteristics in industrial automation (Hao Karen, 2023). Hence, ChatGPT, built on the GPT-4 framework, became the internet's trendiest topic at the end of 2022 and entrenched itself as a '*cultural phenomenon*' (Thorp, 2023).

Particularly, GAI has been superseded by AI-powered language tools able to assist several business to increase productivity across various management sectors and functions (Teubner et al., 2023). Further, GAI is also gaining popularity since it allows for the flexible management of information sources in firms. Information management brings strategic flexibility could strengthen supply chain performance in product delivery (Birasnav et al., 2015; Yoshikuni et al., 2023), system flexibility to introduce customisation (Palanisamy & Foshay, 2013) and agile in business for innovation and new product development (Grover & Kar, 2017). Hence, GAI has a potential to influence big data analytics information that can be utilised by businesses, organisations and governments to plan ahead and make better data-driven decisions aligned with flexibility and agility in Industry 5.0 era (Bharathi, 2017; Sushil, 2017). Likewise, these unconventional GAI models are built on cutting-edge neural network architectures able to develop large language models (LLMs) (Forbes, 2023; Heising & Angelopoulos, 2022; Kushwaha & Kar, 2021). Then, the modern GAI models, ChatGPT (OpenAI, 2023a), DALLE-2 (Ramesh et al., 2022), Midjourney (MD, 2023) and Stable Diffusion (Stable Diffusion, 2023), have a capability and enable users to train the data to produce several forms of content which benefits the various industries like healthcare, customer relationship management, marketing, education, media, bio pharmacy, retail, etc. (Wessel et al., 2023). Thus, GAI is a disruptive technology with the capacity to offer creative services and succeed new business models that integrate all platform participants (Wessel et al., 2023). Then, it has the ability to unravel entire platform sectors, placing them on a downward trend while creating ground-breaking opportunities for digital platform ecosystems such as complementors, users and platform providers (Wessel et al., 2023).

GAI has made major strides in the recent extensive global adoption of ChatGPT and has proved the technology's enormous range of applications which include software development and testing, poetry, essays, business letters and contracts (Metz, 2022; Reed, 2022; Tung, 2023). However, it has also created the risks about the difficulties of distinguishing between human and AI authors within academic and educational communities as well as revived debate about the importance of traditional human pursuits (Else, 2023; Stokel-Walker, 2023). These intricacies occur because ChatGPT can be widely employed for task-based NLP such as text generation, language translation and providing answers to a wide range of questions resulting in both positive and negative consequences (Dwivedi et al., 2023a). In addition, the negative repercussion reflects the GAI challenges, risks and ethical concerns which influence the adverse impact on business.

While keeping this context in mind, we attempt to answer the following research questions to provide valuable insight on GAI:

1. How has the AI ecosystem evolved over time towards GAI?
2. What are the significant opportunities, issues and challenges for GAI and AI language models in their implementation in enterprises?
3. How does GAI enable greater flexibility within organisations?

The literature review section has been categorised into two phases, namely scientific and grey literature review, to draw complementary insights on GAI language models. We have stressed the several domains and functions infused with GAI language model beneficial to the firms. First, we conduct a literature analysis using PRISMA to identify the many drivers and future problems of AI language models from Scopus and Web of Science (WoS). Second, we incorporate a grey literature review derived from Emerald Insights, PROQUEST and ACM Library to find a valuable outcome for emerging technological disruptive programs such as ChatGPT, BERT, NLP and many more. In the remaining chapters, we discuss the evolution of AI to GAI, followed by the methodology used in the review. Then, we converse about the findings based on both scientific and trade literature. The review then concludes with discussions according to the findings and synthesis.

Evolution of AI to GAI

In recent years, AI has progressed into a robust instrument that allows machines to reason and act like humans (Kar et al., 2022). AI possesses intelligence, learning and reasoning capabilities in order to fulfil its purpose, and Fig. 1 depicts the evolution of AI to GAI for better comprehension. Intelligence in AI has a strong ability to reason, solve problems, learn, and incorporate diverse human functions such as thinking, interest, memory, language and planning (Kar et al., 2022). Reformulating Gödel's results, in 1950, Alan Turing, the British mathematician, introduced the Turing Machine (TMs) and stated that any problem could be solved as long as it could be represented and decoded by an algorithm and his attention moved towards research in AI when he proposed the 'imitation game' where he tested if a computer was a thinking machine or not (Batra et al., 2018). Then in 1956, John McCarthy encouraged academicians and industry experts from interdisciplinary disciplines around the world to discuss the significance of computers that consume data and imitate human behaviour (Garg et al., 2022; Herath & Mittal, 2022). From the early 1970s to the 1990s, Carnegie-Mellon University researchers Allen Newell and Herbert Simon proposed the first framework of production systems (Skinner, 2012), also known as a rule-based system or expert system (Grosan & Abraham, 2011), that became the most exciting applications in the AI domain (Tan et al., 2016). Evidently the usage of Bayes networks, hidden Markov models and applications with AI in the field of medical diagnosis (Ahmed et al., 2020), pattern recognition (Ghahramani, 2001) and faults detection (Smyth, 1994) was a dominant theme in the 1980s and 1990s. The early 2000s witnessed the fast global spread of activities in computer vision for transportation. Ironically the mechanical engineering automobile industry advanced both electrical and computer science engineering towards solvable automated computer vision, proving in principle that just like human vision, computer vision can define all problems (Dickmanns, 2004).

In the meantime, AI reasoning enables robots to reason critically and use induction, inference, abduction and monotonic methods to collect information, evidence and knowledge to produce reliable predictions and conclusions (Bittencourt et al., 2009). Hence, AI has been defined as a system's ability to correctly gain insight from external data and implement the acquired knowledge to accomplish specific goals and tasks, and it is categorised into supervised, semi-supervised and unsupervised algorithms (Haenlein & Kaplan, 2019; Kar, 2016). Besides, AI has also been defined as a machine that repeatedly iterates backwards to find steps that would accomplish a specific goal (Zweben & Sweeney, 2021). Generally, AI algorithms attempt to imitate how organisms in nature meet their basic needs such as finding food through scavenging, reproducing and surviving in a changing ecosystem (Chakraborty & Kar, 2017; Kar, 2016). Haenlein and Kaplan (2019) proposed two methods for classifying AI; the first is based on the stages of AI progression while the second relies on the type of intelligence displayed by an AI system. In accordance with its evolutionary phases, AI can be divided into three types: artificial narrow intelligence (ANI), artificial general intelligence (AGI) and artificial super intelligence (ASI). An AI system's intelligence may also be cognitive, emotional or social in nature. As a result, AI systems can be classified as analytical, human-inspired or humanised depending on the nature of their intelligence (Dwivedi et al., 2023b). AI-based decision-making will vary on five components: decision search space, option set size, perception of results and procedures, decision-making speed and decision-making reproducibility (Dwivedi et al., 2023b; Shrestha et al., 2019). When human intelligence and algorithmic intelligence become unbalanced, performative effects include delayed decisions, repetitive labour and manipulations (Bader & Kaiser, 2019). Huang et al.

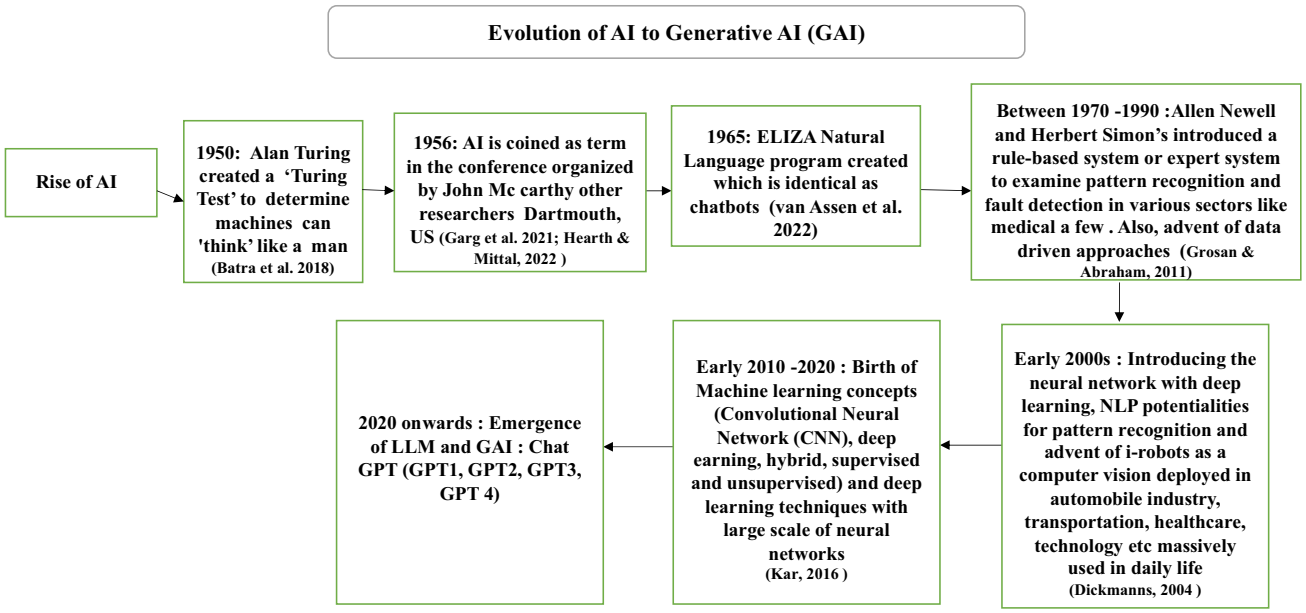

Fig. 1 Evolution of AI to GAI

(2019) highlighted that in the era of Industry 4.0, AI is emerging and attempting to sort out robotic repetitive work for reasoning and analytical tasks. Moreover, Kumar et al. (2019) noted in the research that AI provides managers with predictions regarding customer management and branding in both developed and developing nations. Overgoor et al. (2019) posited that AI was useful in numerous applications including car automation, customer service responses and many others.

AI employs several analytical techniques (Maettig & Foot, 2020; Votto et al., 2021). In this paper, we mentioned that the classifications of AI are machine learning (ML) comprising of supervised, unsupervised, semi-supervised or reinforcement learning. Arthur Lee Samuel first used the term 'Machine Learning' (ML) in 1995 (Syam & Sharma, 2018). ML is frequently seen as a requisite for creating AI applications. It calls for enormous amounts of data and falls under the category of supervised learning when specific data are given to produce a conclusion, while unsupervised learning is a distinct situation when the data are unstructured and unlabelled (Syam & Sharma, 2018). Additionally by deploying algorithms such as linear regression, logistic regression and neural networks supervised learning aims to build a statistical model to estimate or predict an output based on one or multiple inputs (Gareth et al., 2013; Syam & Sharma, 2018). Further, unsupervised ML teaches a machine to discover invisible and counter-intuitive structural patterns without an objective outcome (Lim et al., 2017). Hence, the unsupervised learning algorithm's primary goal is to assist in modelling the underpinning structure to enable a mathematical model to comprehend the data (Dhanaraj et al., 2020). Lastly, semi-supervised learning information is initially labelled as (X), and then some information is labelled as (Y), and this approach falls ambiguously among supervised and unsupervised learning (Dhanaraj et al., 2020). However, AI and ML algorithms can be utilised to examine and harness the unique characteristics of big data to accomplish highly accurate segmentation from a marketing perspective (Ahani et al., 2019; Ernst & Dolnicar, 2018; Kar et al., 2023). In reinforcement learning models, the AI models learn from a state where there is positive or negative reinforcement based on the quality of predictions and take this learning forward to the next state to improve the quality of prediction, thereby resolving the AI's cold start problems regarding the need for large volumes of data to forecast (Singh et al., 2021a; Singh et al., 2022b).

Since its inception, AI has progressed from a genre of science fiction to an important technology that is reshaping industries and lifestyles throughout the world with the latest development in GAI and language models emphasising the advanced potentialities that bring flexibility to the various industries (Marr, 2023c). The enormous recent iteration of GPT-3 and GPT-4 related to its predecessors demonstrates even more advanced abilities of reasoning and adaptive responsiveness in various industrial applications (Marr, 2023c). Hence, the prospects of GAI and ChatGPT give rise to more human-like responses compared to other NLP models such as rule-based techniques can lead to more relevant and engaging interactions with users, resulting in higher user experience and satisfaction bringing flexibility to the various industries to achieve sustainability (Kalla & Smith, 2023). On the other hand, it has more *scalability* to create responses quickly and is able to

handle large volumes of information, making it the best fit for firms to solve customer queries, reduce human interaction and increase operational efficacy (Kalla & Smith, 2023).

Customisation is one of the flexible attributes of GAI in business, allowing organisations to increase personalisation services to customers, which leads to rising satisfaction and loyalty (Kalla & Smith, 2023). For instance, in healthcare, GAI provides flexibility for treatments and patient recovery to improve accurate disease identification, drug discovery simplifies the development of novel treatments and robotics support in precision surgery, boosting patient outcomes and shortening recovery periods (Marr, 2023c). Also, in the financial domain GAI helps to identify fraud detection in credit card and loan evaluations, in manufacturing sectors GAI enables smart manufacturing and automation reduces costs, and in the retail industry GAI enhances customer satisfaction, personalisation, understanding customer behaviour and maintaining advanced inventory management (Marr, 2023c). Thus, the implementation of GAI by automating processes brings efficiency as a *flexibility* in businesses and organisations save time and money while increasing productivity and profitability as represented in framework in Fig. 2.

Research Methodology for Scientific Literature Review

In this research, a systematic literature review was conducted by examining two sources of literature. The initial source of literature is Scopus articles which are mainly concentrated on scientific literature. Since GAI is an emerging and cutting-edge topic and this review is focused on leading top-tier journals in social science, arts and humanities, decision science, business, management and accounting, economics, econometrics and finance categories, only those publications which were in high-quality journals (identified as Q1 in the Web of Science and Scopus database) were incorporated in this study. We further followed stringent inclusion and exclusion criteria based on journal rankings in the Australian Business Dean's Council (Rank A and above) and the Chartered Association of Business Schools (Rank 2 and above) so that findings can be more reliable (Kumar et al., 2023; Tiwary et al., 2021). The second source of literature is Emerald Insights, PROQUEST and ACM Library from grey publications and reviewed news and articles are examined. While conducting reviews of industry-related innovations for emerging technologies such as GAI and large language models, evaluating complementary sources of knowledge like scientific literature and grey literature have a greater external validity and also welcome recent

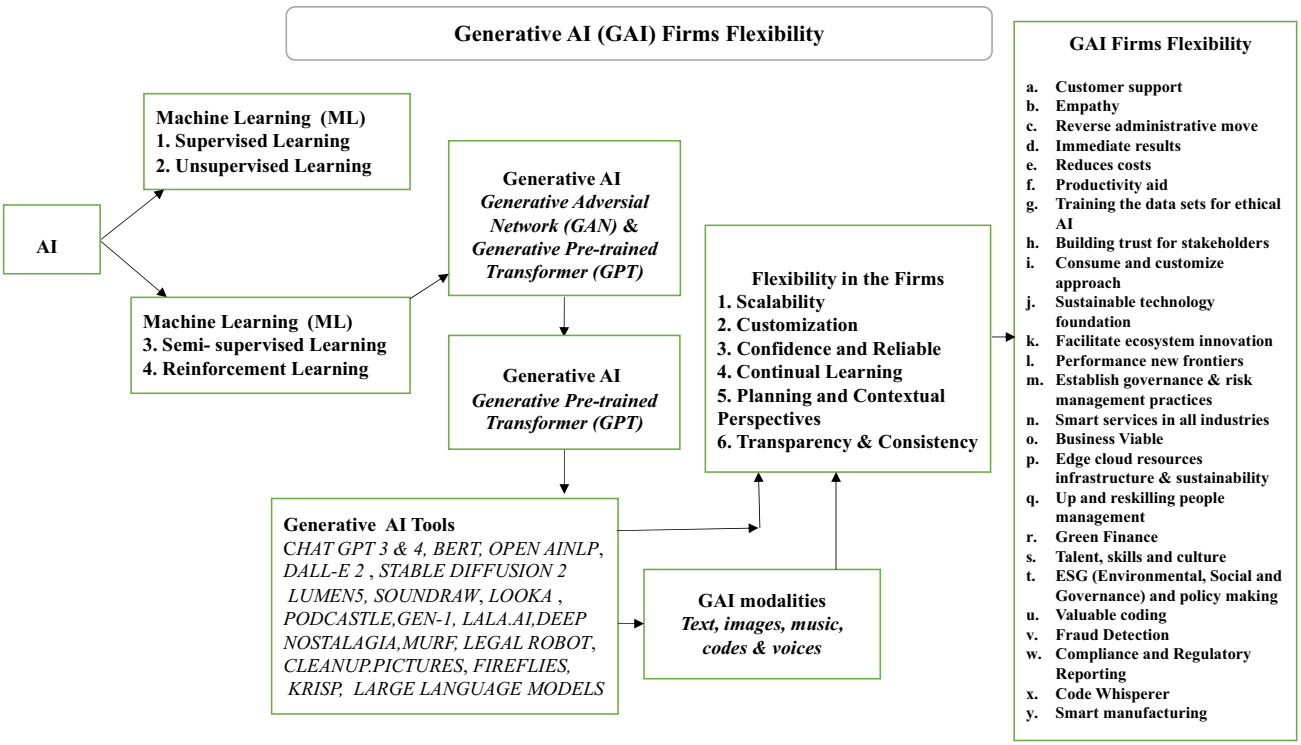

Fig. 2 GAI Framework

developments in a fast-changing ecosystem (Dwivedi et al., 2023a; Kar & Navin, 2021).

Search Protocol in Scientific Literature

Systematic review is used across multidisciplinary disciplines, including healthcare, physics and information systems, to calculate the vast amount of data retrieved from the internet to provide quantifiable, replicable, systematic and transparent insights for a particular topic (Kar et al., 2022; Weed, 2006). We have incorporated systematic reviews and PRISMA methodology for a comprehensive systematic literature review method. In addition, the PRISMA approach provides a detailed checklist of all the factors to produce a reproducible review by several scholars and develops the desired data for future research direction (Booth et al., 2020). Further, PRISMA techniques comprise various steps that are relevant to do research in the healthcare and physics domains, but it is yet to explore the research on information systems. The PRISMA-based procedure is a perfect fit for a systematic literature review as it ensures the best-quality review which enables the researchers to analyse the strengths and weakness of topics, and the review procedure, structure and format using PRISMA connects reference points for others in the field.

We used the Scopus database to find the articles for systematic review as this indexes a large amount of scholarly information that can be used to perform the research. Articles indexed in the Scopus database after doing a precise selection depend on the academic research (Kar et al., 2022; Kumar et al., 2023). To carry out the search, we used a set of keywords together with a search in the database within the manuscript titles and keywords. To draw out the literature related to 'AI' and 'AI language models' the words 'artificial intelligence', 'AI', 'Machine learning', 'ML', 'GAI', 'Conversational agent', 'Generative artificial intelligence' 'ChatGPT', 'Open AI', 'BERT', 'GPT', 'NLP', 'DALLE-2', 'Stable diffusion2', 'Lumen5', 'Soundraw', 'Looka', 'Podcastle', 'Gen-1', 'Lala.Ai', 'Deep Nostalgia', 'Murf', 'Legal Robot', 'Cleanup.Pictures', 'Firefiles', 'Krisp' and 'Large language models' were searched together using Boolean logic (AND/NOT). By using such keywords, generic articles related to 'chatbot', 'virtual bot' and 'BART' may have been missed. Due to these limitations, 2,029 articles were generated for 'Article', 'Review', 'Conference Paper', 'Book' and 'Book chapter' which are more comparable in the information system domain.

Furthermore, we used the content analysis method to label the themes to bring reliability to the concept. Then, we searched the keywords on Scopus in all the fields and screened repetitively to validate the search results by using inclusion and exclusion criteria. In addition, the full-text articles were then screened for relevance and duplicates were removed. The flowchart in Fig. 3 describes the options for search papers.

We performed the exclusion criteria of domains including psychology, engineering, computer science, energy, healthcare and mathematics to limit the articles to subjects specifically relating to social sciences, arts and humanities, decision science, business, management and accounting, economics, econometrics and finance as inclusion criteria retrieved the 640 articles. Subsequently, we excluded articles from conference proceedings, chapters, reviews and books and only included articles in journals. We obtained 173 articles and limited it to those written in English, with 170 articles that are indexed in the Scopus database. Lastly we retrieved 153 articles listed in the Scopus database.

Then, our research with both inclusion and exclusion parameters put forth the total of 153 publications from 77 journals that are indexed in Scopus. The quality of standardisation of journals was maintained with rigorous peer review to understand the key objectives of the article mentioned with respect to introduction, methodology, discussion and critical outputs/findings. After assessing the specific articles, we proposed systematic reviews of key areas and the contribution through the literature review of articles.

Findings from Scientific Literature

In this section, we demonstrate the descriptive results regarding years of publication, industries, methods, cases usage and content analysis which showed the types of learning, challenges and opportunities in GAI language models.

Distribution of Publications

In this section, we emphasise the number of articles related to GAI published over a period of time. Further, Fig. 4 depicts the year-by-year publication of research studies for this systematic review. The graph illustrates that the number of researches on GAI and its language model's impact on diverse domains increases with time. There is a growing emphasis on publishing articles about the GAI language model.

Methodologies used in GAI Research

In this section, we discuss the various methods of GAI by which researchers prefer to conduct research. We examine the language models that can help to discover which type of language is more commonly used by researchers for the

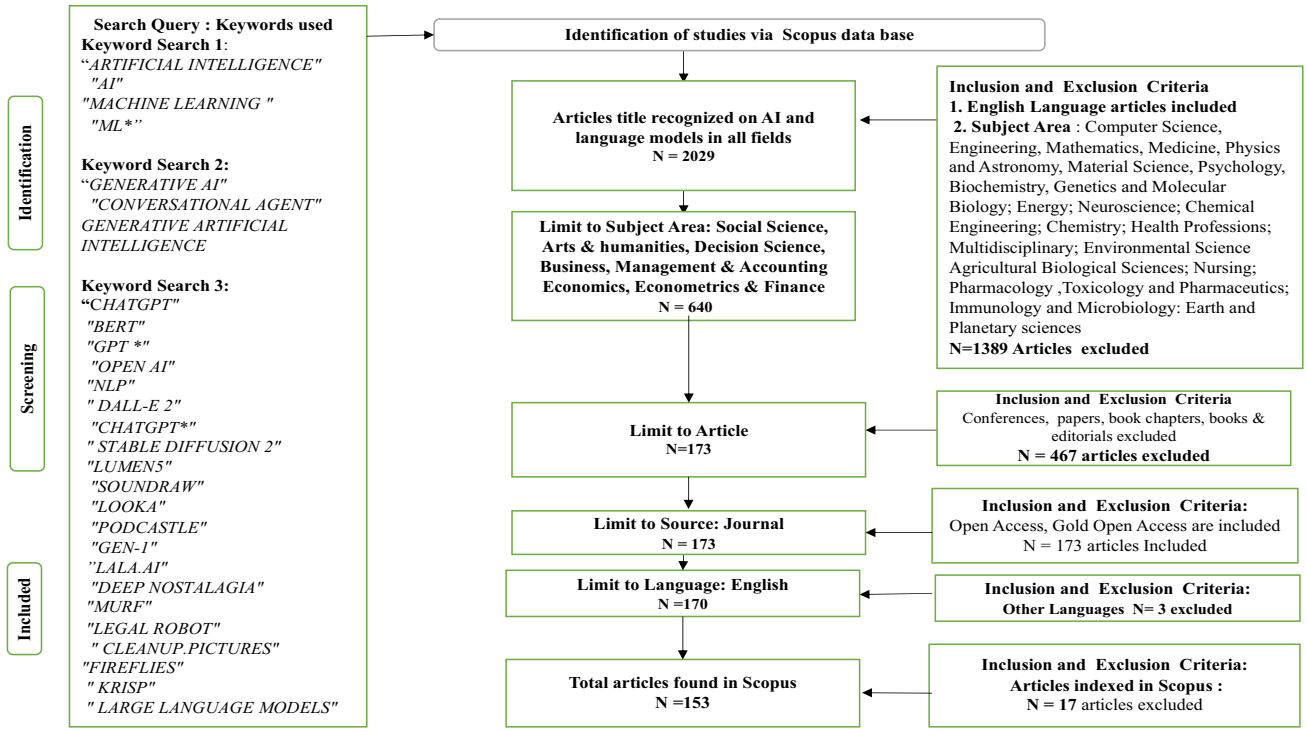

Fig. 3 Flowchart of PRISMA protocol for literature review

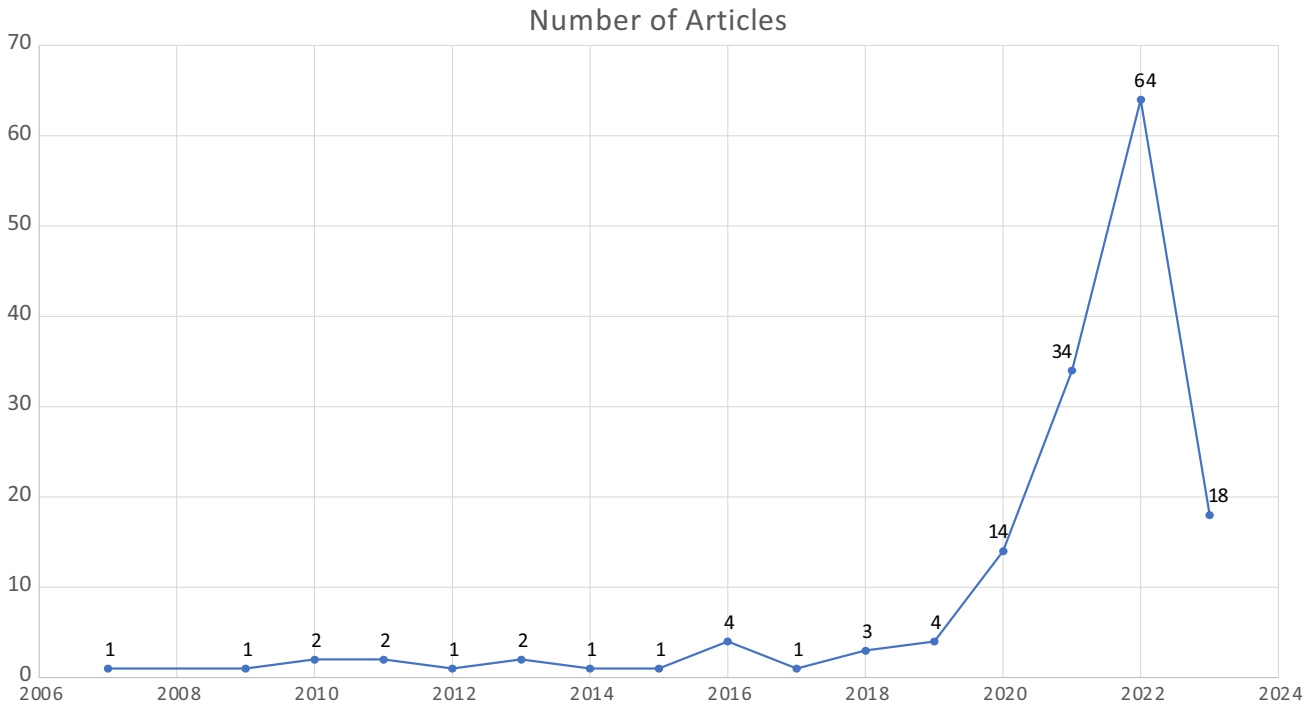

Fig. 4 Distribution of publications

study indexed in Scopus. We uncover that the majority of the research revolves around NLP methodology as represented in Fig. 5. Machine learning is used in 14% of the papers found in this study. In addition, for 12% of studies, researchers used conversational AI and 10% of research was based on BERT language. In addition, we recognise that for generative language models, 30% of the studies were based on qualitative analysis to exhibit the depth of

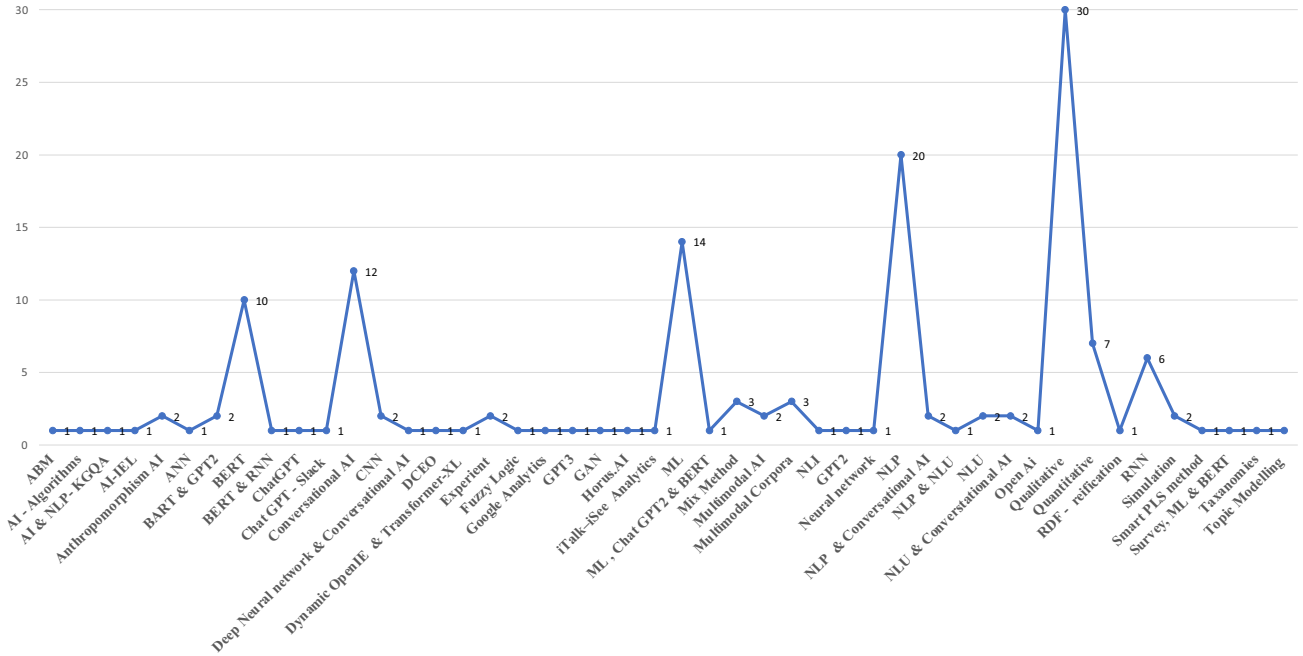

Fig. 5 Methodology used in articles

the conceptual outcome. These review studies help academicians and experts to understand the impact of the GAI language model on various sectors in terms of delivering success and sustainability. However, we can see that the least preferred language used by researchers is GPT-2, GPT-3, Open.AI, neural network and BART, which has yet to be investigated. The rest of the articles deployed ANN, RNN, ABM, ChatGPT, Slack, CNN, DNN, GAN, CORPORA, NLU, topic modelling, simulation or multimodal AI.

To a great extent, we identified in the research that the most prominent methodology from scientific literature in AI is natural language processing (NLP), an analytical technique that automatically analyses and comprehends human language enabling scholars to easily extract valuable insights from textual datasets while avoiding time-consuming data processing (Kang et al., 2020). In advance, natural language processing (NLP) is an important area of study in AI and includes two subfields: NLU (natural language understanding) and NLG (natural language generation) (Kang et al., 2020). The objective of natural language understanding (NLU) is to comprehend natural language by interpreting documents and extracting important information for subsequent tasks (Schank, 1972).

It seems that NLG is the generation of human-understandable text in natural languages that uses the submission of data structure, textual, graphics, audio, and video (McDonald, 2010). Subsequently, it comprises text-to-text, like translation as well as abstract (Genest & Lapalme, 2011); text-to-other, including text-generated images (Xu et al., 2018); and other-to-text, along with video-generated text (Rohrbach et al., 2013). By integrating NLP techniques with AI, it becomes possible to enable smart devices such as Siri, Cortana and Alexa to comprehend and interpret textual information. These devices have drawn attention to language translation, speech-to-text identification, sentiment-based market predictions such as financial news, and Twitter, intelligent shopping guides and robotic customer service assistants which have reshaped the business landscape (Kang et al., 2020). To gain a deeper understanding of consumer behaviour (Chi-Hsien & Nagasawa, 2019; Hou et al., 2016), corporate governance (Chanda & Goyal, 2020; Law & Chung, 2020) and market dynamics (Verma et al., 2020), researchers have shifted to NLP as a means of extracting information from textual datasets in annual reports and press releases compiled by firms and online reviews (Bansal et al., 2019). Hence, research in the disciplines of information systems and marketing frequently employ NLP to capture the attitudes and behaviours of customers, thereby contributing to the firm's success.

Distribution of Publication Sources

The comprehensive review of the literature included 153 papers from 77 journals as represented in Fig. 6. The extensive selection of publications proves the

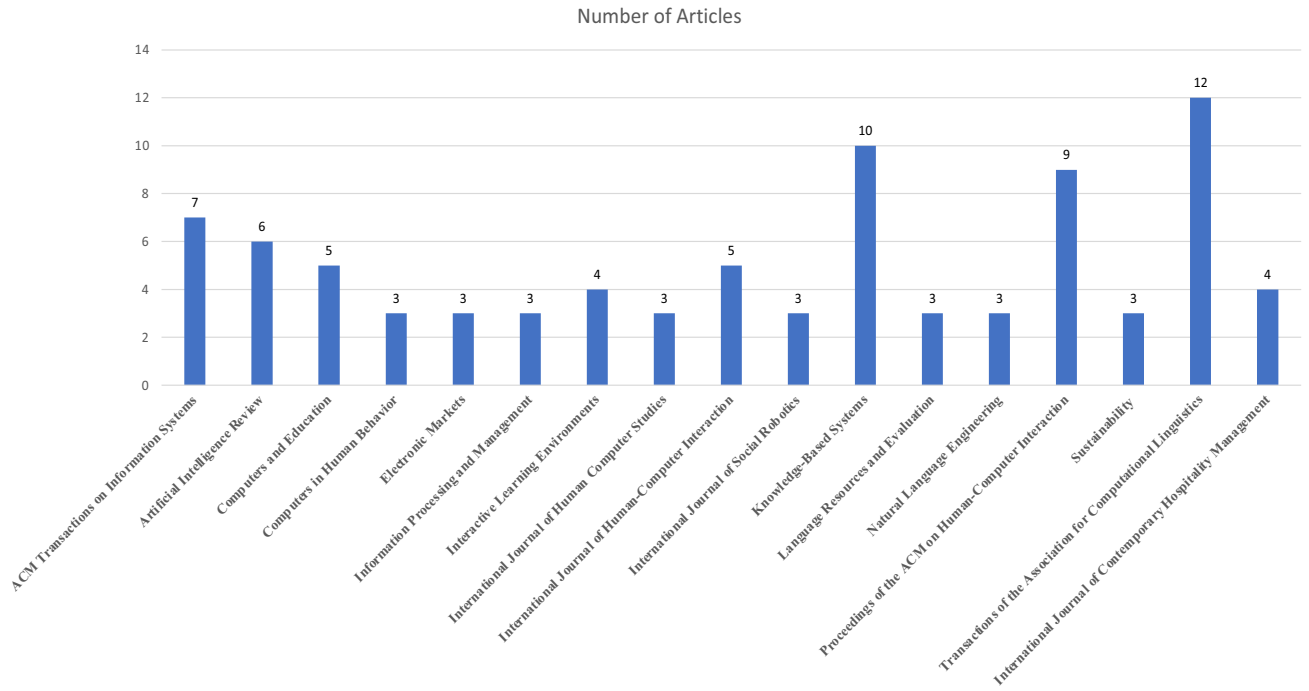

Fig. 6 Journals that published GAI articles

multidisciplinary approach of GAI in language models. It is evident from Fig. 6 that Transactions of the Association for Computational Linguistics publishes the most publications in the interface of AI and language models followed by Proceedings of the ACM on human–computer interaction, knowledge-based systems, ACM human–computer interaction, ACM transactions on information systems, artificial intelligence review and International Journal of Contemporary Hospitality Management.

Research Methodology for Grey Literature (GL) Review

Apart from the search resources, sources from grey literature and Google were found during March 2023. 'Grey literature' refers to subject-relevant articles that are not evaluated in an academic peer review process and are published in non-academic forums. These articles contribute to the systematic review findings as they are readily applicable for practice. A grey literature review is conducted by three strata based on retrievability and the level of retrievability determines the level of credibility of the materials (Adams et al., 2017). The first strata of grey literature includes non-edited books, book chapters, government reports and think-tank publications considered as first tier; the second strata has moderate retrievability, e.g. presentations, non-government reports and studies, news articles, and industry or company publications, while the third strata comprises literature with very low retrievability such as blogs, emails, letters and tweets (Garousi et al., 2020). The advantage of grey literature is that it does not suffer from research publication biases as grey literature reports both the positive and the negatives views of a concept, giving a balanced view of the facts (Benzies et al., 2006; Conn et al., 2003; McAuley et al., 2000; Paez, 2017). Grey literature supports scientific literature by providing complementary perspectives based on recent progress in industrial developments. The recency of honest signals may get lost in the pursuit of rigour in academic publications.

We carried out a systematic analysis of 235 articles from our sources of grey literature from indexing services like Emerald Insights, PROQUEST and ACM Library, to explore suitability. We chose business reports, trade literature and magazines from these sources as our final sources for our grey literature with the purpose of understanding the GAI language models and its applications in a non-peer-reviewed environment. We included the following outcomes: (1) proportions of reviews that were searched and included in each source; (2) proportion of relevant studies in each source for the most highly referred language models—conversational AI, ML, NLP, BERT and RDF-Reification; (3) impact of the results and their implications on various domains.

Initial searches from the above sources using search terms 'AI Algorithms' and 'Artificial intelligence Algorithms' were conducted from March 30, 2023 to April 6,

2023, which resulted in 4,805 articles. Using exclusion criteria of journal articles, peer-reviewed articles and restricting sources to magazines, books, reports, working papers, trade journals, book parts, case studies and expert briefings and newsletters and removing duplicates, we narrowed down our database to 235 articles.

We exported all the available 235 literature records of the three sources and screen for papers containing the most common generative AI language models—conversational AI, BERT, ML, NLP and RDF-Reification—to understand what fundamental human–machine interaction issues and challenges are addressed in these works. The workflow diagram of the literature review process in the three sources is represented in Fig. 7.

Findings from Synthesising Grey Literature with Scientific Literature

AI Language Models

GAI or generative artificial intelligence:

GAI is a kind of artificial intelligence that generates content based on user input employing unstructured deep learning models, and it has been proven to be quite effective in complicated environments that can be precisely defined using various prompts (Euchner, 2023; Korzynski et al., 2023). GAI employs algorithms that create new text that resembles what a human would write (Su & Yang, 2023). It is a linguistic model that generates anthropomorphic answers to natural language queries by using deep learning (Su & Yang, 2023). As part of this process, GAI employs both machine learning and deep learning

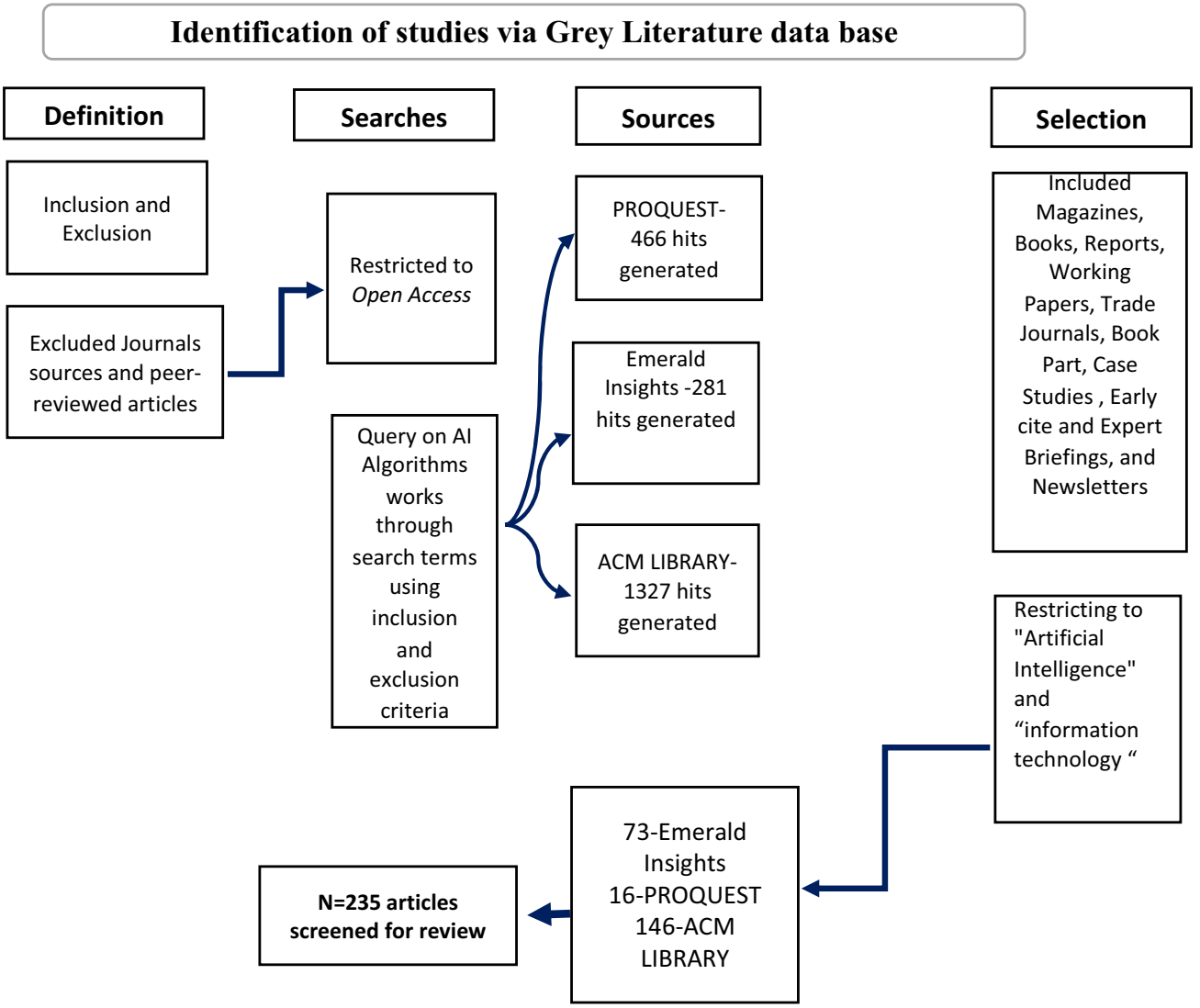

Fig. 7 Flowchart of review process for grey literature

algorithms as a base. It produces written materials, images, video, audio, music and computer code that is referred to as a conversational agent (Goh et al., 2006; Greengard, 2023b). Further, Greengard's (2023a) study disclosed that the GAI language model has had a significant impact, and its dynamic capabilities for content creation usage are as follows.

Text: The language is able to invent content through the words generated from voice assistants like Google LaMDA and Bard, Apple Siri, Microsoft Cortana and Amazon Alexa (Greengard, 2023b).

Images: Both DALLE and Google's MiP-NeRF are capable of producing photorealistic graphics based on text input. For instance, a web designer could type 'traditional Spanish plaza' into the DALLE engine and get an image that appears extraordinarily lifelike although not representing a real location. Similarly, a person may ask DALLE to create an image of a woman sitting at a café in the style of Monet and almost immediately see an image that appears to have been created by the artist (Greengard, 2023b).

Music: GAI is also utilised to set up audio and music such as complete compositions and specialised sound effects. Many firms such as Amper Music, Aiva, Amadeus Code, Google Magenta and MuseNet are capable of making creative music with realistic-sounding instruments. A user can request a music artist or style, such as Mozart, the Rolling Stones or jazz, and then listen to an AI-generated piece in that style (Greengard, 2023b).

Software development: Low-code and no-code platforms based on natural language are introduced by GitHub's CoPilot and Amazon's Code Whisperer platforms. A software developer can use GAI to voice or type a request into a platform and examine actual lines of code written in Python, R, Java or other popular programming languages. Developers may work more efficiently and make reusable modules more quickly (Greengard, 2023b).

Story and game development: With the aid of a GAI tool, subjects can be explored and even brand-new, unique digital and physical items can be created (Greengard, 2023b).

Additionally, the few applications of GAI in business across various domains are as follows:

- Sales content development: A variety of textual content can be produced by GAI systems for emails, websites, product labels, brochures, eBooks and product instructions. The technology can also be operated by businesses to deploy extremely useful chatbots, analyse customer feedback and spot pitfalls and opportunities (Greengard, 2023b).
- Employee query resolutions: HR departments are able to establish an enterprise handbook, job details, resumes and interview questions from GAI and deliver automated onboards, automated job offers and descriptions about selecting health insurance or retirement plans for employees (Greengard, 2023b; Mearian, 2023).
- Production process mapping: The firms might use GAI by acquiring the information from customer chatbot services to design an ideal representation of a complex component and then take pictures of the component as it is being manufactured to make sure it meets quality control criteria (Endrele, 2023; Greengard, 2023b).
- IT software development: Modern programming languages like Python, Perl, Go, PHP and JavaScript can be utilised by GAI. These blocks and snippets can be plugged into applications by development teams and they may be kept as libraries and improve the accuracy of data models (Greengard, 2023b).

Thus, GAI always brings flexibility to various sectors and in terms of higher education it has an innovative approach, shifting this disruption by training students to use technologies efficiently to address real-world marketing challenges and implementing evidence-based teaching methodologies (Mollick & Mollick, 2023; Peres et al., 2023). Moreover, GAI brings flexibility to support marketing operations to help digital marketers in with search engine optimisation (SEO) by producing text for a website's landing page while human editors correct errors and preserve the website's style that fits the brand for content marketing promotion (Reisenbichler et al., 2022). In addition, this technology is infused to create marketing content that produces a gamut of text applications like paid search, social media feeds/posts and online reviews which generate visual content that enables firms to achieve success and reduce costs (Carlson et al., 2023; Kar & Kushwaha, 2021).

GAI Tools

GAI has the advantage of producing distinctive content by utilising larger AI model datasets. Novel GAI solutions are released in the largest technology businesses and budding AI start-ups across the globe. To provide a comprehensive review of the generative AI technology, we considered GAI tools on the basis of their present prominence in the market and business relevance:

7.1 ChatGPT or GPT: ChatGPT is an open AI language model that can generate articles, fiction, poetry and even computer code. ChatGPT can also respond to questions,

hold conversations and in some cases provide genuine answers to highly specific questions and queries (Greengard, 2023a). Moreover, ChatGPT contributes to the increased adaptability of an organisation through its ability to generate websites, reports, marketing materials and human resource handbooks. It also verifies proficiency in comprehending many domains such as customer service, healthcare, legal practices, education and government agencies. Additionally, ChatGPT aids in doing data analysis for difficult datasets (Greengard, 2023a). Also ChatGPT is used in 3D printing as a SaaS platform called AiSync, which replaces the manual coding with visual programming to make a simplified toolpath to print the 3D image, creating a printing process that is optimised and repeatable (Stackploe, 2023). Subsequently, ChatGPT impacts the social and economic factors of societies as a valuable tool that delivers flexibility by minimising disparities in health and community development (Biswas, 2023a). Additionally, this technology also brings flexibility to researchers and industry experts to make polices for climate predictions to reduce global warming using real-time data analysis (Biswas, 2023b). Recently, Auto-GPT has been able to do more complicated multi-step tasks than other LLM-powered programs because it initiates unique prompts and feeds them back to its own, making a loop to achieve flexibility within firms (Marr, 2023d). Further, Auto-GPT helps businesses raise their net worth on their own by looking at their methods and making smart suggestions concerning how they could be made better (Marr, 2023d). For instance, this Auto-GPT acts like a project manager, keeping track of all the work done and putting it all together into the end result (Marr, 2023d).

7.2 BERT: BERT (Bidirectional Encoder Representations from Transformers) is a machine learning framework for open-source NLP. BERT is intended to assist computers in understanding the meaning of imprecise language in text by establishing context to operate neighbouring text (Lutkevich, 2020). In BERT's work on prediction to fill the words, many firms depend on the customer reviews based on their experience, which leads to flexibility in terms of raising profits of their products and services and brings success due to positive online reviews (Durairaj & Chinnalagu, 2021). To accomplish this, models are typically trained using a large repository of specialised labelled training data. BERT can adapt to the ever-expanding body of advanced search content and queries as well as be fine-tuned to a user's preferences. This method is referred to as transfer learning (Lutkevich, 2020). Google is currently using BERT to optimise the understanding of user search queries (Lutkevich, 2020). The examples include patentBERT (patent classification), docBERT (document classification), bioBERT (biomedical text mining), VideoBERT (video-YouTube), SciBERT (scientific text) and G-BERT (graph neural network—medical) (Lutkevich, 2020). Also, an Italian BERT model (AlBERTo) is used to predict the stock value and reads the financial sentences in the stock market (Colasanto et al., 2022).

7.3 DALLE-2: DALLE-2 is an open AI iteration and capable of creating and editing intricate digital graphics based on natural language instructions offered by humans (Perkins, 2023). A growing number of textual and creative outputs are co-created by humans and AI-based technologies bring flexibility in firms to tackle the co-creation complexities which can be codified and located in the domains of creative writing (M Lee et al., 2022a, 2022b; Y Lee et al., 2022a, 2022b), information technology (Biderman & Raff, 2022) and artistic outputs (Oppenlaender, 2022). Hence, DALLE-2 is becoming extremely prevalent as a word-to-image generator (Kim, 2022) to furnish viewers, who may be unfamiliar with the variety of AI art images, with what they are looking for (Chatterjee, 2022). Moreover, DALLE-2 has novel features like merging the images, in- and out-painting, latent diffusion (analysing textual and visual associations), photorealistic images and imitating the pictures in various styles (Naser, 2022). DALLE-2 is used extensively in advertising and marketing to create unique artistic images for several brands like Heinz developing ketchup arts or ketchup in space to promote products on social medial channels to reach as many customers as possible (Naser, 2022). As a result, DALLE-2 is paving the way for the firms to create a brand-new role where AI is a prompt writer for marketplaces providing AI cues for specific image types (Edwards, 2022). Further, this tool brings more flexibility to improve the novel text flows to images and encourages users to understand the language to drive more marketing opportunities by minimising prompt complexities (Liu et al., 2023).

Stable Diffusion 2: Stability AI came out with Stable Diffusion in 2022 which uses a latent diffusion mode that was trained on 512*512 pictures from a subcategory of the LAION-5B database (Lyu et al., 2022). This model, like Google's Imagen, uses a frozen CLIP ViT-L/14 content encoder to train the model to respond to text commands (Lyu et al., 2022). With the upsurge of open-source implementation of AI Stable Diffusion 2, more and more people are employing advanced text-to-image synthesis to make images, which is an important trend in the AI art community (Cetinic & She, 2022). Stable Diffusion 2 is another AI program that turns text into pictures. Its source code and details about the dataset and parameters deployed by its algorithms are accessible to the public (Marr, 2023a). This can also be downloaded and you can install the application on your own computer, while OpenAI's projects can only be accessed

through it with a specialised cloud portal (Marr, 2023a). It is a new depth-guided model that produces superior outcomes when generating images one after the other. This creates new opportunities for features like adding text to 3D models or creating graphics with layers (Wai Foong, 2022). Also, Stable Diffusion 2 can be applied in art, music and biomedicine to bring flexibility by creating several business opportunities in firms through generating new content (Dehouche & Dehouche, 2023; Wiggers, 2022).

Lumen5: Lumen5 is an AI-powered video-making tool with a simple drag-and-drop user interface that enables anyone to develop video content for education, marketing or business (Marr, 2023a). The application of Lumen5 is availed to create marketing video content and provides everything that the user and customer needs including messages, audio and blog posts embedded in the video (Hassan & Albayari, 2022).

Soundraw: Soundraw is the AI language able to relate royalty-free AI music using an automated music generator by selecting the style of music you want to make, the instruments that will be utilised, the mood you want to evoke and the track length (Marr, 2023a).

Looka: Looka provides AI-enhanced designs that generate a unique model or design proposal from raw data in response to specified criteria (Forero & Rennes, 2022). As a result, it advances the creative process by integrating the logo's general concepts with AI to generate a personalised logo (Forero & Rennes, 2022). Subsequently, the software makes it easy to brand your business by utilising AI to develop logos that represent your company's style and messaging. This application simplifies the process of creating personalised promotions, even if you lack design experience, and generates significant revenue for AI in businesses (Marr, 2023a).

Podcastle: This Chrome plugin turns online articles into downloadable, embeddable and shareable audio files and downloads them in MP3 format so that consumers can listen to them without an internet connection (Hope, 2021). By leveraging OpenAI, Podcastle includes options for the voice of the reader and the speed at which the text is read (Hope, 2021). When your podcast opens, users will find download and sharing options (Hope, 2021). In the education sector, this application enables instructors to integrate audio of articles in their learning management system (Anas et al., 2022).

Gen-1: Cloud-based text-to-video technology that makes new videos from uploaded footage, employing text prompts to apply the desired edits and effects, or develops animations from storyboard mock-ups (Marr, 2023a). This application is used in automation services in coffee shops to interact with customers (Yang & Chew, 2021).

Lala.AI: This application employs the Phoenix neural network architecture to automate the separation of audio sources. This involves extracting voices, tunes or specific instrumental sounds such as drumbeats or basslines, either from an audio or video source (Marr, 2023a).

Deep nostalgia: This new technology enables you to animate the faces in family photographs so that you can watch them laugh, wink and giggle, exactly like you'd recorded a video of them in their youth (Marr, 2023a). Moreover, deep nostalgia employs deep learning technology to simulate faces from historical photographs, producing a short video that may be freely shared on social networks (Kidd & Mcavoy, 2023), while Amazon has announced that Alexa will be capable of communicating with the voices of deceased users in an effort to 'make memories last' (Paul, 2022).

Murf: This text-to-speech technology simplifies the process of making natural-sounding synthetic audio recordings in 15 languages with over 100 voices and accents to choose from and the outcome can be readily integrated into robotic marketing or video material, optimising the narration and voiceover creation process (Marr, 2023a).

Legal robot: This system is designed to automatically convert complicated and convoluted legalese into simple, universally understandable language. Beneficial for both common people who want to guarantee that they comprehend legal papers and legal experts who desire to guarantee that their agreements and contracts are written in a language that is accessible to the general public (Marr, 2023a).

Cleanup.pictures: The open AI allows users to enhance photographs by removing undesired items, flaws or even persons, utilising a technique known as in-painting to create the ideal image (Marr, 2023a). Additionally, machine learning systems are better at segmentation (identifying the distinctions between an object and the backdrop) and also superior at in-painting, or putting in the new content. This feature has become a commodity, as illustrated by Cleanup.pictures, and Google unveiled that its latest Pixel 6 has an identical Magic Eraser (Vincent, 2021).

Fireflies: This application integrates with major video conferencing applications like Zoom, Teams and Webex to automate the note-taking and transcription processes. In addition, it analyses discussions in order to offer insights into the trends and decision-making occurring in individual conversations (Marr, 2023a).

Krisp: This is one more important conference calling tool that employs algorithms to eliminate ambient sounds, echo and other distracting aspects in real time, assuring that you are always heard clearly and professionally (Marr, 2023a; Salaberria et al., 2023).

Synthesia: Synthesia is an AI-powered video creation platform that enables users to generate videos using their own scripted prompts by deploying its library of AI avatars, accents and video templates to generate a video with a realistic appearance and sound (Hiter, 2023). This tool is applied to develop product marketing, training and how-to videos for both internal and external users (Hiter, 2023).

Claude: Claude is one of the most recent AI chatbot assistants and content generators such as ChatGPT, but it is designed with a greater emphasis on safety and a conversational customisable tone that has the ability to develop content generation and supports several popular spoken languages and programming languages (Hiter, 2023).

Impact of GAI on Different Functions and Industry

GAI has constituted distinct effects on different management functions and specific industries. In this section, we explore the impacts of GAI in different management functions in detail.

Impact of GAI on Different Management Functions

Financial Management

With the rapid expansion of the web and social networks, users convey their thoughts about businesses and brands on online platforms like microblogging on Twitter (Kang et al., 2020). This knowledge and accompanying sentiments can influence the buying decisions of other customers (Tang & Zhang, 2018) and the investment decisions of investors (Nguyen et al., 2020). Thus, the financial sector brings flexibility through dramatic transformation in the banking sector by leveraging the GAI language models that have been extensively used to comprehend customers' wants and successfully target them with suitable products and services (Mogaji et al., 2020a, 2020b). As a result, GAI language models like ChatGPT, FinBERT and NLP are among the major digital disruptors in banks that facilitate back-end operations, data analysis and marketing for banking services without direct client involvement (Huang et al., 2023; Northey et al., 2022; Sheth et al., 2022). Further, the function of ChatGPT will take over routine (non-critical) jobs in the Banking, Financial Services, and Insurance (BFSI) sector, such as customer service, basic financial assessment and text analytics for customer sentiments (Dwivedi et al., 2023a). Accurate analysis would help auditing and consulting services and allow bank executives to emphasise more on the insight and impact part of the user's computer (Dwivedi et al., 2023a). Subsequently, FinBERT will focus on analysing the firm's revenue generation and capital markets, particularly on stock price, profit and volatilities, to recognise the text maps for further predictions and achieve competitive advantage with higher accuracy in the financial sector (Huang et al., 2023). Moreover, NLP algorithms are deployed for analysing financial documents and sentiment classification in order to comprehend the organisation's and individuals' abilities (Bochkay et al., 2023).

Equivalently, explainable AI(XAI) with ML algorithms for financial process using soft computing techniques for forecasting and predicting currencies, exchange rates, stock market price through ANNs especially in developing nations extensively applied with data security models for deployment for different customer segments achieves success in the firms (Lorente et al., 2021; Sharma et al., 2020). RNN-LSTM (Recurrent Neural Networks–Long Short-Term Memory) and BERT financial institutions are today able to bring flexibility to know and predict financial distress identification in conjunctions with targeted financial ratios specifically to institutional customers, and investors would create trust in the banking system especially in developing nations (Ruan et al., 2021). NLP and deep learning deployed for stock predictions solutions to anticipate future flexible price forecasting (Kar & Rakshit, 2015; Theodorou et al., 2021). Augmented analytics is driven by AI in financial process and business growth through business intelligence (BI) by leveraging ML, NLP, AutoML and NLG (natural language generation) tools along with visualisation tools helps to identify outliers, inconsistent values, null or zero impacts versus planned or targeted values. Causal relation identification and auto generation of dashboards for strategy developments and other insights for deployment would be quicker, easier and more user-friendly than a traditional BI approach (Alghamdi & Al-Baity, 2022). AI models with human interventions encourage flexibility in green finance and can reduce the impact of natural calamities and disasters (Hemanand et al., 2022). Eventually, AI neural networks will mitigate financial exclusion in a social context in rural villages and bridge the gap between urban and rural banking transactions (Huang & Ye, 2022). Hence, GAI and LLMs bring flexibility through sentiment analysis, product/service recognition, language creation and language translation incorporated in financial management firms to bring the customisation of services and refine the customer experience while accelerating digital transformation in sharing and the circular economy (Businesswire, 2023).

Marketing and Sales Management

GAI advancement has evolved to reinforce the scale of language models like GPT-1–3, BERT, Turing-NLG and NLP as measured by the number of parameters and the quantity of training data in the marketing sector (Bender et al., 2021; Chan, 2023). Evidently, this technology employs NLP and ML to deliver automated customer support solutions that can assist businesses, boost productivity and decrease expenditures (George & George, 2023). By considering GAI like ChatGPT's automation, chatbots in e-commerce organisations can quickly reply to client enquiries without investing in additional staffing resources able to reduce expenses and also elevates the overall customer experience (Martyrosian, 2022). Also, ChatGPT's capacity is rapidly increasing which makes it easier for businesses with high internet traffic during peak seasons such as the holidays, when demand is significantly higher than at other times of the year in the hotels and tourism business (Dwivedi et al., 2023c; George & George, 2023). Also, ChatGPT offers empowered writing assistance that influences what users attempt to describe—and what they think and discuss on social media for the betterment of society. It also improves the content in advertising for brand or product promotion (Jakesch et al., 2023). Further, this GAI is used to promote the brands through digital campaigns to provide personalised services to customers (Khushwa et al., 2020). Similarly, NLP helps firms to understand the customers by making comparisons and reviewing products online, where individuals use smart speakers to find, buy and communicate their requirements and then companies invest to obtain cues from firms' press releases to improve investment decisions and businesses analyse sales call transcripts to improve customer satisfaction and conversions (Hartmann & Netzer, 2023). Moreover, in market research, six key NLP techniques that are utilised are text pre-processing, text representation, classification, topic modelling, sentiment analysis and deep learning, to learn about the description of products, social media and chatbot conversations and inspire customers to make purchase decisions (Kang et al., 2020). NLP is also utilised in content development and online experimentation by providing marketers with AI-powered insight based on historical data to enhance their creative process (Kong et al., 2023). BERT is applied in content marketing for product promotions (Sabharwal et al., 2021). Furthermore, sales management in the firms is aided by GAI, since selling is handled with engagement and transaction demand and generates vast volumes of data such as textual patterns from email messages, audio of phone talks and videos of personal interactions (Sinha et al., 2023). The core function of GAI is to achieve flexibility in firms to support salespeople to interact more with customers online, develop sales planning based on product data, customer data and geographical data, increase the firms' sales performance (Sinha et al., 2023). GAI facilitates flexibility and creativity in firms to interchange the fresh perspectives on marketers to improve the efficiency in marketing content, achieve higher product quality and improve job satisfaction for marketers while writing codes (Kalliamvakou, 2022; Noy & Zhang, 2023; Reisenbichler et al., 2022). Lastly, GAI brings flexibility in globalisation of marketing to provide customised communications for fundraising or sales materials aimed at various personality types (Peres et al., 2023). The efficacy of new techniques in creating marketing material, like any evolving technology, must be extensively reviewed and measured in a variety of circumstances to bring firms success (Peres et al., 2023; Yadav & Sagar, 2021).

Operations Management

The GAI LLMs like NLP techniques are deployed in the operations management subjects such as product lifecycle management, operational excellence, inventory control and sales forecasting (Kang et al., 2020). The study disclosed that an NLP combination of text categorisation algorithms and manual inspection was used to extract supplied information from each imported raw data transaction and unprocessed bill of freight forms (Jain et al., 2014). Moreover, NLP uses sentiment analysis through retrieved data from social media websites to understand the quality of products and services in the firms (Cui et al., 2018). Then, NLP upgrades the flexibility in process by evaluating the company descriptions in 10-K filings to determine how product language overlaps at various industry, intra-industry and inter-industry levels (Hoberg & Philips, 2018).

Supply Chain and Logistics Management

The GAI describes the techniques used by AI for sensing and communicating (Pournader et al., 2021). Then, NLP is a language model of AI and its application that involves inventing tools that can carry out tasks when given instructions in human language and magnifies the software and human interfaces (Zanon et al., 2020). As an illustration, the research that investigates how NLP can be used to automatically validate and build supply chain maps for improving architectural insight of a supply chain from unprocessed material including newspapers or blogs (Wichmann et al., 2020). Further, ChatGPT and NLP also contribute and encourage flexibility in route optimisation by analysing logistical data and providing suggestions to expedite delivery and reduce costs (Trivedi, 2023). ChatGPT automates tedious, repetitive procedures such as invoicing and giving real information availability for all

stakeholders and decreasing the chance of misconceptions and errors by strengthening supply chain communication, smart manufacturing, automated customer service, optimising the inventory and warehouse, proper routing, and it enhances customer satisfaction in industry 4.0 (Hose et al., 2023; Trivedi, 2023). For example, FedEx avails NLP as a chatbot to comprehend client queries and provide real-time information on cargo status, delivery timetables and customs clearance. NLP assisted the FedEx firm to increase customer satisfaction and decrease the strain on their customer service crew (Trivedi, 2023). Lastly, through ChatGPT, OpenAI promotes flexibility by simplifying the logistics industry to foster green supply chain operational process, and it delivers information that is not only timely but also corrects errors and achieves client satisfaction with prompt responses and delivery (Brown, 2023; Dhillon et al., 2023).

Human Resource Management

Human resources are among the most sophisticated and imperfect company areas (Joshbersin, 2023; Varsha & Shree, 2023). The emergence and function of ChatGPT GAI generates content for position description, expertise guidelines, understanding layouts, orientation and training and transition tools. Further, this emerging technology constructs skills patterns, knowledge models and applicant profiles for recruitment. Again, ChatGPT assesses and amplifies compensation, salary standards and awards. Lastly, ChatGPT brings flexibility in the human resource domain which contributes to employers and assists managers and employees in terms of implementation of performance management and evaluation, mentoring, leadership training, mental health and well-being (Joshbersin, 2023).

Strategic Management

Another distinguishing feature of new entrepreneurs is a lack of management experience, and the advice given by their colleagues has been determined to impact the performance of their start-up (Chatterji et al., 2019). It is critical for mature companies to achieve innovative thinking in order to gain a competitive advantage. Thus, firms use natural language processing (NLP) to sanitise app descriptions and measure two concepts to attain flexibility: prototype resemblance and exemplar comparability (Barlow et al., 2019). The study disclosed the usage of topic modelling to retrieve 100 themes from the USPTO (United States Patent and Trademark Office) document abstract and to regulate whether patents originated as novel ideas. They chose all patents that exceeded a threshold controlled by three expert coders and were weighted for topic, as well as those that appeared within the first 12 months of topic formation from the entrepreneurs (based on application date) (Kaplan & Vakili, 2015).

Impact of GAI on Different Industries

The rapid growth of industries and the implications of adopting GAI language models have a significant impact on the global economy. Moreover, recent advances and expansions in machine learning have resulted in more sophisticated inventive digital content-generating technologies such as GAI (Baidoo-Anu & Owusu Ansah, 2023; Hu, 2022). Through advancements in deep learning (DL), GAI brings out artificial relics from extant digital materials, which includes video, images/graphics, text, audio, and video, by analysing training cases; learning their patterns and distributions in various industries and enhancing flexibility (Abukmeil et al., 2021; Gui et al., 2021; Hu, 2022; Jovanović, 2022). For instance, in the e-commerce industry for their service operations, sales, marketing and inventory management, they use AI and its language tools like deep learning algorithms, NLP and text analytics to enhance CRM, resolve the digital transaction issues and understand customer preferences (Bagwari et al., 2022; Chen & Kim, 2021). Also in the education sector, employing NLP and AI to teach foreign languages to students in place of instructors not only brings flexibility in terms of reducing costs, but also enables self-paced, individualised interfaces for each student (Jin, 2019).

Furthermore, GAI is deployed in start-ups to enable them to manage customers and to market and encourage venture capitalists to make quicker decisions to achieve a sustainable competitive advantage (Santos & Quin, 2019). On other hand, ML, NLP, rule-based systems and deep learning are used in data analysis to become familiar with medical instances and progression in the healthcare system to provide treatment for affordable services, and to learn about public health policy and develop a smart healthcare system to take clinical decisions for doctors (Alami et al., 2020; Baker et al., 2022; Sharma et al., 2022; Sovrano & Vitali, 2023). Subsequently, the food industry benefits by leveraging GAI to attain flexibility to comprehend knowledge of customer preferences, requirements and to improve service quality (Uma Maheswaran et al., 2022). Seemingly, the infrastructure and construction industry deploys NLP to develop a customer complaints system to recognise defected customers, complaints and tracking warranty services. This could promote residential building projects and builders to better manage and support critical decision-making (Bazzan et al., 2023). On the other hand, BERT enhance ERINE models for text analysis used in the hospitality sector to find out customer expectations and their reviews to enhance hotel services (Wen et al., 2023). The

news, media and entertainment industry employs ML, NLP and ChatGPT-3 to facilitate content creation through automation in a routine way and produce regular write-ups, saving time for the creators to concentrate on critical tasks and strategic planning and to understand the ethical aspects of the algorithms (de-Lima-Santos & Ceron, 2021; Pophal, 2022). In the software sector, AI algorithm GPT 4 is much more powerful than ChatGPT 4, GPT 4 makes all other AI tools look low-quality in comparison with the versatile nature of its usage for webpage creation and affiliate marketing (Melissa, 2023).

Opportunities and Concerns Surrounding GAI

Opportunities Surrounding GAI

Moving on to the future, the potential of GAI from the perspective of the industry is currently gaining attention (Dwivedi et al., 2023a). Further, GAI also has the ability to improve several aspects of customer interactions, ranging from marketing documents and the initial phases of the sales process to detailed interactions tailored to each user in the post-sale space and potential longer-term associations (Dwivedi et al., 2023a). OpenAI is used in firms that emphasise their flexibility by taking several initiatives that seek to improve AI's capabilities and explore its social impact (Haleem et al., 2022). Moreover, ChatGPT has the opportunity to display and evaluate the capabilities of a competent AI system. ChatGPT is a GAI application that enhances organisations' flexibility by generating text, images, music and video utilising natural language processing (Zhai, 2023). ChatGPT is powered by a big language model, but it requires data to function and grow over time. Models receive the same training as individuals do.

The system improves its ability to recognise patterns to forecast future occurrences and generate believable writing (Flanagin et al., 2023). ChatGPT is one of the tools that help firms to offer a wide range of opportunities for business expansion by analysing products, marketing strategies and customer engagement to create novel marketing campaigns via social media platforms, online marketing, retailing, search engine advertising and other digital advertising channels to improve loyalty programmes, enhance customer services, enable fraud detection in online transaction and resolve inventory problems (Marr, 2023b; Nisar & Aslam, 2023; Oviedo et al., 2023).

Besides this, performance analytics provide possibilities to help organisations track and evaluate the effectiveness of their online marketing efforts and to improve results. The campaign plan and tactics can be changed in real time to use this information (Hirosawa et al., 2023; Macey-Dare, 2023). Indeed, the prospects for Midjourney v5 are promising and the approach initiates the development and adaptability of the company where text descriptions are a high-quality and creative image processing has a great influence on advertising of products and brands by AI-generated pictures to reach as many customers as possible (Kristian, 2023). Subsequently, there is a new avenue of algorithmic trading, and by leveraging ChatGPT OpenAI is rapidly expanding the field of finance in which computer algorithms are used to automatically execute trades based on predetermined guidelines and market conditions. This type of trading helps firms to gain popularity and flexibility because it provides several benefits compared to conventional trading such as fast processing, less expensive transactions, lower risk and it enhances firms' portfolio management (Pothula, 2023). Also, there is a wide option in operations management in IT firms to optimise the operational and managerial tasks by using GAI language models like NLP and ChatGPT-3 (Liu et al., 2020, 2021). Probably there are opportunities for supply chain to become smarter by deploying ChatGPT in the manufacturing firms to increase the optimisation of supply chain process activities, enhancing accuracy and efficiencies, better customer services and reducing the operational costs (Softlink Global, 2023).

Further the GAI is harnessed in human resource management in the organisation's incorporated flexible workforce where managers have developed ways to integrate in their operational process to attain greater performance. Thus, ChatGPT has a wide scope for effective tools that help HR professionals in terms of recruitment to streamline the process including resume filtering, scheduling interviews and selection decisions; automating the onboarding for new hires; opportunities for customised training plans for employees to acquire better knowledge and skills; HR experts can access real-time performance employee data for appraisals; conversation bots provide information on policies, insurance, holidays, etc.; reduce the attrition rate; and provide rules and regulations for HR compliance (Marr, 2023c). Hence, the use of GAI in marketing, finance, supply chain and logistics management, operations, human resource management and strategic management is a promising area of research that offers firms flexibility with numerous chances to enhance the firms' success, innovation and new product development.

Adverse Impacts of GAI

Several studies have examined the ethical side of GAI like ChatGPT in terms of how ethically it responds to specific issues (Dantas, 2023; Hasselbalch, 2022). From a rational standpoint, the general impression is that it is fairly good, but it relies partly on how the questions are presented, and the output of ChatGPT is often delivered in the tone of a

middle-class white mother, which is not good for society (Bjork, 2023). Similarly, DALLE-2 LLMs additionally prohibit the creation of images depicting self-harm or illicit activity, and photographs of public people are restricted (Naser, 2022). The firm has also indicated that it has upgraded its filters to reject any efforts to generate similar information, which also violates its content policy and magnifies its detection and response mechanisms to combat misuse (Naser, 2022). Further, the organisation employs both automated and human surveillance mechanisms to protect against illegal content and misuse.

Apart from these attempts and assertions, OpenAI has been candid enough to acknowledge that more work is required in this area (Naser, 2022). Also, OpenAI raises issues about copyright implications of using existing photographs to train an AI model. Due to ambiguous copyright rules, Getty Images has prohibited the usage of AI-generated content in its library. Some artists are afraid that simple text input in a prompt box may soon replace the need for designers and animators, where in the software, they have not mentioned anything gender-specific (Naser, 2022). Also, ethical difficulties occur in deep nostalgia LLMs, showing the level to which animations might be exploitative; this involves examining the potential social repercussions of emotional exploitation, especially when it offers misleading perceptions of users and incorrect links (Kidd & Mcavoy, 2023). Subsequently, the study emphasises the possibility of malicious manipulation of language models like GPT and raises concerns of bias, justice and representation within models such as GPT-3 (Brown et al., 2020). These two challenges are strong examples of study relevant to 'the dark side' of AI, 'algorithmic bias in ML models' and 'managing the AI bias', i.e. the undesirable and unintended implications of AI technologies through AI bias using ML models (Akter et al., 2022; Mikalef et al., 2022; Varsha, 2023).

Several ethical concerns are identified by ChatGPT-3 and are specifically addressed by OpenAI and divergent AI ethicists (Bender et al., 2021; Chiu & Alexander, 2021; Lucy & Bamman, 2021) focusing on the two aspects of manipulation and bias (Chan, 2023). Another major concern is that the societal bias encoded within GPT-3 could be harmful to marginalised populations (Chan, 2023). This is manifested in the form of unsupervised learning which would be filtered in datasets through web crawling and causes harmful effects such as discriminatory practices, unfair treatment and the entrenchment of social inequalities (Chan, 2023). Moreover, the possibility for biases in the data and algorithms from consumer demographics leading to a discriminatory or inaccurate outcome is another key problem for rediscovering the fintech and banking industries by utilising ChatGPT. There is additional risk in data breaches created by security threats or attacks (Tomych, 2023). In the marketing sector, ChatGPT's conversational AI where machine learning models able to train the datasets results the biased or unethical responses leads to a negative impact on customer and brand loyalty (Helps K, 2023). Subsequently, errors in information occur based on demographic group will be the limitations in supply chain and logistics management in terms of customer queries and response generation (TGL, 2023). Hence, these AI LLMs empower the firms to face major concerns in their functional domains in terms of companies' growth (De Cremer & Kasparov, 2021) and financial risks (Blackman, 2020) and reframe the ethical approach (Floridi et al., 2018).

Discussion

This research focused on the various forms of GAI language models incorporated in business and how these LLMs can be deployed in a firm's success. In the current scenario, OpenAI/conversational AI is one of the disruptive technologies that contributes to management functions. We misuse emerging languages like ChatGPT, BERT, DALLE-2, Midjourney, etc., at an alarming rate to some extent, leading to miserable conditions for future generations. In this regard, we need a suitable approach that is based on GAI to address the various issues, challenges, and barriers. The primary objective of the study is to comprehend how the GAI language models of the algorithm evolve (Garg et al., 2022; Kar et al., 2022) and also to understand the kinship of AI language models to redefine domains and functions (Chen & Kim, 2021; Dwivedi et al., 2023a; Huang et al., 2023; Sheth et al., 2022). Finally, these GAI language models are deployed in firms to learn the opportunities, risks and flexibility. For instance, to learn which are the most frequently applied methods to understand the usage of generative AI language models in various sectors and functions, we have plotted a graph for the entire range of AI language models methodologies that have been employed.

However, our study concurs with scientific literature as 14% of the papers in this study make use of machine learning. In addition, conversational AI was mentioned in 12% of studies, and 10% of research was conducted using BERT language. Also, we recognised that 30% of GAI language models' studies were qualitative in order to comprehend the concept's profundity. These assessment studies aid academicians and professionals in understanding the impact of GAI language models on the success and sustainability of various industries. However, we can see that the languages GPT-2, GPT-3, OpenAI, neural network, and BART, which has not yet been studied, are the least preferred by researchers. The remainder of the article's methodologies that include ANN, RNN, ABM, ChatGPT,

Slack, CNN, DNN, GAN, CORPORA, NLU, topic modelling, simulation and multimodal AI are on the edge or at an initial level of research. In a similar vein, grey literature is able to explain suitability for 75 articles randomly retrieved from the databases Emerald Insights, PROQUEST and ACM Library. Grey literature comprises business reports, trade literature and periodicals from these sources in order to realise the GAI models and their applications in an environment without peer review.

The outcome of the grey literature research analysis sheds light on the proportions of search and includes evaluations for each source, as part of the relevant studies in every distinct resource for the most highly cited language models—conversational AI, machine learning, natural language processing, BERT and RDF-Reification—and its impact on the results and their domain-specific implications. Nevertheless, based on research gaps in the existing literature and advancements in GAI in general, we anticipate that methods such as ChatGPT-3, ChatGPT-4, BERT and Midjourney will become extremely valuable in the coming years, given that they facilitate computing on the edge to enrich the diversified services, improving customer loyalty and increasing organisations' success. In order to address the implications of GAI influences on individuals, businesses and societal settings, a systematic evaluation of the literature utilising PRISMA in scientific literature and grey literature was conducted. The current study examines academic and grey literature reports to explain GAI by sector and function. Self-reporting biases may exist in Prisma systematic literature evaluations, which is one of the study's limitations. In addition, the methodology employed has not been extensively investigated in the existing literature since the topic is in a nascent stage. Thus, we leave many possibilities for future research to conduct a systematic literature review by combining academic literature and trade literature. This method necessitates the examination of a domain from the perspectives of two unrelated stakeholders, thereby minimising systematic biases resulting from ecosystem affiliation.

Contributions to Literature

In this study, we analysed a variety of aspects of previously published articles on the GAI models and its impact on sectors and functions. In the scientific literature, there is a spotlight on more GAI language models that are being used in the online education, emotional intelligence (EI), healthcare, IT, psychology and social media marketing industries than in any other industry. Non-classifiable sectors also have majorly deployed GAI models, and other sectors like finance, insurance and retail estate, manufacturing, services and transportation, agriculture, forestry and fishing are emerging areas that are focusing on implementing GAI language models. Thereafter, in the grey literature, few findings found that GAI large language models are used in customer relationship management, e-commerce, education, entrepreneurship and start-ups, finance and portfolio management healthcare, food industry, infrastructure and construction industry, marketing, hospitality, news, media and entertainment, retailing, supply chain and manufacturing sectors. Consequently, this study can assist in understanding the GAI language models' applications in various industries to bring more agility and resilience to attain a competitive advantage.

Understanding the concept of GAI by imparting the current IS (information system) literature systemically recognised, described and reconstituted the theoretical relations that have been conceptual or empirical to investigate in earlier studies is a major theoretical contribution of this research (Dwivedi et al., 2023a). The theory of planned behaviour is where psychological concepts describe consumer psychology when they are interacting with chatbots and also brings transformation in the firm's operational process (Ajzen, 2011; Dwivedi et al., 2023a). As per social response theory (Nass & Moon, 2000; Nass et al., 1994), human–computer interactions (HCIs) are essential for people in an automated environment who unconsciously think of computers as social actors. Even though they know machines do not have emotions or motives they interact with conversational AI, establishing social bonding to provide the right products and better services as anthropomorphic embodiments through digital avatars in metaverse marketing (Adam et al., 2021).

Diffusion of innovation (DOI) theory emphasises innovation's impact on customer experience and firms' introduction of new product development, marketing strategies and sales forecasting through GAI (Baird et al., 2012; Kushwaha et al., 2021; Rogers, 2004). Also, we aligned GAI theory based on functionalities of firms in the finance domain, for example, to adopt a psychology theory in which deep learning techniques are used by NLP to comprehend phrases in 10-K accounting filings (Nguyen et al., 2020), while marketing algorithms implement emotion regulation theory through NLP analysis where customer emotions of products/brands are traced in social media in terms of word-to-word processing (Herhausen et al., 2019) and operations management algorithms identify the topic modelling in the AI language model to bring efficacy in the firms (Ko et al., 2019).

Implications for Stakeholders

Without knowledge of the potential GAI it is difficult to conduct regular assessments while making decisions for major stakeholders which includes organisations, managers and societies in business. So this study entails and suggests

the implications to provide the solutions for the firms success are:

Organisations:

The firms need to know the global environment and market dynamics before implementing GAI and LLMs for growth context. GAI has the significant capabilities and various industries must be aware of and leverage ChatGPT-3, -4, -5 and other iteratives to establish the business model and provide services in a competitive settings. Since it is a self-chat conversation agent, the organisations need to focus on introducing a new feedback technique able to improve performance and minimise risks. Further, companies that implement modern GAI-enabled robotic process automation systems and read the codes have to detect fraudulent behaviour while offering services to customers. Then, it is necessary for firms to educate and train employees on prompt engineering to strengthen the prompts on language models and draw a specific outcome to redefine structure, wording or phrases, test and iterate and identify patterns to increase the work performance and efficiency of the AI responses for several innovations, new product development and hybrid customised services. In addition, firms in both private and public sectors focus on AI in ethics for the future iteratives of ChatGPT-5 to address the socioeconomic challenges. The consideration towards GAI regarding ethical issues, laws and regulations at work places particularly to create images, phrases, logos, etc., must be reviewed and aligned with organisational policies. Consequently, the firms have to pay attention to follow the legal considerations while creating names, logos, trademarks or any content on branding or advertising or services mandatory to have prior consent for outcomes. Also, businesses have to conform to environmental policies regarding energy consumption due to the impact of GAI on model development, particularly when using information from data sources. Lastly, organisations also adhere to the laws on data privacy and professional guidelines for business planning and execution using GAI to transform and manage the organisation's climate, culture, employees and society.

Practitioners:

Managers must understand the emerging disruption of GAI LLMs in a wide range of sectors. In fact, managers and employees identify the significance of platform language models such as OpenAI/GAI/ChatGPT, etc., for generating and analysing different scenarios using an extensive variety of data inputs as well as improving profitability and prediction accuracy and achieving organisational flexibility. Then, managers should train employees to understand the data or use computational resources for iteration or innovation, marketing content, product details, service information and promotional activities. Employees should know how to control and monitor customer feedback and social media conversations. Managers emphasise to the team members the importance of market research to comprehend customer vocabulary, perspectives and attitudes on products, brands and services for mass customisation using GAI to reduce costs and encourage human intervention to increase work performance. Apparently managers are able to communicate with employees using real-time data rather than historical data to make strategic decisions to achieve a competitive advantage. Also, managers supervise employees or marketers to understand empathy with customers when chatbots interact with consumers otherwise it leads to customer dissatisfaction or disengagement. Then, this technology establishes high-quality services like digital banking, e-retailing, smart logistics, e-recruitment, digital healthcare, etc., to customers; hence, frontline employees must be aware of the data patterns, creativeness in responses and interactions to establish excellent CRM in a GAI-driven world. Talent management in firms is compulsory to recruit data science experts to know and reveal the importance of algorithms, prompts and challenges during data analysis to reduce biases and encourage ethical decisions. Acquiring management experience and developing best practices with the integration of AI large language models for innovation, new start-ups, new product development, advertising and promotion-related activities is essential for global companies. Additionally, GAI like ChatGPT-3 and ChatGPT-4 (Midjourney V5) has potential to reframe the business and its strategies while managers and employees can understand vulnerabilities in the operational process and address customers' concern. Further, employees and employers must possess skills to identify fraudulent activities and societal bias while using GAI language models to tackle issues and develop policies regarding ethical usage and how to protect data from the threat of cyberbullying.

Society:

GAI and language models are deployed in firms where practitioners have to participate in the decision-making process in order to provide adequate explanations to maintain judicial transparency and reduce machine or human errors. The investors and stakeholders are responsible for utilising GAI to create more business opportunities. The use of GAI and LLMs in various industries to manufacture new products or provide services has to conform to the idea of human dignity, rights, freedom, cultural diversity and inclusiveness. Evidently, this GAI will be developed in industries around the world by sharing ethical principles that benefit society and humans rather than just the organisation. To manage the risks, organisations have to obtain a licence for GAI migration in the workforce. Further, firms must conduct a periodic risk evaluation of GAI models to avoid adverse effects. In order to establish a fair society, it is also essential that companies are truthful

about the limitations of their GAI models and are able to gain the trust of their customers and users. Regulators and policymakers have to formulate a strategic business model using AI-driven solutions capable of addressing issues of bias, data transparency, privacy and security. In the meantime, companies must appoint ethicists and social scientists to assist in addressing social or ethical issues and to reduce false sales data projections. Therefore, it is important to protect individuals who are unfamiliar with GAI and language models and who may require further explanation or understanding in order to develop trust in technologies and make better decisions in the interests of societal welfare.

Future Research Agenda

This section discusses the future purpose of GAI language model research such as ChatGPT, NLP, BERT, DALLE-2 and others, which are expected to play important roles in several businesses. Some of the intriguing future research directions that we envision in the GAI are as follows:

What role does GAI play in behavioural finance in banking sectors, particularly in robotic process automation, when it provides information to external investors?
How does LLM/GAI-driven textual analysis in online shopping raise serious privacy concerns to customers? How can this hybrid personalisation of text analysis be addressed to protect customer data in digital platforms?
How can adoption of GAI avoid a monopoly of services in various sectors while training the datasets to optimise conversational interfaces, given that access to large volumes of data improves outcomes significantly?
To what extent can GAI support brand logos and images as a visual identity in content marketing? How does it differ from other brands in today's competitive world?
How can consumer decision-making be affected based on interaction with content created by GAI? How can this brand loyalty be measured while companies use GAI?
How can GAI affect high-quality content industries which involve high engagement among consumers (like fashion industries)? What are the benefits and challenges of GAI like Midjourney being poised in the fashion sector to improve sustainable fashion?
How can GAI help in online marketing to increase sales? What are the measures to be taken in e-commerce by leveraging GAI like Midjourney to consider to manage the risks in the design process, personalisation and handling customers?
To what extent does the GAI language model help in digital banking for customer personalisation of services?
What are the advantages and impacts of GAI models used in banking sectors to address financial and governance issues?
How can GAI-based conversational agents help in the service sector to enhance customer relationship management and the efficacy of market campaigns through greater flexibility? How can GAI optimise social media content to enable more appropriate and personalised advertising information sharing?
How can GAI support the supply chain and logistics industries specifically in better warehouse management and greater flexibility in planning, route planning and customer services?
How can AI language models impact human resource management specifically in terms of recruitment, performance appraisal, compliances and training in the firms?
How could user groups interact with GAI-enabled platforms in the sharing and circular economy era in terms of their trust and behaviour?
How does GAI help organisations provide flexibility to their operational processes while training datasets for a continuous learning process strategy?
How can GAI improve the flexibility of firms in their Chain of Thought (CoT) and Internet of Behaviours (IoB) for logical reasoning in response to consumer queries?
To accomplish scalability in the firms, how can GAI help researchers and industry professionals comprehend the large scale of various tasks such as natural language understanding, computer vision and speech recognition for new product development, generating content for promotional activities and to address the customer queries?
How can GAI tackle social issues, bias and ethical concerns in the AI applications in firms without compromising performance?
What are the benefits and risks of using GAI in marketing, and how will the tools change the marketing business scenarios to achieve organisational success?
How can GAI tools facilitate the decentralisation of marketing, business, and cultural actions in firms to achieve sustainability?
How can GAI be used in firms to speed up current marketing tactics like mass customisation and crowdsourcing and to create novel marketing content for branding and promotional activities?
How significantly does GAI alter the role of expertise and businesses on the market by establishing value on customer satisfaction, trust, loyalty, brand affection, etc.?

How does GAI influence creativity and problem solving in various sectors to achieve firms' flexibility, and what are its advantages and disadvantages?
How will firms distinguish one another using textual, graphical and audible content when the content is generated by GAI? What is the purpose of people as creators of value in the world? Which complementors or stakeholders will be impacted the most?
What is the perception of users about how consumers respond to products and services developed by GAI? Will the users reveal that AI usage changes people's notions in terms of quality and will their implication affects the competition and product differentiation in the firms?
How can digital platform providers handle and regulate the employment with use of GAI and be able to create a digital environment with increased alignment among all stakeholders for future business chains?
How might GAI amplify and address the existing social inequalities, emotional and mental well-being of users and ethical concerns on data privacy, bias and accountability?
Does GAI remove obstacles to self-expression and encourage more active user participation in the digital platform to promote their business?
How does GAI contribute to the democratisation and empowerment of underrepresented groups including skills, costs, language barriers and technological compatibility in the firms?
How could GAI impact and enable the business model to adapt based on content developed by firms, and how does it affect the business value propositions when content can be generated artificially in large quantities? What are the strategies incorporated by the firms to handle this?
Application Programming Interface (APIs) are offered by many modern GAI systems in the firms for innovation and strategies. How can GAI change the brand-new business structures based on API?
How do boundary resources adapt for the automated content on a digital platform and what are the strategies considered by governments to accept content produced by GAI?
How does GAI influence beyond digital platforms? How does society get affected and what initiatives can governments use to bring changes in operational process in the public sector?
How can GAI-based interactions have an impact on human skills based on their negative or positive prompts on cognitive abilities of the individual users? How can GAI adversely affect the cognitive skills and overall development of user groups?
How can the implementation of GAI result in disruption along with the loss of internal data, knowledge and trade secrets? How can practitioners establish suitable governance procedures to manage GAI initiatives to prevent an unexpected outcome of GAI adoption in businesses?
How do GAI models affect social ethics, cultural bias and the well-being of users in the data-driven world? How can fairness, inclusivity and biases be addressed in GAI implementations?
How should GAI models be regulated to reduce cybersecurity risks? What are the measures taken by the firms and society to handle privacy while maintaining access to a large amount of high-quality data?

Conclusion

This research focused on examining the influence of GAI with LLMs deployed in various sectors. Further, utilising large language models in a variety of industries is a promising area of study that offers numerous opportunities to enhance customer experience and provide more personalised services. Also, this article provides information on applications of GAI language models in various sectors and functions which deliver benefits to the organisations and customers to enhance flexibility. To sum up, this article provides the outline of GAI language models' benefits which draws attention to the prospective potential for industry practitioners and academicians to be able to bring flexibility to potential avenues for further innovation.

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Conflict of interest The authors declare no conflict of interest.

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Key Questions Addressed

1. How does generative AI (GAI) bring flexibility in managing industrial offerings and services in firms?
2. What are the implications of using GAI language models across a variety of functions and industries?
3. How may GAI implementations create positive and adverse outcomes in firms in both tactical operations and strategic issues?
4. How may firms manage the disruptions introduced while adopting GAI?

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