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Review

Enhancing Work Productivity through Generative Artificial Intelligence: A Comprehensive Literature Review

Humaid Al Naqbi, Zied Bahroun * and Vian Ahmed

Department of Industrial Engineering, College of Engineering, American University of Sharjah, Sharjah P.O. Box 26666, United Arab Emirates; b00061471@aus.edu (H.A.N.); vahmed@aus.edu (V.A.)
* Correspondence: zbahroun@aus.edu

Abstract: In this review, utilizing the PRISMA methodology, a comprehensive analysis of the use of Generative Artificial Intelligence (GAI) across diverse professional sectors is presented, drawing from 159 selected research publications. This study provides an insightful overview of the impact of GAI on enhancing institutional performance and work productivity, with a specific focus on sectors including academia, research, technology, communications, agriculture, government, and business. It highlights the critical role of GAI in navigating AI challenges, ethical considerations, and the importance of analytical thinking in these domains. The research conducts a detailed content analysis, uncovering significant trends and gaps in current GAI applications and projecting future prospects. A key aspect of this study is the bibliometric analysis, which identifies dominant tools like Chatbots and Conversational Agents, notably ChatGPT, as central to GAI's evolution. The findings indicate a robust and accelerating trend in GAI research, expected to continue through 2024 and beyond. Additionally, this study points to potential future research directions, emphasizing the need for improved GAI design and strategic long-term planning, particularly in assessing its impact on user experience across various professional fields.

Keywords: generative artificial intelligence; work productivity enhancement; management; chatbots; ChatGPT; ethics; knowledge management; review

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1. Introduction

Over recent decades, we have seen remarkable advancements in science and technology, bringing benefits across various sectors and disciplines. Today, we are immersed in an era defined by revolutionary changes, driven mostly by significant strides in digital technology, particularly Artificial Intelligence (AI). Consequently, experts widely anticipate a growing impact of AI on the economy in the coming years, paralleled by an increasing interest in its diverse applications [1]. This indicates that the world is going through an unprecedented transformation in the field of AI, a field that aims to better serve humanity [2]. Moreover, advances in Generative Artificial Intelligence (GAI) have notably expanded textual material production techniques in job automation. GAI, particularly through Large Language Models (LLMs), focuses on the autonomous creation of creative content. These LLMs, considered fundamental algorithms, represent a major leap in the field [3]. After OpenAI introduced a free trial of the ChatGPT-3.5 model in 2022, LLMs gained widespread appeal [4]. To elaborate further, OpenAI is at the forefront of the Artificial Intelligence revolution. Its ChatGPT bot has created significant buzz in the tech community. Remarkably, ChatGPT attracted over 100 million monthly active users in just about two and a half months, making it the fastest-growing web application in history [5]. This huge success has led technology companies to accelerate and produce upgrades and new AI-powered products, such as Bard and Claude, to keep up with this rapid technological revolution [6].

According to Feuerriegel et al. [7], the term "generative" in the context of AI refers to an AI system's capacity to generate new material autonomously, without human involvement.

This content, which may be text, image, audio, or video, interacts with specific standards or guidelines [8]. The aim of advancements in Artificial Intelligence is to achieve a level of creativity and innovation that surpasses human capabilities. This goal is evident in how ChatGPT leverages its creative abilities to simplify and add enjoyment to interactions with technology [9]. On the other hand, generative AI is more than just a new technology tool; it is a transformative engine that reshapes not only how we live and work but also expands the horizons, paving the way for limitless possibilities in the workplace environment [10].

More specifically, GAI is used in a variety of disciplines, including healthcare, education, art, environment, etc., where it plays an important role in aiding and accelerating the content production process [11]. According to Mao et al. [12], GAI personalizes learning experiences and creates innovative educational materials. Moreover, Mao et al. [12] claim that this technology allows the creation of new and innovative educational materials based on educational data. In medicine, generative AI helps diagnose diseases and provides healthcare [13]. Additionally, GAI empowers businesses to create effective marketing materials and fosters innovation in the arts and cultural sectors [14]. As a result, GAI extends beyond conventional uses, becoming a key driver of transformation across various industries.

These revolutionary discoveries in the field of Artificial Intelligence, which have occurred in many industries and disciplines, are seen as a fundamental transformation not only in its impact on the daily lives of individuals but also in its consequences for organizations [15]. This progress underscores the importance of leveraging advanced programs and technologies to enhance and sustain organizational performance. Increasing efficiency has become a universal goal across private, public, and government sectors worldwide. Consequently, corporate executives are now considering integrating this technology into their operations. In this context, the strategic use of GAI in corporate settings is being recognized as a promising solution to enhance work productivity. Moreover, the technical innovations in GAI present a unique approach for businesses to address productivity challenges within organizational frameworks [16]. As a result, companies of all sizes are actively considering the use of AI technology to gain a competitive edge [17]. GAI has the potential to dramatically boost productivity by eliminating mistakes, enhancing decision making, and simplifying challenges [18].

This review delves into applications of GAI in various professional settings, the tools and techniques used, and the effectiveness of GAI in academia, research, engineering, technology, communications, cultural studies, agriculture and agricultural sciences, government, public administration, and business. As such, this study aims to provide a comprehensive overview of the potential of GAI technologies and their use to increase productivity at work in these areas and focuses on analyzing and compiling a range of existing reviews on GAI in the above-mentioned areas. Hence, this paper is a guide for academics, users, and regulators who are keenly interested in researching the revolutionary relationship between GAI and work productivity.

The structure of this review study unfolds as follows: The paper begins with a comprehensive methodology in Section 2, which outlines the systematic literature review process conducted in four stages. This section details the rigorous steps involved in gathering and analyzing the literature on the utilization of GAI to enhance employee productivity in various professional settings. Following the methodology, this study proceeds with a detailed content analysis that explores the fundamental impact of GAI across diverse professional sectors, including academia, engineering, technology, communications, and more. This analysis seeks to discern the transformative role of GAI in these fields, particularly focusing on its capacity to enhance work productivity. Subsequently, a thorough bibliometric analysis is conducted, offering a critical examination of the proliferation and regional distribution of GAI research, as well as insights into key AI tools and interdisciplinary collaborations. The paper ends with a conclusion in Section 5 that synthesizes the key findings, discusses the implications for future research and practice, and provides insights into the prospective trajectory of GAI in enhancing work productivity across various professional disciplines.

2. Methodology

According to Sanjay [19], a systematic literature review is conducted in four stages. This section will therefore discuss the steps followed to gather and analyze the literature on the use of GAI to enhance employee productivity in the modern workplace, as explained below:

- Literature retrieval—The first and most important step in the data collecting process, this step comprises selecting acceptable search keywords and key phrases to thoroughly gather relevant articles relating to the targeted topic. Pre-existing papers and publications in several areas of employee competency development were collected from the Scopus database. The above process was carried out using a list of keywords, such as "productivity", "Conversational AI", "employees", "Chatbot", "Generative Artificial Intelligence", "efficiency", "workers", "ChatGPT", and "GAI". Thus, authors were able to conduct more targeted research across titles, keywords, and abstracts as a result of these phrase combinations. Over the years 1989 to September 2023, the main data-gathering method resulted in the inclusion of 683 research publications.
- Literature screening—The PRISMA statement, a well-known and stringent technique for performing systematic reviews and meta-analyses, affected the literature screening procedure in this investigation as indicated in Figure 1. This technique provides an organized structure for ensuring the systematic identification, selection, and evaluation of the relevant literature, hence improving the review process's accuracy and repeatability [19]. Initially, 683 papers were collected for this study. After removing duplicates, 646 papers remained. Further rigorous review to align with the research scope reduced this to 159 relevant reviews, articles, and publications from 2014 to September 2023.

Figure 2 visually illustrates the increase in the number of publications related to the topic over this period, and the chronological chart highlights a surge in publications, particularly in 2023. This trend, showing a rapid increase since 2014, correlates with the rise of advanced GAI tools like ChatGPT. This research reflects the recognition of AI's potential to enhance professional performance, leading to heightened awareness among business leaders, managers, and government agencies about the benefits of integrating AI into their operational activities and organizational frameworks.

- Content analysis—The content analysis process involved a thorough examination and organization of a large body of material, particularly research journals, to identify recurring themes and patterns. This study's focus was on exploring how GAI enhances staff efficiency, categorizing articles into distinct categories and sub-fields. This systematic classification provided a comprehensive understanding of GAI's multifaceted impact within organizations, facilitating the extraction of significant findings and insights from the data.
- Bibliometric analysis—The bibliometric analysis in this study systematically examined the academic literature, focusing on citations and references within articles. Its goal was to enhance understanding of the impact, trends, and connections in academia. By analyzing citation patterns, co-authorship, and keywords, it identified key authors, pivotal publications, emerging research areas, and collaborative networks.

The subsequent sections will therefore methodically carry out both content and bibliometric analyses, adhering closely to the previously outlined methodologies. This structured approach ensures a comprehensive and accurate assessment of the research.

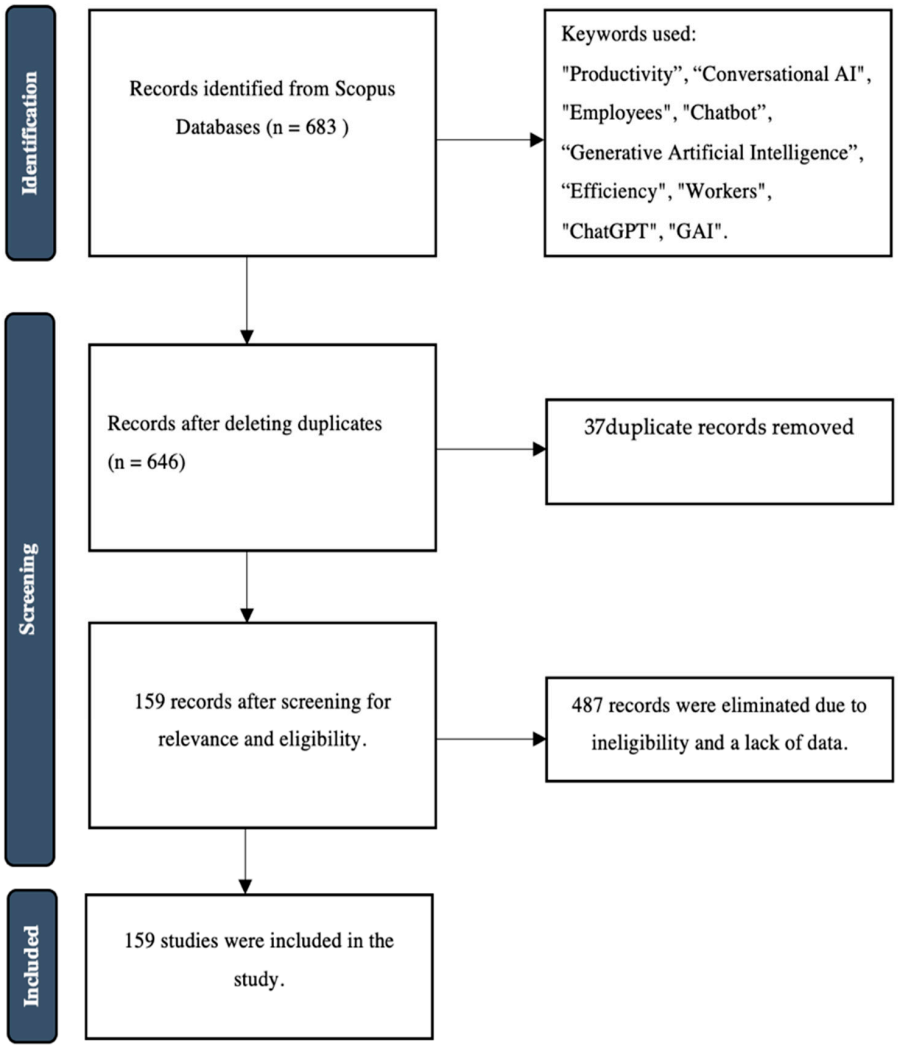

Figure 1. Literature screening approach.

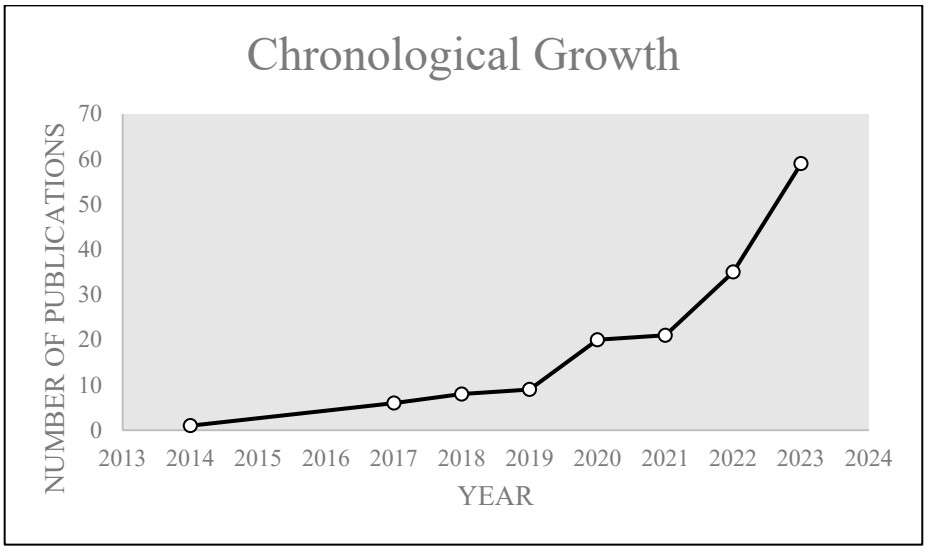

Figure 2. The number of articles and publications related to the use of GAI to improve employee productivity (2014–2023).

3. Content Analysis

The integration of GAI into professional settings is generating significant interest due to its potential to enhance employee performance. This includes automating tasks, improving data analysis, assisting decision making, and offering customized services, all while reducing errors and operational costs. This section aims to conduct an in-depth content analysis to evaluate GAI's application in diverse professional areas, thereby shedding light on its impact on workplace productivity.

3.1. Application of GAI in Academia and Research

Taking the lead from chatbots, these technologies have begun to improve organization and communication within the academy, paving the path for new methods to handle assignments more successfully. Hence, this section focuses on a curated collection of research articles that examine the role of GAI in academia and research. As detailed in Table 1, the objective is to assess various aspects of GAI technologies, particularly their impact on productivity enhancement for academics and professionals in these fields.

Table 1. The applications of GAI in academia and research.

Themes	Authors	Focus
Using GAI to improve academic and research workflows	Budhwar et al. (2023) [20]	Investigates the complex relationship between GAI and Human Resource Management (HRM), analyzing the deep repercussions of new technologies on employment dynamics and giving useful insights for HRM practitioners and scholars.
	Varnavsky (2022) [21]	Demonstrates a transformational approach to the "Flipped Classroom" teaching style, employing a Telegram chatbot to improve student engagement with course materials and evaluations, appealing to educators and researchers looking for increased efficiency.
	Košecka et al. (2022) [22]	Indicates the benefits of integrating chatbot services within universities to improve operational effectiveness and efficiency, with a particular emphasis on their adoption in university contexts, improving educational institutions through the use of Generative AI Models.
	Sebastian and Nugraha (2021) [23]	Highlights the cost-effective use of chatbots for streamlined customer service management across academic institutions' numerous online accounts, emphasizing optimization of resources in response to the expanding social media environment, and providing insights into the use of Telegram API and webhook methods.
	Suresh et al. (2021) [24]	Addresses the issue of insufficient career assistance for university students and graduates by developing an effective chatbot that provides job advice. This project assists individuals in making educated professional decisions that are in line with their interests and beliefs.
	Colace et al. (2018) [25]	Prioritizes university student support by creating a chatbot prototype committed to supporting academic institutions and their students.

Table 1. *Cont.*

Themes	Authors	Focus
Ethical issues in AI-enhanced academia and research	Dergaa et al. (2023) [26]	Examines the influence of ChatGPT and other Natural Language Processing (NLP) technologies on academic efficiency, addressing possible ethical and credibility issues in research and writing, and engaging academics, researchers, and individuals in a critical analysis.
AI-powered tools are transforming education and research	Leiker et al. (2023) [27]	Analyzes the incorporation of generative AI into educational video content; this evaluation examines the potential of AI-generated materials as alternatives for traditionally created instructional videos, with the goal of improving accessibility in online education.
	Muhyidin et al. (2021) [28]	Investigates the area of chatbot-based communication media, delving into development and quality assessment to improve information distribution and communication efficiency within the field of chatbot-based public relations communication, using advanced Chatbots and Conversational Agents for academics and education.
	Irwan et al. (2023) [29]	Examines strategies for forecasting water quality, with a special emphasis on AI-based models. The goal of this investigation into water quality prediction using AI algorithms and approaches is to aid researchers, professionals, and specialists in the area.
	Ren et al. (2020) [30]	Highlights efficient adversarial text creation for attacking text classification models and goes into the subject of NLP {XE "Natural language processing: (NLP)"} adversarial machine learning. This specialist information is intended for academics, researchers, and experts, and provides insights into the interconnections between AI methods and security concerns.

The analysis of selected papers offers significant insights into how GAI, especially through chatbots, is transforming academia. These technologies notably boost administrative and informational efficiency in educational environments. Additionally, GAI-driven instructional materials are poised to revolutionize educational content creation, promising resources that are both high-quality and cost-effective. The adaptability of chatbots, particularly in applications involving Natural Language Processing (NLP) and adversarial machine learning, supports innovative teaching methodologies such as the flipped classroom model. However, to effectively integrate chatbots in educational settings, a comprehensive understanding of unique educational demands and challenges is essential.

The research provides important insights into GAI's application in academic and research settings. However, it also highlights ethical concerns surrounding the use of AI technologies like ChatGPT and NLP in these areas. These concerns emphasize the necessity of addressing ethical challenges to maintain the integrity and productivity of academic and research environments. The research suggests that future studies should focus on identifying and managing these ethical issues to ensure the responsible incorporation of GAI in academia, safeguarding its integrity and ethical use.

3.2. Application of GAI in Engineering and Technology

In many engineering and technological fields, Generative Artificial Intelligence (GAI) has become a disruptive force that increases employee performance. As such, innovation is on the rise, and the pace of work is accelerating. This section therefore contains 20 unique

and outstanding articles that demonstrate the impact of GAI on enhancing efficiency, improving safety, and enhancing creativity. These articles are categorized into three distinct groups, as detailed in Table 2, providing an organized overview of GAI's impact in these specific fields.

Table 2. The applications of GAI in engineering and technology.

Themes	Authors	Focus
Design automation and engineering efficiency	Wang and Vinogradov (2023) [31]	Emphasizes increasing Early Failure Detection (EFD) {XE "Early Failure Detection: (EFD)"} in industrial machine components by using an intelligent data analysis technique called Acoustic Emission (AE) {XE "Acoustic Emission: (AE)"} signal processing, with a main goal of improving efficiency and accuracy for industrial machinery maintenance experts.
	Ratajczak et al. (2023) [32]	Provides algorithm-aided design workflows in architecture, offering a methodology and toolkit to enhance design processes by incorporating modern methods and methodologies, optimizing building shape and window-to-wall ratio while taking energy and daylight performance into account; this increases architect and designer productivity.
	Zhao et al. (2022) [33]	Investigates the combination of generative architectural design and technology integration, addressing obstacles to selecting aesthetic solutions through performance-based generative design, and integrating a technology-driven solution based on Sketch-Based Image Retrieval (SBIR) {XE "Sketch-Based Image Retrieval: (SBIR)"} algorithms to improve architectural design productivity.
	Zhang et al. (2021) [34]	Demonstrates a technical approach that combines architecture, energy optimization, and Artificial Intelligence to automatically generate and evaluate design strategies for energy-efficient residential buildings, as well as discuss the use of a text-based chatbot for staff participation in completing workplace mental health assessments.
	Manuel et al. (2020) [35]	Presents an innovative approach to optimize and construct turbine machinery aimed at achieving targeted performance goals, offering valuable insights and methodologies for industry professionals and technical experts.
	Venkatesh et al. (2019) [36]	Outlines the creation of adaptable hardware designs to enhance cryptographic processes, catering to the requirements of cryptographers, hardware engineers, and information security researchers through the application of traditional exponential techniques in Diffie–Hellman protocols.
	Ahmad et al. (2023) [37]	Examines Architecture-Centric Software Engineering (ACSE) {XE "Architecture-Centric Software Engineering: (ACSE)"} and focuses on the critical role of AI-powered DevBots like ChatGPT in optimizing software architecture design for increased effectiveness and productivity, with a key audience of software architects, engineers, and researchers in mind.
	Liu et al. (2022) [38]	Identifies a ground-breaking strategy for mechanical fault detection in wind turbines, demonstrating a transfer learning technique based on Conditional Generative Adversarial Networks (CVAE-GANs), resulting in improved mechanical fault diagnostic efficiency and efficacy.
	Zhu et al. (2022) [39]	Discovers the Chemical Genetic Algorithm for Large Molecular Space (CALM), {XE "Chemical Genetic Algorithm for Large Molecular Space: (CALM)"} a unique method developed for efficient creation and optimization of molecules with particular features, with an emphasis on enhancing the performance and efficiency of molecular generation and optimization procedures.

Table 2. *Cont.*

Themes	Authors	Focus
GAI improves Human–Machine Interaction	Nawrocki et al. (2021) [40]	Explores the development and integration of chatbots to improve communication and provide personalized event-related information, using Natural Language Processing (NLP) and Human–Computer Interaction (HCI) {XE "Human-Computer Interaction: (HCI)"}, with a focus on providing specific information to event and conference participants via chatbot technology.
	Badini et al. (2023) [41]	Investigates the use of ChatGPT for optimizing the Additive Manufacturing (AM) process, with a primary emphasis on improving the speed and precision of G-code generation for 3D printing.
	Tsai et al. (2021) [42]	Examines the potential of chatbot technology in increasing the productivity of government disaster response and safety processes, with a focus on disaster response and safety measures.
	Shi (2022) [43]	Focuses on using AI techniques to improve creative and artistic processes in representation art, particularly on improving image generation quality, investigating the development of a new activation function (SReLU), and employing Convolutional Neural Networks (CNNs) {XE "Convolutional Neural Networks: (CNNs)"} and Generative Adversarial Networks (GANs). {XE "Generative Adversarial Networks: (GANs)"}
	Meng and Schaffer (2020) [44]	Reveals the development of tools aimed at improving security reporting in railway settings, with a particular emphasis on improving the performance of railway security staff and personnel through the integration of conversational interfaces, which falls under the domain of Railway Security and Mobile Multimodal Interaction.
	Zhong et al. (2020) [45]	Considers the combination of NLP and Deep Learning techniques in the construction sector to deliver rapid replies via the chatbot-based question answering system (QAS4CQAR), with the goal of optimizing energy usage and efficiency.
	Lin et al. (2018) [46]	Studies the creation of a task-oriented chatbot application aimed at monitoring and accessing information associated with the front-end system of a Taiwanese photon source, with the aim of improving the efficiency of defect detection and information retrieval.
	Angeline et al. (2018) [47]	Points out the integration of Artificial Intelligence and the Internet of Things (IoT) into supermarket automation to improve customer satisfaction by empowering customers easily and efficiently, while providing support to supermarket chains and companies interested in deploying automated shopping systems.
	Saka et al. (2023) [48]	Offers a systematic review of Conversational AI in the Architecture, Engineering, and Construction (AEC) {XE "architecture, engineering, and construction: (AEC)"} industry, with the goal of understanding its present-day development and exploring possible applications, obstacles, and opportunities, emphasizing the importance of improving productivity and efficiency in the AEC industry through the use of Conversational AI.
AI-boosted creativity and safety in selected fields	Yazici (2020) [49]	Indicates the improvement in architectural decisions by combining data on geometry, materials, and structural performance, with an emphasis on improving time savings and design outcomes through the use of Machine Learning (ML) techniques such as Artificial Neural Networks (ANN), Non-Linear Regression (NLR), and Gaussian Mixture (GM).

The integration of Generative Artificial Intelligence (GAI) in engineering and technology sectors marks a significant leap in operational efficiency, safety, and innovation.

The analysis indicates that GAI notably improves the precision in identifying and rectifying defects, which enhances workplace safety and reliability while reducing operational downtime. Furthermore, the implementation of chatbots has emerged as a pivotal factor in refining human–machine interactions. This advancement leads to more efficient information exchange and task execution across various fields, highlighting GAI's transformative impact in these sectors.

The integration of GAI into engineering and technology is transformative, enhancing productivity in various professional roles. Key issues such as practicality, bias, and human skill preservation are critical to ensuring that GAI aligns with company standards. This analysis suggests that technologies like chatbots in disaster response should complement, not replace, human expertise. A balanced approach, where GAI tools augment rather than dominate the workplace, is essential. These findings propose that the successful implementation of GAI hinges on careful application and ongoing evaluation to maximize effectiveness in these fields.

3.3. Application of GAI in Communication and Cultural Studies

Generative AI continues to grow as one of the new approaches to improving productivity in communication and cultural studies. This technology is an important tool to reflect the improvement and transition in how individuals interact with cultural diversity and how people perceive the continuing progress in communications. To elaborate more, this section delves into the challenges and applications of GAI for enhancing efficiency in communications and cultural studies. The six selected articles in Table 3 are categorized based on their primary focus, with specific themes outlined for each.

Table 3. The applications of GAI in communication and cultural studies.

Themes	Authors	Focus
Enhancing user experience and perception with chatbots	Zhou et al. (2023) [50]	Evaluates the impact of chatbots on users' perceptions of communication effectiveness, offering findings with implications for chatbot design, and using chatbots broadly in multiple situations.
	Wagner et al. (2022) [51]	Investigates the dynamics of group chatbots in multi-party dialogues, focusing on coordinating and negotiating collective appointments. This study aids in enhancing user interface and interaction design for multi-user chatbot systems, with the goal of refining chatbot behaviors in group settings to boost user engagement, usability, and overall efficiency.
AI in cultural contexts and tourism	Casillo et al. (2022) [52]	Emphasizes the use of ontological approaches and chatbot technology to personalize and enrich the cultural heritage tourism experience, particularly in the framework of technology applications for cultural heritage and experiential tourism, with the goal of enhancing cultural heritage discovery and learning through digital technologies.
	Carvalho and Ivanov (2023) [53]	Analyzes the applications, benefits, and risks of ChatGPT and large languages in the tourism context with the goal of developing a research agenda to investigate their implications in the industry, with a focus on the use of AI, specifically ChatGPT, in tourism and hospitality to increase efficiency and productivity.
AI in industry-specific communication	Lopezosa et al. (2023) [54]	Provides insights into the integration of AI tools such as ChatGPT in journalism education, offering a training program for this integration based on interviews with college professors and academics to assess the potential uses and implications of AI in this field, with a focus on improving productivity in content production tasks.
	Płaza et al. (2022) [55]	Includes the creation of an emotion classification system for detecting emotions in conversational material in the contact center business, with a specific emphasis on NLP and emotion recognition applications to improve customer experience in contact centers.

This section's content analysis on GAI in communication and cultural studies reveals how chatbots enhance user experience and perception, evolving from mere information providers to significant influencers of organizational brand image. The concept of "conversational branding" emerges, where chatbot interactions directly impact brand perception. Chatbots also streamline operations by handling routine queries, allowing human staff to focus on complex tasks, thus boosting overall workforce efficiency. The seamless integration of chatbots in communication strategies demonstrates a symbiotic relationship between user experience and productivity.

In cultural and tourism contexts, GAI plays a significant yet subtle role in enhancing productivity. For instance, GAI enhances a tourist's experience by providing personalized recommendations and guidance, leading to more efficient and enjoyable trips. This optimization extends to industry-specific communication, facilitating more productive interactions. GAI's ability to simultaneously improve user experience and professional efficiency makes it a valuable tool in various communication sectors.

3.4. Application of GAI in the Medical and Healthcare Discipline

Technologies and inventions advance at a rapid pace to meet the demands of a heterogeneous society, as do communications improvements while their influence seems to spread across the medical and healthcare discipline. As the influence of technologies and inventions spreads to all parts of medicine and healthcare, GAI is emerging as a key driver for changing the dynamics of this field. Thus, this section reviews research on the adoption of GAI technologies in healthcare, focusing on the most recent papers listed in Table 4. This selection provides a contemporary perspective on how GAI is influencing medical practices.

Table 4. The applications of GAI in the medical and healthcare Discipline.

Themes	Authors	Focus
Enhancing healthcare communication and support with GAI	Comulada et al. (2023) [56]	Explores the use of chatbots in the treatment of Human Immunodeficiency Virus (HIV) {XE "Human Immunodeficiency Virus: (HIV)"} and healthcare support, with a special emphasis on improving the efficiency and convenience of healthcare interventions, particularly in the context of HIV.
	Gala and Makaryus (2023) [57]	Highlights the importance of healthcare personnel having excellent training to maximally utilize AI and model languages while addressing possible dangers and limitations, particularly helping to improve cardiology practice by combining these algorithms.
	Santandreu et al. (2023) [58]	Examines issues associated with interaction in healthcare, focusing on the potential advantages of technology such as ChatGPT and NLP tools while noting that such tools should enhance human engagement in healthcare environments rather than replace it entirely.
	Nandini et al. (2023) [59]	Illustrates the prospective benefits of using chatbots with Artificial Intelligence for medical consultations, with the primary goal of increasing medical support and patient care in the medical sector.
AI in medical decision making and diagnosis	Lecler et al. (2023) [60]	Provides perspectives on the applications of ChatGPT in radiology practice, including report generation, clinical decision support, and patient communication, with the aim of increasing radiology practices through AI and GAI-based models.
	Ong et al. (2023) [61]	Focuses on improving the delivery of healthcare by investigating the possibilities of AI technologies, such as ChatGPT and LLMs, to improve the treatment of patients, promote health equality, and battle healthcare inequities in marginalized regions.

Table 4. *Cont.*

Themes	Authors	Focus
	Yang et al. (2023) [62]	Intends to improve the efficiency of clinical diagnosis and treatment results inside medical question-and-answer systems by addressing data disparities and pseudo-correlation concerns, with a focus on a counterfactual-based method for enhancing medical question-answering.
	Bussola et al. (2023) [63]	Introduces the "PathologyAI" system, with an emphasis on automating the inspection of pathology slides using AI technology, and focuses on a technological method for automating pathology analysis, notably in the context of animal toxicity studies.
	Grupac et al. (2023) [64]	Discusses how ChatGPT may aid medical professionals and patients in evaluating complicated healthcare data and delivering individualized treatment suggestions, with a special focus on medical decisions and personalized healthcare.
	Panthier and Gatinel (2023) [65]	Assesses ChatGPT's success in passing the European Board of Ophthalmology (EBO) {XE "European Board of Ophthalmology: (EBO)"} exam in French, as well as its prospective role in enhancing productivity in medical education and knowledge evaluation.
AI advancements in healthcare technology and research	Tustumi et al. (2023) [66]	Investigates the role of Machine Learning (ML), specifically ChatGPT, in the healthcare sector, particularly in assisting medical teams in identifying, treating, and preventing diseases using evidence-based protocols and data-driven decisions, with the overarching goal of improving healthcare efficiency through the use of AI.
	Escorcia et al. (2023) [67]	Centers on the use of Artificial Intelligence and blockchain technology in Internet of Things (IoT) {XE "Internet of Things: (IOT)"} healthcare systems, with a focus on the development of an innovative system (AIBS-IoTH) intended to improve energy efficiency and security in medical information management.
	Strunga et al. (2023) [68]	Emphasizes the use of sophisticated Artificial Intelligence (AI) software in orthodontic treatment, with the goal of improving the accuracy, efficiency, and patient experience in this field through the use of AI-based evaluation and tracking software.

This section synthesizes findings from selected studies on GAI integration in healthcare, focusing on enhancing medical tasks. GAI tools, especially chatbots, and ChatGPT, are highlighted for their potential in healthcare communication and support. Therefore, for effective implementation, healthcare organizations should enhance efficiency by becoming familiar with GAI tools and training their staff to mitigate risks. The authors note chatbots as key in simplifying healthcare interactions, enhancing staff productivity, and improving patient care.

Other studies focus on GAI's technical aspects in healthcare, like automated pathology, clinical decision support, and radiology practices, aiding clinicians and reducing diagnostic errors. GAI enhances healthcare delivery by streamlining medical procedures. It also explores medical data reliance, secure IoT data transmission, and orthodontic advancements. GAI's applications in healthcare encompass assessment, treatment, and research, with the aim of providing informed decisions, protecting privacy, and introducing innovative methods to medical practices.

The integration of GAI in healthcare suggests transformative potential in medical practices. While GAI enhances efficiency and potentially improves patient outcomes, it raises potential privacy challenges regarding medical data. This necessitates the development of ethical frameworks to balance efficiency gains with data privacy. The focus should be on

aligning healthcare efficiency improvements and data protection to fully benefit from GAI in healthcare settings.

3.5. Application of GAI in Agriculture, Agricultural Sciences, Government, and Public Administration

Human experience and technology have come together at a new crossroads, with Generative AI emerging as a conduit for a radical shift in agriculture, agricultural research, governance, and public administration. This section, as outlined in Table 5, reviews research on implementing GAI in these sectors, focusing on its potential to enhance employee performance.

Table 5. The applications of GAI in agriculture, agricultural sciences, government, and public administration.

Themes	Authors	Focus
Transforming agricultural sustainability and public governance	Wang et al. (2021) [69]	Points out the application of AI-powered chatbots to improve consumer experience and productivity in the agricultural sector, with results demonstrating the suitability of a hybrid recall generation approach for agricultural chatbots, evaluating their efficiency and construction costs, and exploring customer satisfaction factors in Taiwan's agricultural sector.
	Feitosa et al. (2020) [70]	Focuses on the development of chatbot prototypes for the Brazilian Ministry of Agriculture with the primary purpose of enhancing the execution of services and providing plant health information.
Precision agriculture and efficient public service delivery	Ramadoss et al. (2023) [71]	Indicates the incorporation of Machine Learning and Artificial Intelligence with the purpose of increasing agricultural output, being under the umbrella of Chatbots and Conversational Agents, catering to farmers and agricultural researchers in this sector.
AI collaboration for agricultural advancements and informed governance	Usip et al. (2022) [72]	Utilizes agricultural technology and knowledge propagation, naming the government as an ideal client for obtaining input on governance through agricultural services, to enhance agricultural knowledge availability and production with a mobile chatbot created exclusively for crop producers.
	Tsai et al. (2021) [73]	Explores government agencies, particularly those involved in disaster response operations, and their experiences with deploying chatbot systems for managing data, with the goal of improving data management effectiveness within the government sector.

The selected articles explore the integration of GAI technologies, like chatbots and ChatGPT, in agriculture, agricultural sciences, government, and public administration. They assess how these tools enhance work scope and productivity, particularly for employees and farmers. GAI is noted for improving user experience, efficiency, and information flow in agriculture. The studies also discuss GAI's potential in government, while acknowledging concerns like accessibility, data privacy, and infrastructure, emphasizing the need for addressing effective GAI application in these fields.

These studies emphasize the strategic use of AI in sectors like agriculture and government, acknowledging specific constraints to broaden GAI's scope. They aim to raise awareness of potential challenges requiring solutions for successful technology adoption. A key focus is on responsible and safe AI integration, underscoring its role in driving positive changes in these fields.

3.6. Application of GAI in Business and Organizational Management

In light of the constant problems and changes in corporate management and organization, Generative AI emerges as a new and stimulating solution to increase company performance and efficiency. Table 6 summarizes a number of specialized studies that demonstrate the potential of GAI applications in the field of business management, with a particular focus on increasing employee productivity in both large and small companies.

Table 6. The applications of GAI in business and organizational management.

Themes	Authors	Focus
Strategic AI integration in business operations	Walkowiak (2023) [74]	Discusses advances in technology and economics, with an emphasis on microeconomics and productivity in the economy, all within the framework of Generative AI Models.
	Bankins et al. (2023) [75]	Explores the impact of AI technology, notably generative AI tools, on individual, social, and organizational aspects, and examines numerous issues associated with human–AI interaction in work settings.
	Araujo et al. (2022) [76]	Focuses on the area of technology adoption and its consequences for organizational processes, with particular emphasis on the Adoption of Conversational Agents and their related expectations at the organizational front lines.
	Makhija and Chacko (2021) [77]	Examines the implementation of Artificial Intelligence (AI) within the financial services context, focusing mainly on its application for reducing expenses, efficiency improvement, and customer engagement, addressing the growth, advantages, obstacles, and customers of AI in this sector, shedding light on both its potential and vulnerabilities.
	Illescas et al. (2023) [78]	Concentrates on the deployment of chatbots in the realms of technological transformation and change management in enterprise, particularly in the context of technology adoption, with the goal of increasing efficiency through automation and chatbot integration to facilitate the digital evolution process.
	Anagnoste et al. (2021) [79]	Assists companies in making well-informed digital transformation judgments by focusing on the topics of digital transformation and automation in business, highlighting the reshaping of business models, decreasing work, and generating occupations more suitable for humans.
	Straßer and Axmann (2021) [80]	Compares individual AI use cases for their applicability to actual logistics applications, with an emphasis on efficiency-enhancing AI solutions in logistics and a larger goal of industrial effectiveness and logistics optimization.
	Chen et al. (2023) [81]	Highlights recent advancements and practical applications of (AI) in business and finance, citing potential benefits, restrictions, and challenges associated with deploying generative AI, resulting in greater accessibility, efficiency, and cost savings.
	Leo et al. (2017) [82]	Explores enterprise-level productivity by improving the efficiency of data science components, with the goal of bridging the gap between the natural language expression of a business workflow and the manual translation of that workflow into algorithmic software.
Empowering employee efficiency and skills development	Al-Ababneh et al. (2023) [83]	Illustrates the real-world advantages of incorporating AI into large companies, such as increased labor productivity and significant cost savings, through an examination of the impact of Artificial Intelligence technology on the performance of large companies, with a particular emphasis on the banking sector.
	Fan et al. (2023) [84]	Investigates the effects of various forms of chatbot flexibility on consumer satisfaction and provides significant information for service providers on the optimal deployment of AI chatbots in customer interactions.
	Saengrith et al. (2023) [85]	Comes under the category of education and human resource development, involving the use of chatbots to improve the ability to solve problems in the workplace, with an emphasis on developing skills for problem solving among employees through integrated training with a chatbot.

Table 6. *Cont.*

Themes	Authors	Focus
	Chithra and Brahmananda (2020) [86]	Provides useful knowledge into the architecture, platforms, development frameworks, and also the benefits and drawbacks of interactive agents, with the goal of improving customer experience and optimizing efficiency across various industries, with a particular emphasis on the use of NLP and NLU technologies.
	Virkar et al. (2019) [87]	Focuses on strategies intended at boosting chatbot conversational skills and improving chatbot interactions in many industries, particularly in the commercial and financial domains to enhance staff productivity.
	Chandar et al. (2017) [88]	Plans the practical implementation of a conversational system aimed to assist new recruits throughout their onboarding process inside a business, with the goal of improving training efficiency through the use of AI-based Conversational Agents.
	Steinbauer et al. (2019) [89]	Emphasizes optimizing business software interaction with chatbots, notably inside Customer Relationship Management (CRM) software, assessing the influence on staff activities and user experiences, and eventually increasing the productivity of customer relationship management and business processes.
AI-driven business transformation and digital evolution	Piyatumrong et al. (2018) [90]	Focuses on enhancing performance in internal information distribution using chatbot technology to improve information exchange within Research and Development (R&D) companies.
	Hsu and Lin (2023) [91]	Falls into the evaluation of the quality of service provided by AI chatbots in customer service with the objective of increasing client satisfaction and trust, and is especially concerned with AI-powered chatbots and their function in customer service.
	Hung et al. (2021) [92]	Provides helpful information into the use of technologies such as Robotic Process Automation (RPA) {XE "Robotic Process Automation: (RPA)"} and chatbots to improve business processes and overall efficiency, focusing on RPA and chatbots in the context of business productivity.
	Silva et al. (2023) [93]	Discusses data from an online survey and uses modeling with structural equations to study the elements that impact consumer preferences to use chatbots for online shopping, with the overriding objective of improving the online shopping experience with chatbots.
	Bialkova (2023) [94]	Delivers perspectives on the aspects influencing customer satisfaction in chatbot interactions, with a particular emphasis on chatbot accessibility, with the goal of improving chatbot functionality and user enjoyment in Human–Computer Interaction (HCI).
Quality and user perception enhancement	Mehrolia et al. (2023) [95]	Investigates the influence of several aspects of chatbot service quality on user satisfaction and retention, while also considering the reducing impact of perceived risk, with the goal of understanding user expectations and improving services delivered by AI-powered chatbots.
	Lappeman et al. (2023) [96]	Analyzes the interaction between privacy issues, confidence, and user self-disclosure, with a particular focus on the convergence of banking marketing and technology, covering digital privacy concerns and their influence on user honesty.
	Kar and Kushwaha (2023) [97]	Offers knowledge about the elements that might determine the success of AI projects in business, notably in the field of business decision making, centered on the use of Artificial Intelligence (AI) to improve decision-making processes and experimentation in the business environment.
	Xu et al. (2022) [98]	Discovers the quality assessment mechanism in user–chatbot interaction examining the relationship between chatbot performance and user perception, and eventually building a model for quality assessment in communication, concentrating on the influence of chatbot performance on user opinion.
	Colace et al. (2017) [99]	Includes the creation of a conversational workflow prototype for a chatbot specialized in wheels, utilizing a Petri-net-based model to offer suitable tires to users, with the goal of improving user experience and efficiency in the tires domain through chatbot interactions.

This section analyzes the impact of AI on business and organizational management. The research spans from AI's strategic integration in banking to enhancing employee skills and user awareness. It offers insights on improving information flow in R&D companies and the role of AI in streamlining business processes and customer service. These conclusions inform strategic decision making for businesses exploring AI's potential to increase staff productivity and operational efficiency. Based on the authors' research and

results, this section thoroughly examines the influence of AI on business and organizational management via GAI applications.

Future research should delve into the impact of enhanced knowledge-sharing platforms on research efficiency, particularly in business and organizational management. This research would guide AI integration and create frameworks for future AI exploration. Additionally, it should focus on addressing challenges in AI integration within research settings, ensuring successful technology application. Key areas include strategic AI integration in business operations, empowering employee efficiency and skills development, AI-driven business transformation, digital evolution, and enhancing quality and user perception.

3.7. Application of GAI in Miscellaneous Professional Fields

GAI has proven itself as an effective resource for increasing employee productivity across a wide range of professional fields. This section reviews studies that focus on the impact of GAI in enhancing employee productivity across various professional domains, as outlined in Table 7. The research provides insights into how GAI technologies are applied and their effects in different professional settings.

Table 7. The applications of GAI in miscellaneous professional fields.

Themes	Authors	Focus
Assessing the impact and potential of GAI in organizational transformation	Dwivedi et al. (2023) [100]	Gives unique visions into the potential benefits and risks of Artificial Intelligence technologies in a variety of sectors, including computer science, marketing, information systems, education, policy, hospitality and tourism, management, publishing, and nursing; it not only seeks to improve productivity across a variety of businesses and areas but also investigates the ethical and legal issues associated with the use of AI.
	Iparraguirre et al. (2023) [101]	Discovers the various advantages and typologies of Artificial Intelligence (AI) in the realm of information systems, delving into the broad surroundings of Conversational Agents (bots) within different subdivisions, encompassing customer service, healthcare, and presentation, all contributing to the advancement of business processes.
	Cao et al. (2022) [102]	Presents insights into prospective applications for customization and user adaption strategies in the context of technical client service chatbots, helping to measure user experience factors in customer support areas.
Enhancing user experiences and productivity with GAI	Temple et al. (2020) [103]	Focuses on increasing employee efficiency and educated decision making through the strategic implementation of cognitive solutions, including AI Algorithms and Techniques, across many organizational fields.
	Banerjee et al. (2018) [104]	Shows the variables driving human decision making and their relevance to chatbots, with a comparative examination of human and AI decision making, offering perspectives to the broader field of AI.
	Deksne and Vasiljevs (2018) [105]	Promotes productivity and client satisfaction through chatbot installation, with application in customer service center development and assessment.

This section highlights achievements in organizational transformation and increased worker productivity through GAI. It acknowledges challenges like data confidentiality and safety, emphasizing the need for robust data security. The section recommends that

while GAI enhances process efficiency and strategy development, it is crucial to balance technology use with human skill preservation and social interaction in the workplace. Some authors view GAI as a tool for better decision making and improving organizational relationships, highlighting the importance of setting appropriate limits in its application.

Future research should focus on evaluating the multifaceted impact of GAI in organizational transformation. This includes exploring GAI's benefits and risks across various sectors, its role in enhancing business processes and user experiences, and addressing the ethical and legal challenges it presents. Additionally, investigating how GAI can improve decision making and customer service effectiveness in organizations would be valuable.

3.8. Application of GAI in Computer Science and Artificial Intelligence

In the era of rapid technological speed, GAI has become recognized as an important force for change in computer science and artificial intelligence. Therefore, this section examines the use of GAI in computer science and AI to boost employee efficiency. With 58 articles, it is one of the most extensive sections, offering a deep dive into GAI's application in professional settings, particularly in the tech industry, as detailed in Table 8.

Table 8. The applications of GAI in computer science and artificial intelligence.

Themes	Authors	Focus
Enhancing professional productivity	Noy and Zhang (2023) [106], Gilardi et al. (2023) [107], Hassani and Silva (2023) [108], Yue and Yuan (2023) [109], Deng et al. (2023) [110], Wang (2023) [111], Weekes and Eskridge (2022) [112], Jo and Kim (2022) [113], Hardi et al. (2022) [114], Xu et al. (2021) [115].	• Utilizes ChatGPT to increase professional productivity through AI applications in the context of mid-level professional writing tasks. • Examines ChatGPT's performance in text annotation tasks, with the goal of improving the effectiveness and value of such jobs in NLP applications. • Investigates the possibilities of employing ChatGPT to improve data science operations and boost field productivity. • Determines the enhancement of efficiency in interior design using AI-based design prediction, applying approaches such as adversarial learning and Generative Adversarial Networks (GANs). • Investigates the use of Bio-Inspired Design (BID) {XE "Bio-Inspired Design: (BID)"} in conjunction with deep generative models to increase the efficiency and accuracy of product shape creation. • Assesses the use of Artificial Intelligence in local laws to improve process efficiency and personnel productivity. • Focuses on the application of cognitive optimization techniques and responsible Artificial Intelligence (AI) principles to understand business, with a particular focus on Flow Choice Architecture (FCA) {XE "Flow Choice Architecture: (FCA)"} . • Demonstrates novel approaches for improving object identification model accuracy in manufacturing processes, with an emphasis on cost-effective data augmentation utilizing Generative Adversarial Networks (GANs). • Indicates the use of AI-based chatbot technology in educational organizations to improve the productivity and reaction times of academic personnel. • Looks into the implementation of the Generative Action Selection via Probability (GRASP) {XE "Generative Action Selection via Probability: (GRASP)"} algorithm to improve exploration performance in Deep Reinforcement Learning (DRL) {XE "Deep Reinforcement Learning: (DRL)"} and address problems in reinforcement learning algorithms.

Table 8. *Cont.*

Themes	Authors	Focus
Understanding user interactions and motivations	Hyun and Kim (2023) [116], Alamleh et al. (2023) [117], Kuang et al. (2023) [118], Manshad and Brannon (2022) [119], Casadei et al. (2022) [120], Gao and Jiang (2021) [121].	• Investigates user motivation and its impact on perceptions of anxiety, trust, and willingness to continue using AI-generated chatbots, improving knowledge of user interactions with AI-based chatbot technology. • Analyzes the usefulness of predictive Machine Learning algorithms in differentiating between human-written and AI-generated text, with a focus on ChatGPT, to evaluate their text discrimination performance. • Studies the adoption of AI-powered conversational assistants, such as ChatGPT, to improve accessibility test analysis and the speed of UX review procedures. • Emphasizes the value of adopting user demographics into account when designing chatbot interfaces for financial services, highlighting the necessity to personalize the user experience based on different groups' preferences and usability assessments. • Reveals the impact of job complexity on confidence and task satisfaction in relationships between people and chatbots, bringing light to the aspects that influence user trust and contentment with these relationships. • Considers the consequences of chatbot proposals on processing quality and efficiency inside conversations, with the goal of improving response efficiency and quality in conversational systems.
AI in specific domains and use cases	Tai et al. (2023) [122], Subramani et al. (2023) [123], Roberts et al. (2023) [124], Xu et al. (2023) [125], Radoi (2023) [126], Jiang et al. (2023) [127], Aydin and Ayhan (2022) [128].	• Digs into the use of conditional diffusion models to improve voice quality by solving issues in applying Denoising Diffusion Probabilistic Models (DDPMs), with the goal of enhancing speech enhancement in this sector. • Reviews the acceptance and use of ChatGPT within the larger disciplines of AI and natural language processing, stressing the chatbot system's quick uptake and employment. • Introduces the notion of "linguistical" and explores the domains of linguistics, artificial intelligence, and the research of communication possibilities with alien intelligence. • Emphasizes the integration of Mixed Reality (MR) and Digital Twin (DT) {XE "Digital Twin: (DT)"} technologies and GAI to improve safety and traffic management in autonomous vehicles while enabling data integration in the context of vehicular MR. • Concentrates on the development of an OSINT (Open-Source Intelligence) platform that incorporates a GPT model, namely the OpenAI Davinci model, to speed data analysis in the framework of Natural Language Processing and OSINT investigations. • Describes Generative Urban Design (GUD) {XE "Generative Urban Design: (GUD)"} as a transformational method in urban planning and design, increasing the performance and productivity of urban design processes with artificial intelligence-powered computational design tools. • Analyzes the efficiency, design, and possibilities of the transformer-assisted GPT-3 model within the field of Deep Learning (DL), NLP, and AI applications, with a particular focus on GPT-3 technology.

Table 8. *Cont.*

Themes	Authors	Focus
Ethical and philosophical implications	Perez et al. (2023) [129], Ionuț (2022) [130], Rawat et al. (2022) [131], Rzepka et al. (2022) [132], Borsci et al. (2022) [133], Camargo et al. (2022) [134], Lee (2022) [135], Mohana (2022) [136], Kathirvelu et al. (2022) [137].	• Looks at the possibility of misusing AI text generators, specifically GPT-2, to generate false evaluations. • Finds the creation and usage of chatbots in many areas of activity to increase productivity and benefits in various situations, offering more perspectives on possible productivity improvements. • Highlights the utilization of AI-based chatbots and Deep Learning approaches to improve chatbot features and behaviors, which are under the purview of Artificial Intelligence (AI) and NLP technology. • Determines the situations in which Voice Assistants (VAs) {XE "Voice Assistants: (VAs)"} are more beneficial than text conversations, with an emphasis on consumer service efficiency and comparisons of these two communication modalities. • Creates standardized tools to analyze the quality of user interactions with Chatbots and Conversational Agents, resulting in accurate estimates of customer satisfaction. • Provides domain-specific datasets that enhance the performance of Conversational AI systems in autonomous client service, fulfilling the necessity for specialized data resources. • Assesses the application of AI, particularly Generative Adversarial Networks (GANs), to enhance artistic processes in fashion design while addressing environmental problems, with the goal of increasing productivity in the fashion sector. • Analyzes advancements in GAN architecture and optimization techniques to enhance efficiency in diverse computer vision applications. • Establishes a speech identification chatbot for customer service and investigates its function in simulating human interaction to assist consumers with their inquiries, emphasizing the usage of Machine Learning technology and AI for increased efficiency.

This research collection delves into enhancing professional productivity using GAI in computer science and AI. It explores increasing efficiency and value in tasks like professional writing and deep language processing. The studies also examine user interactions with AI technologies and their ethical implications. A significant focus is on the effectiveness of predictive Machine Learning algorithms in differentiating between human and AI-generated text, especially regarding ChatGPT, and how these technologies influence user interactions and motivations.

The articles explore ethical aspects of AI, aiming to enhance user experience with a focus on ethics. This research could positively impact technological applications across various sectors, improving service efficiency and quality. Future work aims to contribute significantly to AI, particularly in enhancing GAI's role in professional settings. This includes advancing ChatGPT models and exploring new applications within set boundaries. Overall, the goal is to provide educational tools and support for individuals and professionals to effectively utilize AI in their daily tasks.

Future research based on these studies could explore different aspects of using GAI in these fields. Key areas include enhancing professional productivity through AI applications in tasks like mid-level professional writing, text annotation, and data science operations. Another important area is understanding user interactions and motivations with AI-generated chatbots by examining their influence on user satisfaction and decision

making. Finally, ethical and philosophical implications of AI, including the misuse of AI text generators and the integration of AI in customer service, should be a significant focus to ensure responsible and sustainable AI development.

Figure 3 presents a fishbone diagram summarizing the use of GAI in enhancing employee efficiency across various professional domains. This hierarchical, fishbone structure helps to analyze and understand the potential causes and factors that may hinder achieving specific goals in GAI application [138].

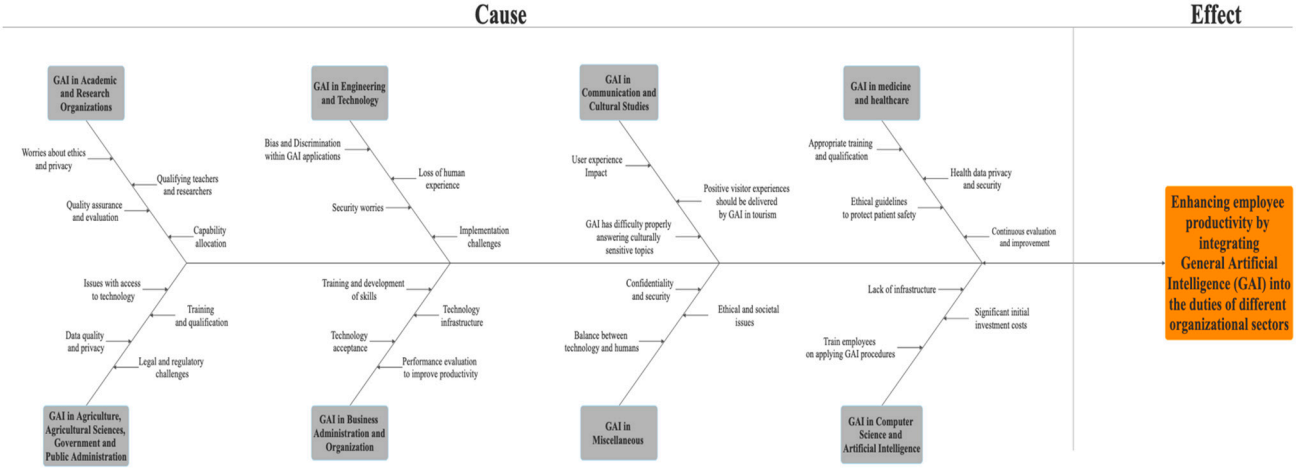

Figure 3. Fishbone analysis of GAI impact on employee productivity in various sectors.

Figure 4 uses a spider diagram to summarize the main findings of this study, effectively employing a two-layer approach for clarity. The first layer shows the main fields in GAI applications and work productivity, with the circle sizes representing the dominance of each field based on the total number of articles relevant to each field, which totaled 159 articles across all fields. The second layer delves into the specific themes within these fields, with sub-circle sizes reflecting their importance based on the focus of the specific articles within each field. This diagram provides a comprehensive view of GAI's impact on work productivity and the breadth of current research and applications.

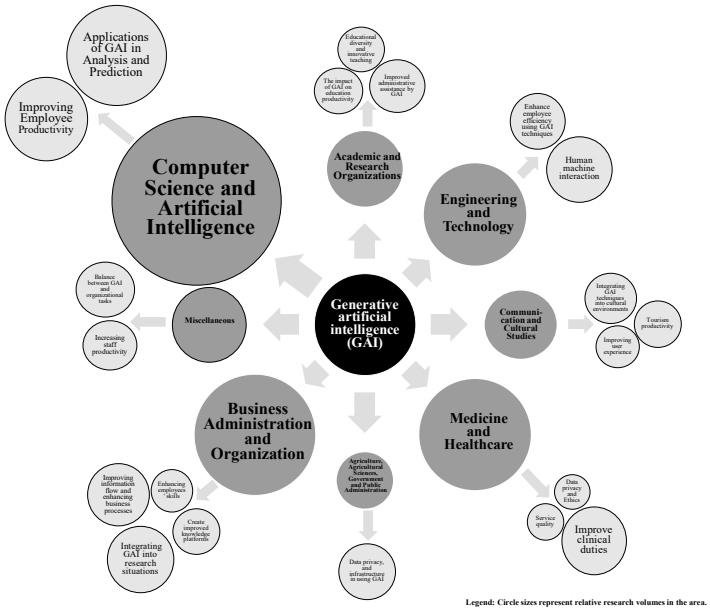

Figure 4. Summary of GAI research and applications in various fields.

The next section will therefore conduct a bibliometric analysis of studies that utilize GAI to enhance workforce productivity across different sectors.

4. Bibliometric Analysis

This bibliometric analysis explores the link between workforce efficiency and GAI in professional settings. Utilizing a systematic approach, it reviews scholarly articles from Scopus to map GAI's academic landscape. The focus is on its integration in various fields and its effect on employee performance. The analysis is key to identifying trends and themes and understanding GAI's broader impacts on workforce productivity across disciplines. By systematically screening the literature and analyzing data, this section seeks to offer valuable insights into the current state and prospects of GAI in professional environments. This study focuses on a spectrum of critical topics, highlighting the interdisciplinary nature of GAI research, principal methodologies, geographic distribution of scholarly contributions, and its diverse applications in professional domains. This segment of the analysis charts a path for future research expansion, examines word co-occurrence patterns to uncover emerging trends, and identifies notable implementations of GAI techniques within professional settings. These insights, derived from a detailed analysis and informed viewpoints, emphasize the evolving role of GAI and its practical impact across various professional landscapes.

VOSviewer 1.6.20, a widely used software tool in research, excels in creating five distinct types of visualization maps. These maps utilize circles to represent various elements like documents, scholars, and keywords, details of which are explored further. It is essential for users to understand three key aspects of these visualizations. First, larger circles and increased font sizes signify higher levels of activity, whereas smaller circles and fonts indicate lesser activity. Secondly, the spatial distance between any two words in the visualization correlates with their degree of interrelation; closer proximity suggests a stronger link, while greater distance implies a weaker association. Lastly, these visualizations offer insights into the interconnectedness and relative prominence of research topics within a field [139].

4.1. Co-Occurrence Map Based on Text Data

By scrutinizing the textual content of the 159 chosen publications, we successfully pinpointed terms that hold significance and occur with regularity. The process of text data analysis aims to extract pertinent terms found within the titles and abstracts of the chosen articles. Subsequently, it builds a network of co-occurrence connections among these terms [139]. This systematic analysis empowers researchers to pinpoint influential terminology within the field of GAI in professional domains. In totality, 1419 distinct terms were generated, with 15 of them surpassing the established minimum threshold of five occurrences. To further enhance the selection of terms, VOSviewer calculates a relevance score for each term [139]. This meticulous process resulted in the discovery of the 15 words highlighted in the network, as seen in Figure 5. In this context, highly relevant phrases, such as "Artificial Intelligence" (AI), imply a concentration on more specific themes within the content of the document. Additionally, keywords with lower relevance scores are considered generic [139].

The results of a wide range of studies and investigations in the field of enhancing employee productivity within corporate contexts using GAI are shown in Figure 6. The network of key phrases proposes that AI research has expanded into a variety of disciplines, including natural language processing, generative adversarial networks, human–computer interaction, user interfaces, and Conversational Agents. The outcomes underscore AI's game-changing potential, as indicated by the rise of concepts like "productivity", "human", and "efficiency". Figure 6 additionally demonstrates the direct correlations between AI and these concepts.

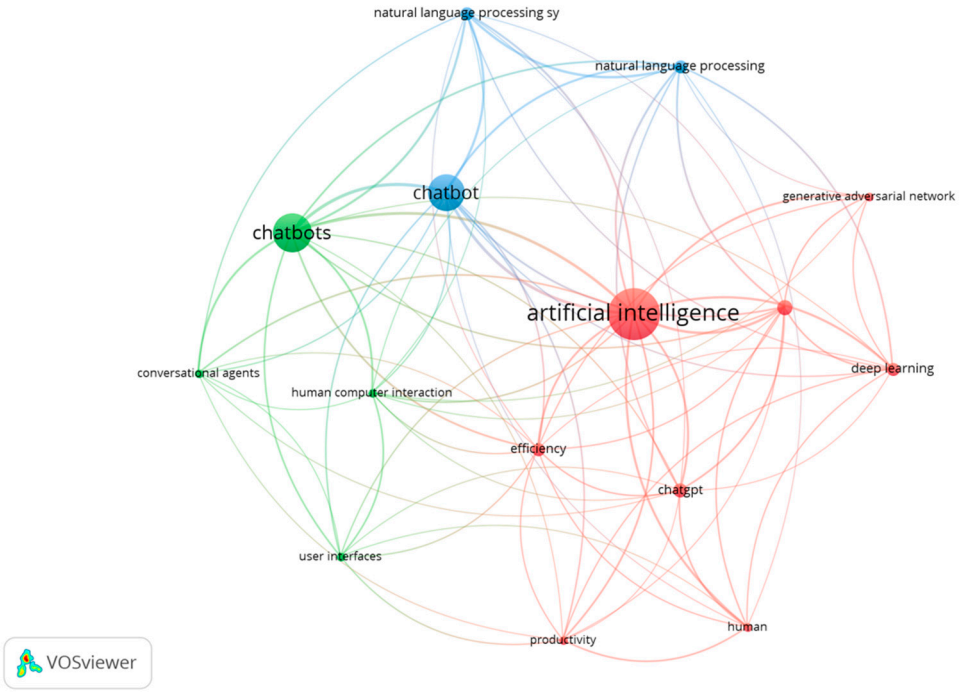

Figure 5. Co-occurrence map of text data.

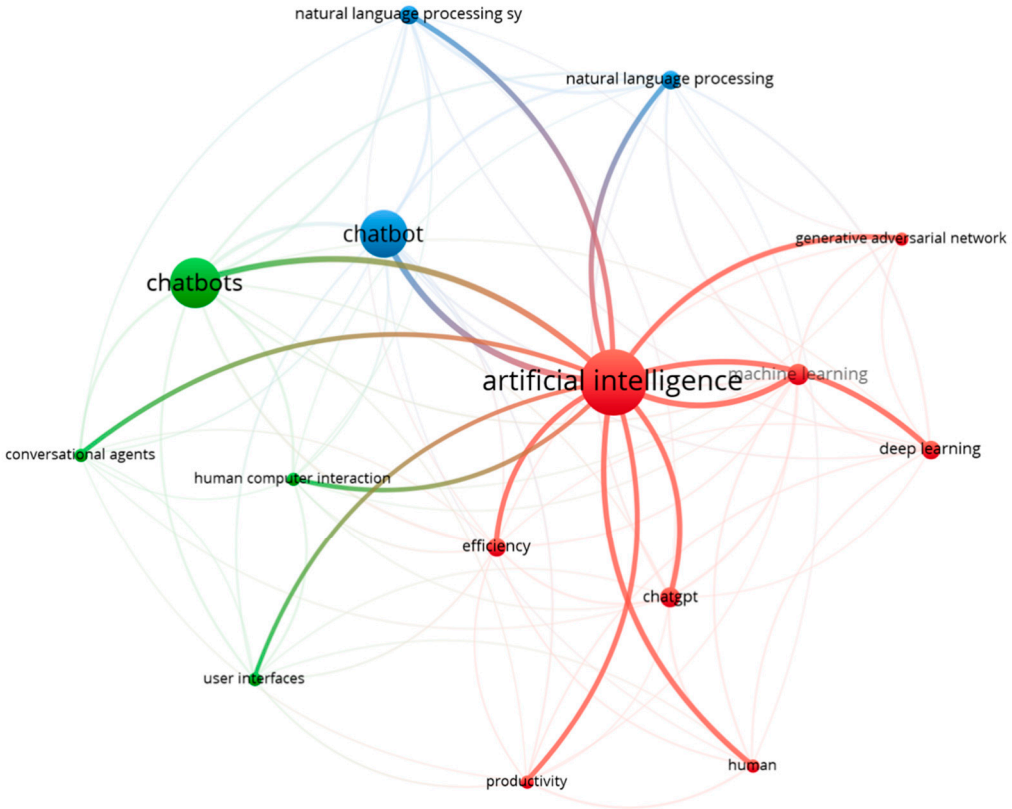

Figure 6. Terms directly connected with "Artificial Intelligence".

Furthermore, Figure 6 depicts a significant correlation between AI and chatbots in terms of the integration of AI technology into the regulatory domain. To elaborate more, chatbots are an operational application of AI technology, notably in the field of NLP. Based on several professional areas, the utilization of chatbots has increased remarkably in recent

years. This increase may be ascribed to their ability to automate operations, improve operational efficiency, raise customer service standards, and provide useful insights. Moreover, integrating GAI into a company's operations can have an important impact on a range of aspects of individuals' work experiences, such as productivity, motivation, and learning outcomes. Furthermore, the link of GAI with terms like "productivity", "human", "efficiency", and "Deep Learning" emphasizes the beneficial presence of GAI applications in business organizations. GAI has the potential to support a variety of professional aspects, including data analysis, repetitive task automation, customer support, predictive analytics, supply chain optimization, talent management, healthcare diagnosis, legal research, innovation, and ethical decision making. On the other hand, the use of GAI in assessments creates concerns about the fairness and dependability of automated evaluation systems, which is why it is critical to avoid any unethical behaviors.

The highest eight words that appeared the most frequently, together with their corresponding frequency counts, are listed in Table 9. Furthermore, each phrase receives a relevance value calculated by VOSviewer. This software tool also examined the distribution of (second order) co-occurrences among all words for each term and then compared it with the general distribution of co-occurrences across terms. Table 1 provides a complete analysis of the key phrases that are commonly used in the context of GAI's involvement; these phrases shed light on the many facets of GAI's integration into professional areas. The term "efficiency" refers to the larger context in which AI functions, highlighting the importance of optimizing and simplifying AI systems and processes, particularly for personnel. On the flip side, "performance" refers to GAI's ability to excel or achieve in a variety of jobs. To clarify more, performance refers to how successfully an AI system can achieve its intended goals, solve issues, and adapt to changing circumstances. The word "language" emphasizes the need to tackle communication hurdles and language diversity in institutional settings. "User interface" highlights GAI's favorable potential for improving accessibility, usability, and user happiness by enabling seamless interactions between people and sophisticated AI systems. The popularity of "machine learning" indicates the critical role it plays in artificial intelligence, acting as the basis upon which AI algorithms and models are created, allowing computers to interpret and analyze data. Similarly, phrases such as "efficiency" and "Deep Learning" highlight GAI's importance in boosting staff effectiveness and its ability to revolutionize workforce efficiency.

Table 9. Top eight terms by occurrence.

Rank	Term	Occurrences	Relevance Score
1	Machine Learning	18	1.1329
2	Deep Learning	16	1.2878
3	Efficiency	16	0.6708
4	User interface	11	0.8669
5	Human	11	1.3399
6	Performance	6	0.8336
7	Language	6	1.334
8	Language model	5	5.2478

4.2. Co-Occurrence Map Based on Keywords

This research analyzed bibliographic data from 159 selected papers, identifying a total of 1419 keywords. From this dataset, 26 keywords were selected based on a minimum occurrence threshold of six, as depicted in Figure 7. The utilization of a thesaurus in VOSviewer played a crucial role in standardizing these keywords, effectively eliminating redundancy and repetitive terms. The analysis includes both author keywords, which are specifically chosen by the authors of the articles, and index keywords, assigned by indexers

or databases for the purposes of classifying articles and indexing information. This dual approach ensures a comprehensive representation of the research landscape [139]. The most common keywords discovered were "AI", "chatbots", "ChatGPT", and "efficiency".

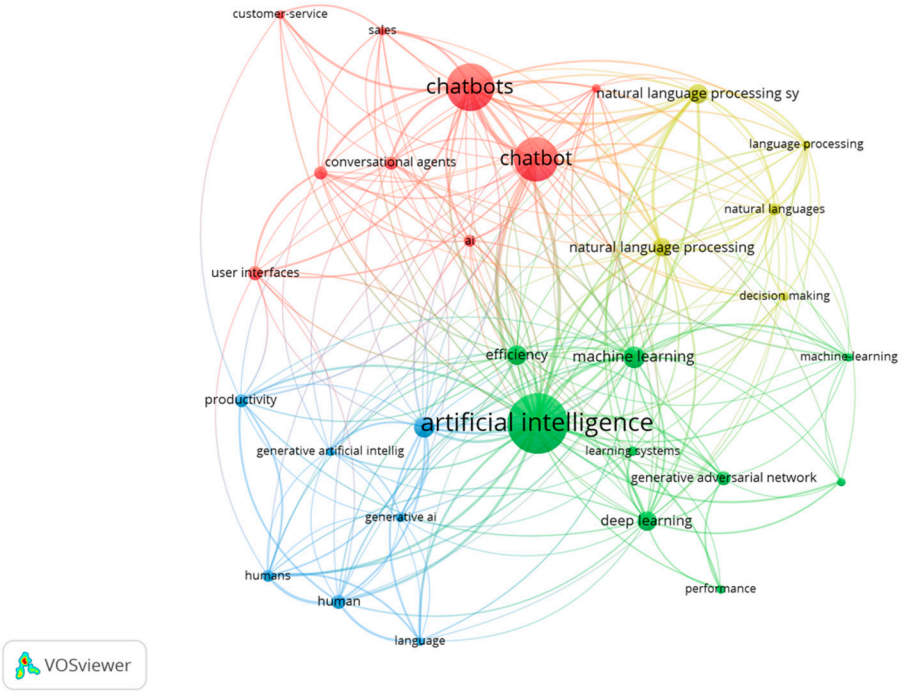

Figure 7. Co-occurrence map of all keywords.

Moreover, a collection of the ten most frequently used keywords, presented in Table 10, provides insight into their individual frequencies as well as the aggregate link strength they carry. The cumulative robustness of co-occurrence relationships between a certain term and its equivalents is represented by this link strength [139].

Table 10. Top 10 terms by occurrence.

Rank	Term	Occurrences	Total Link Strength
1	Artificial Intelligence	60	144
2	Chatbots	45	101
3	Chatbot	42	83
4	Machine Learning	18	67
5	Natural Language Processing	15	63
6	Natural Language Processing Systems	16	58
7	ChatGPT	17	53
8	Deep Learning	16	48
9	Efficiency	16	45
10	Human	11	44

This section highlights important trends and emerging research areas in this field. In Table 10, terms like "Artificial Intelligence" underline its importance in evolving organizational processes, while "ChatGPT" exemplifies its role in AI chatbots and wide-ranging professional uses. "Efficiency" and "chatbot" emphasize GAI's impact on organizational

operations and interactions. "Deep Learning" and "Machine Learning" represent the integration of high-tech capabilities and algorithm application in professional contexts. In addition, the term "human" focuses on the experiences of clients and employees, underlining the expansive research scope of GAI in improving professional operations through technological advancements.

For a clearer understanding, VOSviewer has produced two additional keyword maps. The first, shown in Figure 8, maps the co-occurrence of author-assigned keywords, highlighting 12 key terms that each appear at least five times. The second map, in Figure 9, visualizes index keywords, again using a minimum occurrence of five, and displays a network of 30 significant terms. These maps provide visual insights into the most emphasized keywords from both author and indexing perspectives, aiding in the understanding of key research themes.

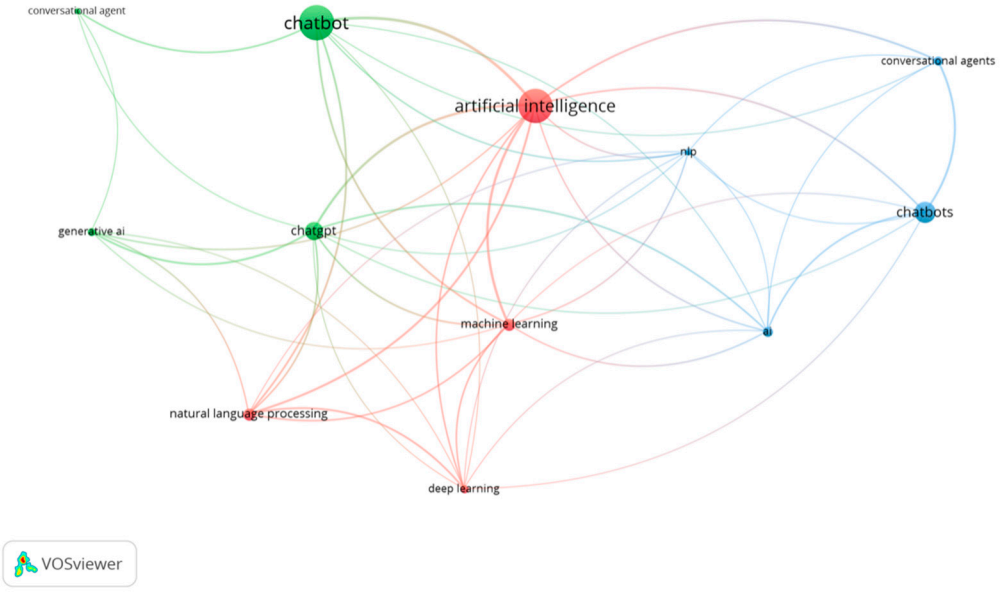

Figure 8. Co-occurrence map of author keywords.

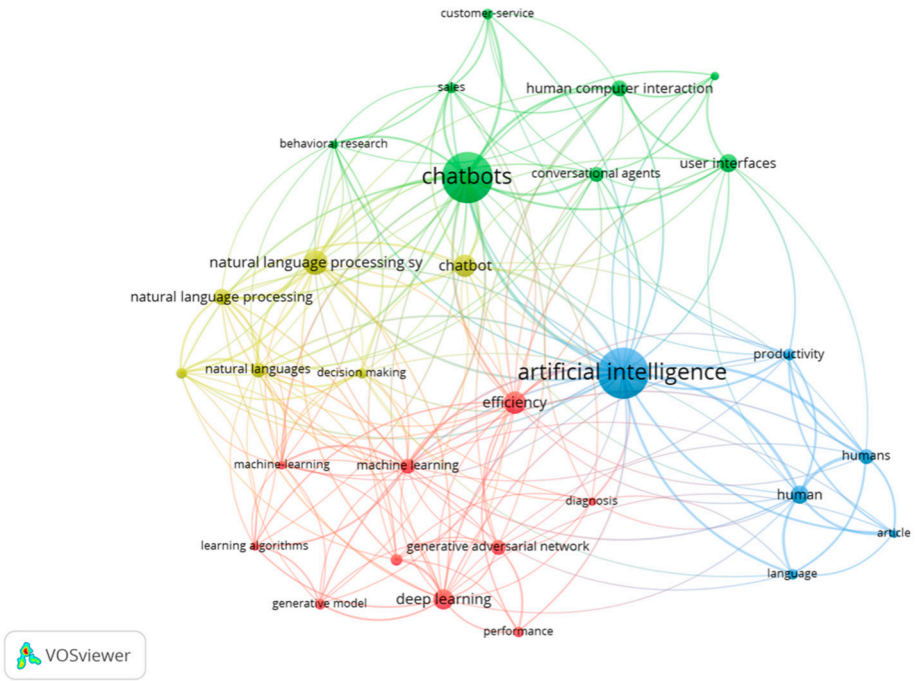

Figure 9. Co-occurrence map of index keywords.

The keyword analysis in this study highlights the primary themes in GAI research within professional settings. Key terms such as "Artificial Intelligence", "ChatGPT", and "productivity" demonstrate the value of technology in transforming professional practices. This represents a trend toward integrating advanced AI solutions in various professional domains to drive efficiency and innovation.

4.3. Co-Occurrence Map Based on Country of Co-Authorship

The co-occurrence map based on the country of co-authorship in this study offers insights into the geographical spread of the 159 selected articles. A visual map highlights the global distribution of research, focusing on countries with a minimum of five publications. Out of 59 countries with published papers, 17 met this criterion, as shown in Figure 10. The United States, China, India, and the United Kingdom emerged as major contributors. Table 11 details the top ten countries, illustrating significant global research connections, thereby providing a clear picture of international collaboration in this field.

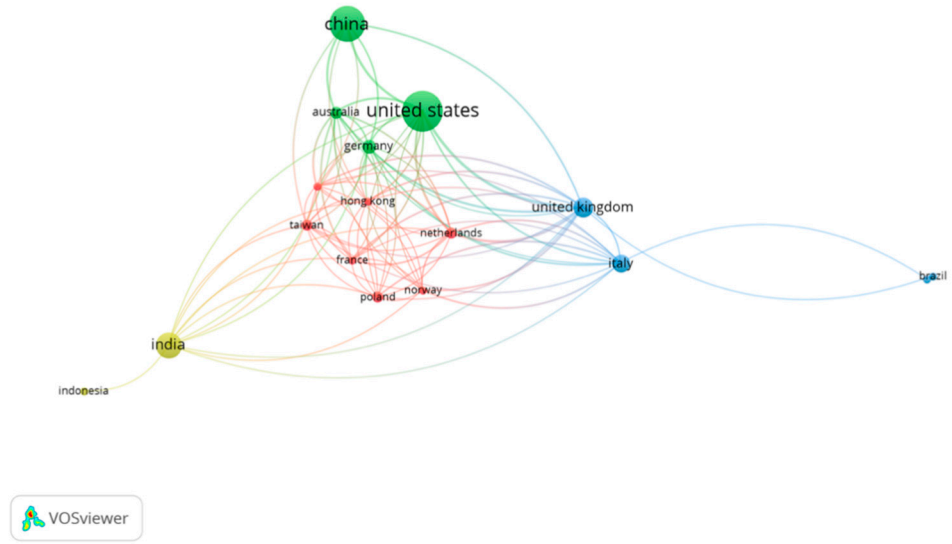

Figure 10. Country of co-authorships.

Table 11. Top 10 countries by link strength.

Rank	Term	Documents	Citations	Total Link Strength
1	United States	32	400	29
2	China	28	83	14
3	India	19	179	13
4	United Kingdom	14	223	29
5	Italy	12	249	19
6	Germany	9	135	17
7	Australia	8	154	23
8	Netherlands	7	135	22
9	Poland	7	133	13
10	Taiwan	7	141	13

Table 11 systematically highlights the top ten countries contributing significantly to GAI research, focusing on sectors both commercial and governmental, particularly in enhancing employee productivity. The United States leads this ranking, showing its dominance in GAI research, followed by China, showcasing its robust involvement, and

other countries like India, the United Kingdom, Italy, Germany, Australia, the Netherlands, Poland, and Taiwan also feature, reflecting their active participation in GAI advancements

The widespread geographic distribution of research on GAI in professional settings reflects its global relevance and collaborative nature.

European nations such as the United Kingdom, Italy, Germany, the Netherlands, and Poland have a significant influence in the domain of GAI research and technological innovation. Collectively, they contribute to 49 documents, which, when assessed in relation to their combined population compared with that of China, underscores their substantial impact on GAI research.

4.4. Co-Occurrence Map Based on Authorship

This study explores authorship dynamics in GAI research, focusing on contributors with at least five citations. Of the 159 authors reviewed, 41 surpassed this criterion. The resultant network visualization, shown in Figure 11, displays varied connections but lacks intertwined links that strongly unite these twenty-five authors, reflecting a diverse yet independent authorship landscape in this field.

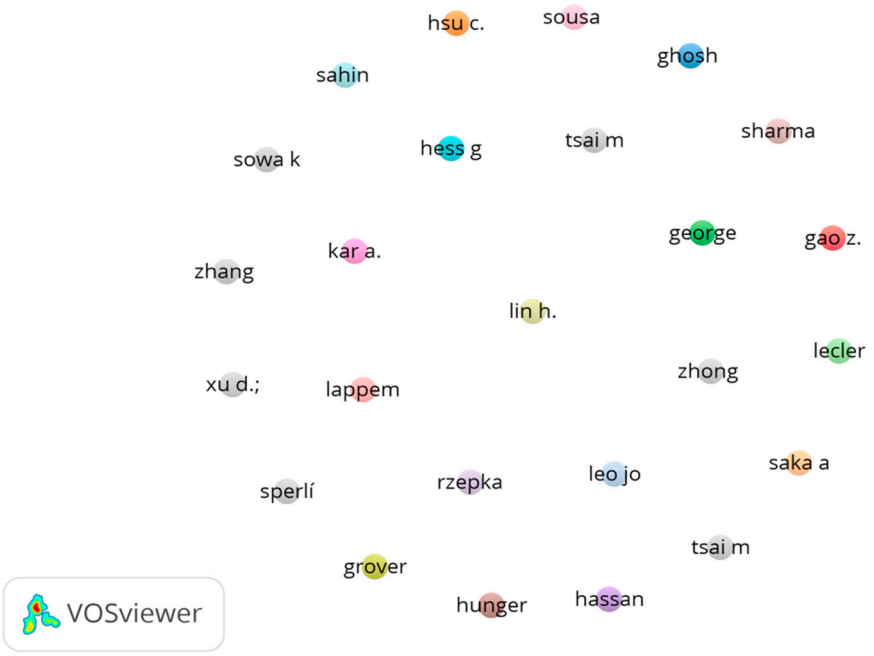

Figure 11. Co-occurrence map of authors.

The network visualization in this study, characterized by isolated circles without interconnections, underscores a dual nature in GAI research for enhancing labor productivity: individual efforts and a notable lack of collaboration. This highlights the need for more interdisciplinary partnerships to foster innovation and knowledge exchange in this field. The distinct separation of these circles in the visualization indicates a major gap in collaborative dynamics, underscoring the importance of both individual contributions and collective efforts.

Table 12 showcases leading authors in GAI research within professional sectors. Their significant impact is evident from their high citation counts and strong link strengths. Notably, each author contributed a single paper to the 159 articles reviewed, underscoring a notable deficit in collaborative research efforts.

Table 12. Top 10 authors by citations.

Rank	Term	Citations	Documents	Total Link Strength
1	George et al. [140]	169	1	0
2	Dwivedi et al. [100]	112	1	0
3	Leo John et al. [82]	39	1	0
4	Lecler et al. [60]	34	1	0
5	Zhong et al. [45]	26	1	0
6	Kar and Kushwaha [97]	22	1	0
7	Colace et al. [99]	21	1	0
8	Zhang et al. [34]	20	1	0
9	Grover et al. [141]	19	1	0
10	Sperlí et al. [142]	19	1	0

The authors George et al., Dwivedi et al., and Leo John et al. are prominent in GAI research, with citation counts of 169, 112, and 39, respectively. George et al.'s 2017 paper [140], "A Generative Vision Training Model with Unprecedented Data Efficiency and Victory over Text-Based CAPTCHA", stands out. This groundbreaking work significantly influenced the early development of engineering and technology applications in GAI, setting a foundation for future innovations in the field.

4.5. Data Analysis Based on Document Field

The 159 publications were categorized into 9 primary fields, with each field's productivity measured by article frequency. The bar graph in Figure 12 illustrates the top nine fields by publication number, showcasing the multidisciplinary reach of GAI research. This analysis includes disciplines such as computer science, business, and medicine, highlighting the importance of cross-disciplinary collaboration in addressing complex challenges in GAI adoption.

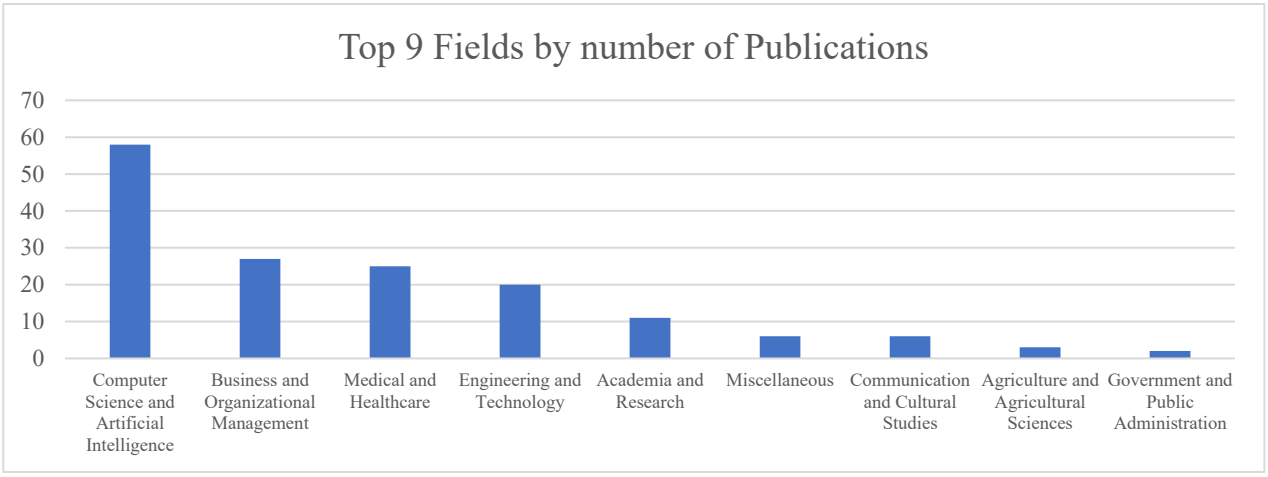

Figure 12. Bar graph of the top 9 fields by number of publications.

4.6. Data Analysis on Document Type, GAI Tools Used, and Research Types

This study categorizes articles by document type, presenting these data in the chart in Figure 13. "Conference paper" leads with 75 entries, followed by "article" at 70, "review" at 8, and "book chapter" at 4. The dominance of conference papers reflects the emerging nature of GAI, with researchers favoring conferences due to quicker publication timelines compared with journals.

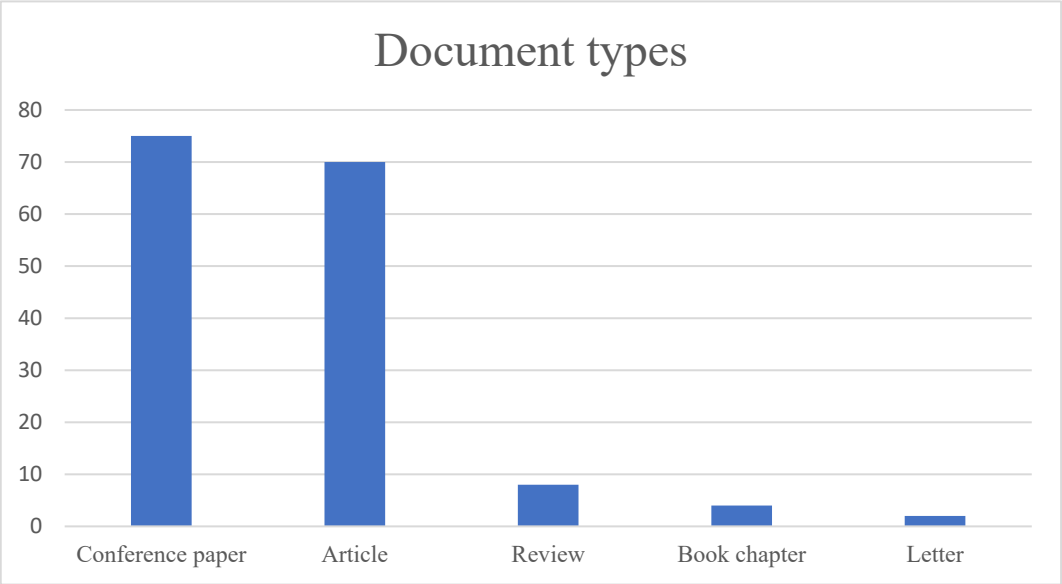

Figure 13. Occurrence of document types.

This study also analyzed the tools mentioned in each publication, revealing insights into their use in enhancing employee productivity through GAI, as detailed in Figure 14. Generic terms such as "GAI" and "AI" are frequently used. Specific categories include "Chatbots and Conversational Agents", "Generative AI Models", "AI Algorithms and Techniques", "AI Integration", and "Adoption of Conversational Agents". This classification facilitates an understanding of different methodologies, allowing for a deeper examination of GAI tools and their impact on productivity in professional settings.

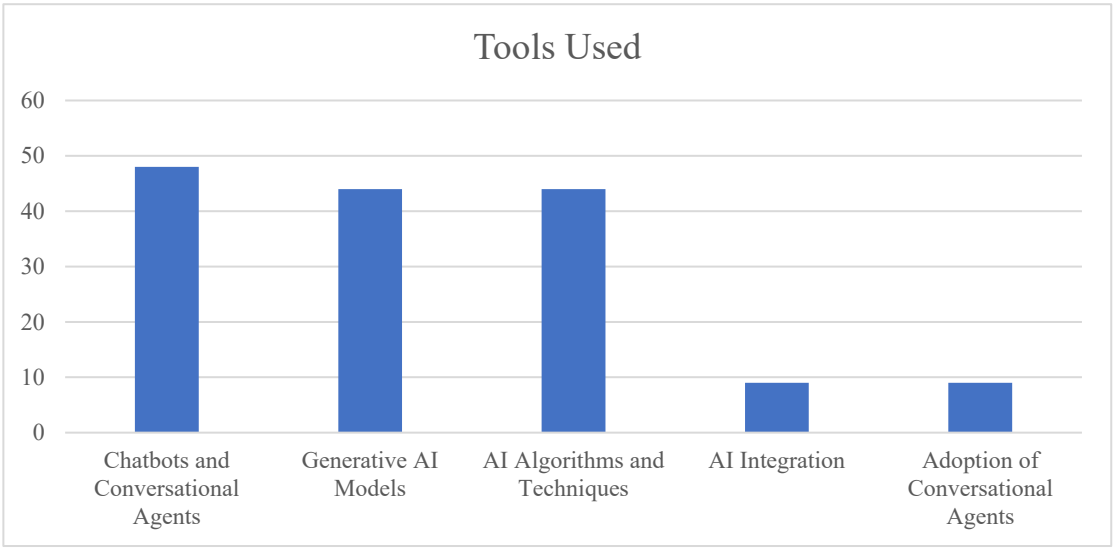

Figure 14. Occurrence of AI tools used.

The category "Chatbots and Conversational Agents" dominates the research, appearing in 48 articles, underlining its significance in organizational contexts for various professional tasks. This prominence highlights its role in enhancing workplace efficiency, as it is particularly valued for automating tasks and facilitating access to information. The categories "AI Algorithms and Techniques" and "Generative AI Models" also feature prominently with 44 mentions, highlighting their importance in research. Meanwhile, "AI

Integration" and "Adoption of Conversational Agents" are less frequent but still noticeable, each with nine occurrences, showcasing diverse technology applications in the field.

In Figure 15, "Research Methods" clearly stands out as the most common category with 62 instances, with an emphasis on methodological rigor. "Proposal and Development" are followed with 39 articles, focusing on data and model evaluation. "Development and Application of Models" ranked third with 28 mentions, highlighting the system's building of organizational support. "Overview and Assessment" and "Analysis and Solution", appear 19 and 10 times, respectively, indicating different research focuses, from broad GAI impact evaluations to more targeted problem-solving approaches.

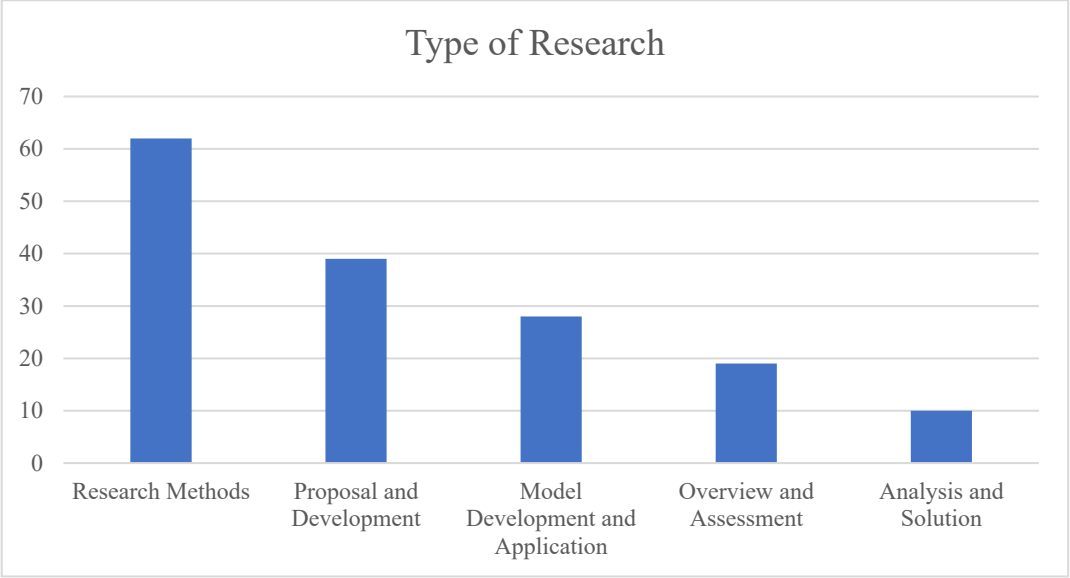

Figure 15. Occurrence of research types in professional fields.

This bibliometric analysis has provided valuable insights into the impact of GAI on workforce efficiency across various professional settings. It highlights the importance of GAI in enhancing employee productivity, underscoring its role in current trends and future research directions. This study emphasizes the interdisciplinary nature of GAI and its diverse applications.

5. Conclusions and Future Research

The integration of GAI in various organizations marks a significant leap in digital transformation and creativity enhancement. Its application across sectors like academia, engineering, and communications is revolutionizing how work productivity is increased, from creating compelling advertising to swiftly producing accurate technical reports. However, GAI's implementation poses ethical challenges, necessitating adherence to safety standards and legislation. Recognizing its social and cultural implications is crucial. Thus, while GAI is a potent tool for businesses, its effective and responsible use requires careful management. This review deeply analyses GAI's impact in these areas, drawing insights from 159 Scopus-sourced publications.

The first phase of this study involved an in-depth review of the application of GAI in a variety of fields such as academia, research, engineering, technology, communications, cultural studies, agriculture and agricultural sciences, government and public administration, and business organization. This research was carried out by conducting a comprehensive assessment and content analysis of the important literature in these disciplines.

The content analysis revealed noteworthy findings from eight separate fields on GAI applications, providing a complete overview of its benefits and possible challenges. The literature review focuses on the eight disciplines mentioned above and their relevance to GAI applications. Furthermore, research publications provide conclusions in the study

of applications of GAI in a variety of fields, emphasizing significant benefits. However, ethical and safety issues do occur, underscoring the importance of careful deliberation. GAI promotes educational governance and information exchange in academia but also requires ethical concerns. Engineering research also emphasizes increased efficiency, safety, and error detection, as well as calling for continuous review and bias resolution of this technology. Through the integration of GAI, communications and cultural studies desire to improve the user experience and influence the reputations of companies. In the field of healthcare, research focuses on the role of chatbots in medical tasks, with an emphasis on training and privacy solutions. As agricultural companies and the government investigate GAI technology to boost production, stakeholders face obstacles such as issues of access and data confidentiality. Articles in the field of business management address the role of GAI in the growth of banks and companies, with an emphasis on data security and balancing human aspects. Thus, computer science research needs to examine and predict performance while also addressing ethical and societal issues.

Following the completion of the content analysis, the second stage involved a bibliometric analysis of the relationship between GAI and work productivity within the indicated fields. This procedure entails screening a large number of previously published papers and publications from the Scopus database. This study is enhanced by a comprehensive examination of the literature and elimination of duplication to provide a curated list of 159 papers specifically focusing on GAI for improving user productivity across eight key areas.

A large-scale bibliometric study analyzing the use of GAI in the above-mentioned fields has provided insights into changing professional structures and increasing productivity. To expand, an analysis of GAI applications revealed a significant and rapid expansion from 2014 to September 2023, with a striking increase in publications in 2023, likely as a result of the widespread popularity and innovation driven by tools such as ChatGPT. This highlights the critical importance of communication and collaboration in effectively disseminating GAI techniques in specific fields of study. However, scholarly exchange in this area requires concerted efforts to enhance authors' collaboration and expand the application of GAI in these areas of study.

It is important to acknowledge a notable gap in our literature review concerning the application of GAI in the finance industry. While our review predominantly focused on employee productivity across various sectors, the specific intersection of GAI with financial services has emerged as a burgeoning area of interest. For instance, the study by Dowling and Lucey [143] explores the potential of ChatGPT in finance research, underscoring its utility in idea generation and data identification, while also highlighting limitations in literature synthesis and developing testing frameworks. Additionally, the work of Ali and Aysan [144], published after our search deadline, delves into the diverse applications of ChatGPT in finance, ranging from customer engagement to stock forecasting. These studies indicate a growing recognition of GAI's potential within the financial sector and propose an expanding research horizon. Future research endeavors are likely to fill this gap, shedding more light on the multifaceted implications and uses of GAI technologies in the financial domain.

In exploring future research directions for the enhancement of employee productivity through GAI, a range of critical areas has been identified. These encompass various sectors and require in-depth investigation to fully leverage GAI's potential in boosting workplace efficiency and innovation. In the field of professional development in education, there is a need for comprehensive research into the necessary skills and competencies for educators and researchers to integrate GAI. This includes evaluating current training programs and proposing innovative models that blend technical skills with pedagogical methods. The issue of AI bias and discrimination calls for the development of methodological approaches aimed at reducing biases in GAI applications, potentially through interdisciplinary research that combines AI technology with insights from social sciences. The field of quality assurance and evaluation models in GAI requires expansion, particularly in integrating Machine Learning techniques. Research should explore the applicability of GAI across diverse sec-

tors, extending beyond employee performance metrics. Data privacy and security in GAI applications is another critical area. Research should focus on the latest advancements in encryption and data security, considering their impact on user trust and regulatory compliance. Enhancing user experience in GAI applications is essential, with a focus on linguistic and cultural adaptability. Research should delve into user interface designs that are inclusive and appealing to a diverse user base. Addressing the technology access gap, especially in rural areas, is vital. This involves developing strategies for infrastructure improvement, policy interventions, and community-based approaches to ensure widespread technology access and adoption. In healthcare, GAI holds transformative potential. Future research should pinpoint specific areas, like predictive analytics for patient care and administrative process optimization, where GAI can make significant contributions. Legal and regulatory frameworks related to GAI call for focused research, especially in developing international standards and exploring liability issues. Interdisciplinary collaboration is key to the development of GAI. Research should emphasize the importance of cross-sector collaboration and investigate potential models and their outcomes. Finally, ethical considerations in professional sectors regarding GAI use need expansion. This includes proposing ethical frameworks and guidelines and discussing the long-term societal implications of GAI.

This extensive literature review on GAI is a comprehensive exploration of its applications in a variety of sectors, providing a nuanced understanding of its role in enhancing productivity. By examining GAI's usage in different professional environments, this work offers valuable insights for future researchers and practitioners. It serves as a crucial resource for identifying emerging trends, understanding current challenges, and discovering potential opportunities for innovation in GAI. Furthermore, this review underscores the importance of strategic implementation and continuous assessment of GAI technologies, guiding future endeavors to optimize their utility in diverse professional environments. The synthesis of these findings provides a roadmap for future research and practical applications, highlighting areas where GAI can be leveraged for significant improvements in productivity and efficiency.

In concluding this review paper on enhancing work productivity through GAI, the rapidly evolving nature of this field is recognized. The categories and statistics presented in this study reflect the current state of research but are likely to undergo significant changes as the field advances. Therefore, this work serves as a foundational reference for ongoing research, with the understanding that future developments will bring new perspectives to these findings.

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References

1. Melehy, A.K. The Impact of AI on the Economy: A Comprehensive Analysis. 2023. Available online: https://www.researchgate.net/publication/370400293_The_Impact_of_AI_on_the_Economy_A_Comprehensive_Analysis (accessed on 12 December 2023).
2. Jutel, M.; Zemelka-Wiacek, M.; Ordak, M.; Pfaar, O.; Eiwegger, T.; Rechenmacher, M.; Akdis, C. The artificial intelligence (AI) revolution: How important for scientific work and its reliable sharing. *Allergy* **2023**, *78*, 2085–2088. [CrossRef] [PubMed]

3. Hadi, M.U.; Al-Tashi, Q.; Qureshi, R.; Shah, A.; Muneer, A.; Irfan, M.; Zafar, A.; Shaikh, M.; Akhtar, N.; Wu, J.; et al. Large Language Models: A Comprehensive Survey of Its Applications, Challenges, Limitations, and Future Prospects. 2023. Available online: https://www.techrxiv.org/users/618307/articles/682263-large-language-models-a-comprehensive-survey-of-its-applications-challenges-limitations-and-future-prospects (accessed on 12 December 2023).
4. Mhlanga, D. The Value of Open AI and Chat GPT for the Current Learning Environments and The Potential Future Uses. *SSRN Electron. J.* **2023**. [CrossRef]
5. Hadi, M.; Najm, M. Introduction to ChatGPT: A new revolution of artificial intelligence with machine learning algorithms and cybersecurity. *Sci. Arch.* **2023**, *4*, 276–285. [CrossRef]
6. Borji, A.; Mohammadian, M. Battle of the Wordsmiths: Comparing ChatGPT, GPT-4, Claude, and Bard. 2023. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4476855 (accessed on 12 December 2023).
7. Feuerriegel, S.; Hartmann, J.; Janiesch, C.; Zschech, P. Generative AI. *Bus. Inf. Syst. Eng.* **2023**, *66*, 111–126. [CrossRef]
8. Banh, L.; Strobel, G. Generative artificial intelligence. *Electron. Mark.* **2023**, *33*, 63. [CrossRef]
9. Lund, B.; Wang, T. Chatting about ChatGPT: How may AI and GPT impact academia and libraries? *Libr. Hi Tech News* **2023**, *40*, 26–29. [CrossRef]
10. Nah, F.; Zheng, R.; Cai, J.; Siau, K.; Chen, L. Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration. *J. Inf. Technol. Case Appl. Res.* **2023**, *25*, 277–304. [CrossRef]
11. Morris, M. Scientists' Perspectives on the Potential for Generative AI in their Fields. 2023. Available online: https://montrealethics.ai/scientists-perspectives-on-the-potential-for-generative-ai-in-their-fields/ (accessed on 12 December 2023).
12. Mao, J.; Chen, B.; Liu, J. Generative Artificial Intelligence in Education and Its Implications for Assessment. *TechTrends* **2023**, *68*, 58–66. [CrossRef]
13. Zhang, P.; Kamel Boulos, M. Generative AI in Medicine and Healthcare: Promises, Opportunities and Challenges. *Future Internet* **2023**, *15*, 286. [CrossRef]
14. Epstein, Z.; Hertzmann, A.; Herman, L.; Mahari, R.; Frank, M.; Groh, M.; Schroeder, H.; Smith, A.; Akten, M.; Fjeld, J.; et al. Art and the Science of Generative AI: A Deeper Dive. *arXiv* **2023**, arXiv:2306.04141.
15. Cardon, P.; Getchell, K.; Carradini, S.; Fleischmann, A.C.; Stapp, J. Generative AI in the Workplace: Employee Perspectives of ChatGPT Benefits and Organizational Policies. 2023. Available online: https://osf.io/preprints/socarxiv/b3ezy (accessed on 12 December 2023).
16. Govori, A.; Sejdija, Q. Future prospects and challenges of integrating artificial intelligence within the business practices of small and medium enterprises. *J. Gov. Regul.* **2023**, *12*, 176–183. [CrossRef]
17. Gonçalves, R.; Dias, Á.; Costa, R.; Pereira, L.; Bento, T.; Rosa, Á. Gaining competitive advantage through artificial intelligence adoption. *Int. J. Electron. Bus.* **2022**, *1*, 386–406. [CrossRef]
18. Wamba-Taguimdje, S.; Fosso Wamba, S.; Jean Robert, K.K.; Tchatchouang, C.E. Influence of Artificial Intelligence (AI) on Firm Performance: The Business Value of AI-based Transformation Projects. *Bus. Process Manag. J.* **2020**, *26*. [CrossRef]
19. *Patole Sanjay Principles and Practice of Systematic Reviews and Meta-Analysis*; Springer: Cham, Switzerland, 2021.
20. Budhwar, P.; Chowdhury, S.; Wood, G.; Aguinis, H.; Bamber, G.J.; Beltran, J.R.; Boselie, P.; Lee Cooke, F.; Decker, S.; DeNisi, A.; et al. Human resource management in the age of generative artificial intelligence: Perspectives and research directions on ChatGPT. *Hum. Resour. Manag. J.* **2023**, *33*, 606–659. [CrossRef]
21. Varnavsky, A.N. Chatbot to Increase the Effectiveness of the «flipped Classroom» Technology. In Proceedings of the 2022 2nd International Conference on Technology Enhanced Learning in Higher Education, TELE 2022, Lipetsk, Russian, 26–27 May 2022; pp. 289–293. [CrossRef]
22. Košecka, D.; Balco, P.; Murgor, S.C. Chatbot at University, a Communication Tool to Increase Work Productivity. *Lect. Notes Netw. Syst.* **2022**, *527*, 74–84. [CrossRef]
23. Sebastian, D.; Nugraha, K.A. Academic Customer Service Chatbot Development using TelegramBot API. In Proceedings of the 2021 2nd International Conference on Innovative and Creative Information Technology, ICITech 2021, Salatiga, Indonesia, 23–25 September 2021; pp. 221–225. [CrossRef]
24. Suresh, N.; Mukabe, N.; Hashiyana, V.; Limbo, A.; Hauwanga, A. Career Counseling Chatbot on Facebook Messenger using AI. In Proceedings of the International Conference on Data Science, Machine Learning and Artificial Intelligence, Windhoek, Namibia, 9–12 August 2021; pp. 65–73. [CrossRef]
25. Colace, F.; De Santo, M.; Lombardi, M.; Pascale, F.; Pietrosanto, A.; Lemma, S. Chatbot for e-learning: A case of study. *Int. J. Mech. Eng. Robot. Res.* **2018**, *7*, 528–533. [CrossRef]
26. Dergaa, I.; Chamari, K.; Zmijewski, P.; Saad, H.B. From human writing to artificial intelligence generated text: Examining the prospects and potential threats of ChatGPT in academic writing. *Biol. Sport* **2023**, *40*, 615–622. [CrossRef]
27. Leiker, D.; Gyllen, A.R.; Eldesouky, I.; Cukurova, M. Generative AI for Learning: Investigating the Potential of Learning Videos with Synthetic Virtual Instructors. *Commun. Comput. Inf. Sci.* **2023**, *1831*, 523–529. [CrossRef]
28. Muhyidin, A.; Setiawan, M.A.F. Developing UNYSA Chatbot as Information Services about Yogyakarta State University. *J. Phys. Conf. Ser.* **2021**, *1737*, 012038. [CrossRef]
29. Irwan, D.; Ali, M.; Ahmed, A.N.; Jacky, G.; Nurhakim, A.; Ping Han, M.C.; AlDahoul, N.; El-Shafie, A. Predicting Water Quality with Artificial Intelligence: A Review of Methods and Applications. *Arch. Comput. Methods Eng.* **2023**, *30*, 4633–4652. [CrossRef]

30. Ren, Y.; Lin, J.; Tang, S.; Zhou, J.; Yang, S.; Qi, Y.; Ren, X. Generating natural language adversarial examples on a large scale with generative models. *Front. Artif. Intell. Appl.* **2020**, *325*, 2156–2163. [CrossRef]
31. Wang, Y.; Vinogradov, A. Improving the Performance of Convolutional GAN Using History-State Ensemble for Unsupervised Early Fault Detection with Acoustic Emission Signals. *Appl. Sci.* **2023**, *13*, 3136. [CrossRef]
32. Ratajczak, J.; Siegele, D.; Niederwieser, E. Maximizing Energy Efficiency and Daylight Performance in Office Buildings in BIM through RBFOpt Model-Based Optimization: The GENIUS Project. *Buildings* **2023**, *13*, 1790. [CrossRef]
33. Zhou, Q.; Xue, F. Pushing the boundaries of modular-integrated construction: A symmetric skeleton grammar-based multi-objective optimization of passive design for energy savings and daylight autonomy. *Energy Build.* **2023**, *296*, 113417. [CrossRef]
34. Zhang, J.; Liu, N.; Wang, S. Generative design and performance optimization of residential buildings based on parametric algorithm. *Energy Build.* **2021**, *244*, 111033. [CrossRef]
35. Manuel, F.; Philipp, E.; Boris, K.; Stefan, G.; Antonio, D.; Valentyn, B. Numerical performance predictions of artificial intelligence-driven centrifugal compressor designs. *Am. Soc. Mech. Eng. Fluids Eng. Div. Publ. FEDSM* **2020**, *1*. [CrossRef]
36. Venkatesh, K.; Pratibha, K.; Annadurai, S.; Kuppusamy, L. Reconfigurable architecture to speed-up modular exponentiation. In Proceedings of the 2019 International Carnahan Conference on Security Technology, Chennai, India, 1–3 October 2019. [CrossRef]
37. Ahmad, A.; Waseem, M.; Liang, P.; Fahmideh, M.; Aktar, M.S.; Mikkonen, T. Towards Human-Bot Collaborative Software Architecting with ChatGPT. In Proceedings of the 27th International Conference on Evaluation and Assessment in Software Engineering, Oulu, Finland, 14–16 June 2023; pp. 279–285. [CrossRef]
38. Liu, X.; Ma, H.; Liu, Y. A Novel Transfer Learning Method Based on Conditional Variational Generative Adversarial Networks for Fault Diagnosis of Wind Turbine Gearboxes under Variable Working Conditions. *Sustainability* **2022**, *14*, 5441. [CrossRef]
39. Zhu, J.-F.; Hao, Z.-K.; Liu, Q.; Yin, Y.; Lu, C.-Q.; Huang, Z.-Y.; Chen, E.-H. Towards Exploring Large Molecular Space: An Efficient Chemical Genetic Algorithm. *J. Comput. Sci. Technol.* **2022**, *37*, 1464–1477. [CrossRef]
40. Nawrocki, P.; Radziszowski, D.; Sniezynski, B. Heterogeneous Information Access System with a Natural Language Interface in the Context of Organization of Events. *Commun. Comput. Inf. Sci.* **2021**, *1371*, 188–200. [CrossRef]
41. Badini, S.; Regondi, S.; Frontoni, E.; Pugliese, R. Assessing the capabilities of ChatGPT to improve additive manufacturing troubleshooting. *Adv. Ind. Eng. Polym. Res.* **2023**, *6*, 278–287. [CrossRef]
42. Tsai, M.-H.; Chan, H.-Y.; Chan, Y.-L.; Shen, H.-K.; Lin, P.-Y.; Hsu, C.-W. A chatbot system to support mine safety procedures during natural disasters. *Sustainability* **2021**, *13*, 654. [CrossRef]
43. Shi, L. Application Model Construction of Traditional Cultural Elements in Illustration Design under Artificial Intelligence Background. *Mob. Inf. Syst.* **2022**, *2022*, 1–9. [CrossRef]
44. Meng, L.; Schaffer, S. A Reporting Assistant for Railway Security Staff. In Proceedings of the 2nd Conference on Conversational User Interfaces, Bilbao, Spain, 22–24 July 2020; pp. 1–3. [CrossRef]
45. Zhong, B.; He, W.; Huang, Z.; Love, P.E.D.; Tang, J.; Luo, H. A building regulation question answering system: A deep learning methodology. *Adv. Eng. Inform.* **2020**, *46*, 101195. [CrossRef]
46. Lin, Y.-Z.; Chuang, J.-Y.; Sheng, I.C.; Cheng, Y.T.; Chang, C.-C.; Yang, Y.-C.; Hsueh, H.-P.; Huang, C.-H. Development of a task-oriented chatbot application for monitoring Taiwan photon source front-end system. In Proceedings of the 12th International Workshop on Emerging Technologies and Scientific Facilities Controls, PCaPAC 2018, Hsinchu, Taiwan, 16–19 October 2018; pp. 228–229. [CrossRef]
47. Angeline, R.; Gaurav, T.; Rampuriya, P.; Dey, S. Supermarket Automation with Chatbot and Face Recognition Using IoT and AI. In Proceedings of the 3rd International Conference on Communication and Electronics Systems, ICCES 2018, Coimbatore, India, 15–16 October 2018; pp. 1183–1186. [CrossRef]
48. Saka, A.B.; Oyedele, L.O.; Akanbi, L.A.; Ganiyu, S.A.; Chan, D.W.M.; Bello, S.A. Conversational artificial intelligence in the AEC industry: A review of present status, challenges and opportunities. *Adv. Eng. Inform.* **2023**, *55*, 101869. [CrossRef]
49. Yazici, S. A machine-learning model driven by geometry, material and structural performance data in architectural design process. *Proc. Int. Conf. Educ. Res. Comput. Aided Archit. Des. Eur.* **2020**, *1*, 411–418.
50. Zhou, Q.; Li, B.; Han, L.; Jou, M. Talking to a bot or a wall? How chatbots vs. human agents affect anticipated communication quality. *Comput. Hum. Behav.* **2023**, *143*, 107674. [CrossRef]
51. Wagner, N.; Kraus, M.; Tonn, T.; Minker, W. Comparing Moderation Strategies in Group Chats with Multi-User Chatbots. In Proceedings of the 4th Conference on Conversational User Interfaces, Glasgow, UK, 26–28 July 2022. [CrossRef]
52. Casillo, M.; De Santo, M.; Mosca, R.; Santaniello, D. An Ontology-Based Chatbot to Enhance Experiential Learning in a Cultural Heritage Scenario. *Front. Artif. Intell.* **2022**, *5*, 808281. [CrossRef]
53. Carvalho, I.; Ivanov, S. ChatGPT for tourism: Applications, benefits and risks. *Tour. Rev.* **2023**. [CrossRef]
54. Lopezosa, C.; Codina, L.; Pont-Sorribes, C.; Vállez, M. Use of generative artificial intelligence in the training of journalists: Challenges, uses and training proposal. *Prof. De La Inf.* **2023**, *32*. [CrossRef]
55. Płaza, M.; Trusz, S.; Kęczkowska, J.; Boksa, E.; Sadowski, S.; Koruba, Z. Machine Learning Algorithms for Detection and Classifications of Emotions in Contact Center Applications. *Sensors* **2022**, *22*, 5311. [CrossRef]
56. Comulada, W.S.; Rezai, R.; Sumstine, S.; Flores, D.D.; Kerin, T.; Ocasio, M.A.; Swendeman, D.; Fernández, M.I. A necessary conversation to develop chatbots for HIV studies: Qualitative findings from research staff, community advisory board members, and study participants. In *AIDS Care—Psychological and Socio-Medical Aspects of AIDS/HIV*; Taylor Francis Group: Abingdon, UK, 2023. [CrossRef]

57. Gala, D.; Makaryus, A.N. The Utility of Language Models in Cardiology: A Narrative Review of the Benefits and Concerns of ChatGPT-4. *Int. J. Environ. Res. Public Health* **2023**, *20*, 6438. [CrossRef] [PubMed]
58. Santandreu-Calonge, D.; Medina-Aguerrebere, P.; Hultberg, P.; Shah, M.-A. Can ChatGPT improve communication in hospitals? *Prof. Inf.* **2023**, *32*. [CrossRef]
59. Nandini Prasad, K.S.; Sudhanva, S.; Tarun, T.N.; Yuvraaj, Y.; Vishal, D.A. Conversational Chatbot Builder—Smarter Virtual Assistance with Domain Specific AI. In Proceedings of the 2023 4th International Conference for Emerging Technology, INCET 2023, Belgaum, India, 26–28 May 2023. [CrossRef]
60. Lecler, A.; Duron, L.; Soyer, P. Revolutionizing radiology with GPT-based models: Current applications, future possibilities and limitations of ChatGPT. *Diagn. Interv. Imaging* **2023**, *104*, 269–274. [CrossRef] [PubMed]
61. Ong, H.; Ong, J.; Cheng, R.; Wang, C.; Lin, M.; Ong, D. GPT Technology to Help Address Longstanding Barriers to Care in Free Medical Clinics. *Ann. Biomed. Eng.* **2023**, *51*, 1906–1909. [CrossRef] [PubMed]
62. Yang, Z.; Liu, Y.; Ouyang, C.; Ren, L.; Wen, W. Counterfactual can be strong in medical question and answering. *Inf. Process. Manag.* **2023**, *60*, 103408. [CrossRef]
63. Bussola, N.; Xu, J.; Wu, L.; Gorini, L.; Zhang, Y.; Furlanello, C.; Tong, W. A Weakly Supervised Deep Learning Framework for Whole Slide Classification to Facilitate Digital Pathology in Animal Study. *Chem. Res. Toxicol.* **2023**, *36*, 1321–1331. [CrossRef]
64. Grupac, M.; Zauskova, A.; Nica, E. Generative Artificial Intelligence-based Treatment Planning in Clinical Decision-Making, in Precision Medicine, and in Personalized Healthcare. *Contemp. Read. Law Soc. Justice* **2023**, *15*, 45–62. [CrossRef]
65. Panthier, C.; Gatinel, D. Success of ChatGPT, an AI language model, in taking the French language version of the European Board of Ophthalmology examination: A novel approach to medical knowledge assessment. *J. Fr. Ophtalmol.* **2023**, *46*, 706–711. [CrossRef] [PubMed]
66. Tustumi, F.; Andreollo, N.A.; de Aguilar-Nascimento, J.E. Future of the Language Models in Healthcare: The Role of chatGPT. *Arq. Bras. Cir. Dig.* **2023**, *36*, e1727. [CrossRef] [PubMed]
67. Escorcia-Gutierrez, J.; Mansour, R.F.; Leal, E.; Villanueva, J.; Jimenez-Cabas, J.; Soto, C.; Soto-Díaz, R. Privacy Preserving Blockchain with Energy Aware Clustering Scheme for IoT Healthcare Systems. *Mob. Netw. Appl.* **2023**. [CrossRef]
68. Strunga, M.; Urban, R.; Surovková, J.; Thurzo, A. Artificial Intelligence Systems Assisting in the Assessment of the Course and Retention of Orthodontic Treatment. *Healthcare* **2023**, *11*, 683. [CrossRef] [PubMed]
69. Wang, E.T.G.; Chen, A.P.S.; Liu, C.W. A Hybrid Evaluation of AI Chatbots in Taiwan Agriculture Services. In Proceedings of the 2021 International Conference on Technologies and Applications of Artificial Intelligence, TAAI 2021, Taichung, Taiwan, 18–20 November 2021; pp. 112–118. [CrossRef]
70. Feitosa, W.R.; Do Patrocinio, F.O.; Santos, S.R.; Silva, S.C.E. Proposal for a Chatbot Prototype in the Plant Health Department of Brazilian Ministry of Agriculture. In Proceedings of the 2020 IEEE/ITU International Conference on Artificial Intelligence for Good, AI4G 2020, Geneva, Switzerland, 21–25 September 2020; pp. 17–21. [CrossRef]
71. Ramadoss, P.; Ananth, V.; Navaneetha, M.; Oviya, U. E -Xpert Bot -Guidance and Pest Detection for Smart Agriculture using AI. In Proceedings of the 2023 12th IEEE International Conference on Communication Systems and Network Technologies, CSNT 2023, Bhopal, India, 8–9 April 2023; pp. 797–802. [CrossRef]
72. Usip, P.U.; Udo, E.N.; Asuquo, D.E.; James, O.R. A Machine Learning-Based Mobile Chatbot for Crop Farmers. *Commun. Comput. Inf. Sci.* **2022**, *1666*, 192–211. [CrossRef]
73. Tsai, M.-H.; Yang, C.-H.; Chen, J.Y.; Kang, S.-C. Four-Stage Framework for Implementing a Chatbot System in Disaster Emergency Operation Data Management: A Flood Disaster Management Case Study. *KSCE J. Civ. Eng.* **2021**, *25*, 503–515. [CrossRef]
74. Walkowiak, E. Task-interdependencies between Generative AI and Workers. *Econ. Lett.* **2023**, *231*, 111315. [CrossRef]
75. Bankins, S.; Ocampo, A.C.; Marrone, M.; Restubog, S.L.D.; Woo, S.E. A multilevel review of artificial intelligence in organizations: Implications for organizational behavior research and practice. *J. Organ. Behav.* **2023**. *early review*. [CrossRef]
76. Araujo, T.; Van Zoonen, W.; Ter Hoeven, C. "A Large Playground": Examining the Current State and Implications of Conversational Agent Adoption in Organizations. *Int. J. Innov. Technol. Manag.* **2022**, *19*. [CrossRef]
77. Makhija, P.; Chacko, E. Efficiency and Advancement of Artificial Intelligence in Service Sector with Special Reference to Banking Industry. In *Fourth Industrial Revolution and Business Dynamics: Issues and Implications Efficiency and Advancement of Artificial Intelligence in Service Sector with Special Reference to Banking Industry*; Springer Science + Business Media: Berlin/Heidelberg, Germany, 2021; pp. 21–35.
78. Illescas, C.; Ortega, T.; Jadán-Guerrero, J. Gender Bias in Chatbots and Its Programming. *Smart Innov. Syst. Technol.* **2023**, *337*, 481–489. [CrossRef]
79. Anagnoste, S.; Biclesanu, I.; D'Ascenzo, F.; Savastano, M. The Role of Chatbots in End-To-End Intelligent Automation and Future Employment Dynamics. In *Springer Proceedings in Business and Economics*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 287–302. [CrossRef]
80. Straßer, T.; Axmann, B. Analysis and evaluation of ai applications in logistics. *Logist. J.* **2021**, *2021*. [CrossRef]
81. Chen, B.; Wu, Z.; Zhao, R. From fiction to fact: The growing role of generative AI in business and finance. *J. Chin. Econ. Bus. Stud.* **2023**, *21*, 471–496. [CrossRef]
82. Leo John, R.J.; Potti, N.; Patel, J.M. Ava: From data to insights through conversation. In Proceedings of the CIDR 2017—8th Biennial Conference on Innovative Data Systems Research, Chaminade, CA, USA, 8–11 January 2017.

83. Al-Ababneh, H.; Borisova, V.; Zakharzhevska, A.; Tkachenko, P.; Andrusiak, N. Performance of Artificial Intelligence Technologies in Banking Institutions. *WSEAS Trans. Bus. Econ.* **2023**, *20*, 307–317. [CrossRef]
84. Fan, H.; Gao, W.; Han, B. Are AI chatbots a cure-all? The relative effectiveness of chatbot ambidexterity in crafting hedonic and cognitive smart experiences. *J. Bus. Res.* **2023**, *156*, 113526. [CrossRef]
85. Saengrith, W.; Viriyavejakul, C.; Pimdee, P. Problem-Based Blended Training via Chatbot to Enhance the Problem-Solving Skill in the Workplace. *Emerg. Sci. J.* **2022**, *6*, 1–12. [CrossRef]
86. Chithra Apoorva, D.A.; Brahmananda, S.H. A future research scope: Survey on an artificial interactive agent. *Int. J. Adv. Sci. Technol.* **2020**, *29*, 6158–6166.
87. Virkar, M.; Honmane, V.; Rao, S.U. Humanizing the chatbot with semantics based natural language generation. In Proceedings of the 2019 International Conference on Intelligent Computing and Control Systems, ICCS 2019, Madurai, India, 15–17 May 2019; pp. 891–894. [CrossRef]
88. Chandar, P.; Khazaeni, Y.; Davis, M.; Muller, M.; Crasso, M.; Liao, Q.V.; Shami, N.S.; Geyer, W. Leveraging Conversational Systems to Assists New Hires During Onboarding. *Lect. Notes Comput. Sci. Incl. Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinform.* **2017**, *10514*, 381–391. [CrossRef]
89. Steinbauer, F.; Kern, R.; Kröll, M. Chatbots assisting German business management applications. *Lect. Notes Comput. Sci. Incl. Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinform.* **2019**, *11606*, 717–729. [CrossRef]
90. Piyatumrong, A.; Sangkeettrakarn, C.; Witdumrong, S.; Cherdgone, J. Chatbot technology adaptation to reduce the information gap in RD center: A case study of an IT research organization. In Proceedings of the PICMET 2018—Portland International Conference on Management of Engineering and Technology: Managing Technological Entrepreneurship: The Engine for Economic Growth, Proceedings, Honolulu, HI, USA, 19–23 August 2018. [CrossRef]
91. Hsu, C.-L.; Lin, J.C.-C. Understanding the user satisfaction and loyalty of customer service chatbots. *J. Retail. Consum. Serv.* **2023**, *71*, 103211. [CrossRef]
92. Hung, P.D.; Trang, D.T.; Khai, T. Integrating Chatbot and RPA into Enterprise Applications Based on Open, Flexible and Extensible Platforms. *Lect. Notes Comput. Sci. Incl. Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinform.* **2021**, *12983*, 183–194. [CrossRef]
93. Silva, S.C.; De Cicco, R.; Vlačić, B.; Elmashhara, M.G. Using chatbots in e-retailing—How to mitigate perceived risk and enhance the flow experience. *Int. J. Retail Distrib. Manag.* **2023**, *51*, 285–305. [CrossRef]
94. Bialkova, S. How to Optimise Interaction with Chatbots? Key Parameters Emerging from Actual Application. *Int. J. Hum.-Comput. Interact.* **2023**. [CrossRef]
95. Mehrolia, S.; Alagarsamy, S.; Moorthy, V. Will Users Continue Using Banking Chatbots? *The Moderating Role of Perceived Risk. FIIB Bus. Rev.* **2023**. [CrossRef]
96. Lappeman, J.; Marlie, S.; Johnson, T.; Poggenpoel, S. Trust and digital privacy: Willingness to disclose personal information to banking chatbot services. *J. Financ. Serv. Mark.* **2023**, *28*, 337–357. [CrossRef]
97. Kar, A.K.; Kushwaha, A.K. Facilitators and Barriers of Artificial Intelligence Adoption in Business—Insights from Opinions Using Big Data Analytics. *Inf. Syst. Front.* **2023**, *25*, 1351–1374. [CrossRef]
98. Xu, Q.; Yan, J.; Cao, C. Emotional Communication Between Chatbots and Users: An Empirical Study on Online Customer Service System. *Lect. Notes Comput. Sci. Incl. Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinform.* **2022**, *13336*, 513–530. [CrossRef]
99. Colace, F.; De Santo, M.; Pascale, F.; Lemma, S.; Lombardi, M. BotWheels: A petri net based Chatbot for recommending tires. In Proceedings of the 6th International Conference on Data Science, Technology and Applications, DATA 2017, Madrid, Spain, 24–26 July 2017; pp. 350–358. [CrossRef]
100. Dwivedi, Y.K.; Kshetri, N.; Hughes, L.; Slade, E.L.; Jeyaraj, A.; Kar, A.K.; Baabdullah, A.M.; Koohang, A.; Raghavan, V.; Ahuja, M.; et al. "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *Int. J. Inf. Manag.* **2023**, *71*, 102642. [CrossRef]
101. Iparraguirre-Villanueva, O.; Obregon-Palomino, L.; Pujay-Iglesias, W.; Sierra-Liñan, F.; Cabanillas-Carbonell, M. Productivity of incident management with conversational bots—A review. *IAES Int. J. Artif. Intell.* **2023**, *12*, 1543–1556. [CrossRef]
102. Cao, Y.; Carmona, V.I.S.; Liu, X.; Hu, C.; Iskender, N.; Beyer, A.; Möller, S.; Polzehl, T. On the Impact of Self-efficacy on Assessment of User Experience in Customer Service Chatbot Conversations. *Lect. Notes Electr. Eng.* **2022**, *943*, 253–262. [CrossRef]
103. Temple, J.G.; Burkhart, B.J.; McFadden, E.T.; Elie, C.J.; Portnoy, F. Cognitive Solutions in the Enterprise: A Case Study of UX Benefits and Challenges. *Adv. Intell. Syst. Comput.* **2020**, *965*, 267–274. [CrossRef]
104. Banerjee, S.; Singh, P.K.; Bajpai, J. A comparative study on decision-making capability between human and artificial intelligence. *Adv. Intell. Syst. Comput.* **2018**, *652*, 203–210. [CrossRef]
105. Deksne, D.; Vasiljevs, A. Collection of resources and evaluation of customer support chatbot. *Front. Artif. Intell. Appl.* **2018**, *307*, 30–37. [CrossRef]
106. Noy, S.; Zhang, W. Experimental evidence on the productivity effects of generative artificial intelligence. *Science* **2023**, *381*, 187–192. [CrossRef]
107. Gilardi, F.; Alizadeh, M.; Kubli, M. ChatGPT outperforms crowd workers for text-annotation tasks. *Proc. Natl. Acad. Sci. USA* **2023**, *120*, e2305016120. [CrossRef]
108. Hassani, H.; Silva, E.S. The Role of ChatGPT in Data Science: How AI-Assisted Conversational Interfaces Are Revolutionizing the Field. *Big Data Cogn. Comput.* **2023**, *7*, 62. [CrossRef]

109. Yue, P.; Yuan, T. Artificial Intelligence-Assisted Interior Layout Design of CAD Painting. *Comput.-Aided Des. Appl.* **2023**, *20*, 64–74. [CrossRef]
110. Deng, Z.G.; Lv, J.; Liu, X.; Hou, Y.K. Bionic Design Model for Co-creative Product Innovation Based on Deep Generative and BID. *Int. J. Comput. Intell. Syst.* **2023**, *16*, 8. [CrossRef]
111. Wang, K. On the Application of Artificial Intelligence in Local Legislation. *Appl. Math. Nonlinear Sci.* **2023**, *9*. [CrossRef]
112. Weekes, T.R.; Eskridge, T.C. Responsible Human-Centered Artificial Intelligence for the Cognitive Enhancement of Knowledge Workers. *Lect. Notes Comput. Sci. Incl. Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinform.* **2022**, *13518*, 568–582. [CrossRef]
113. Jo, Y.-W.; Kim, H.-W. Generative Adversarial Network based Cost-efficiency data Augmentation for AI Object Detection on De-palletizing Robots. *J. Inst. Control Robot. Syst.* **2022**, *28*, 888–896. [CrossRef]
114. Hardi, R.; Pee, A.N.C.; Abdullah, M.H.L.B.; Pitogo, V.A.; Pribadi, A.S.; Rusdi, J.F. Academic Smart Chatbot to Support Emerging Artificial Intelligence Conversation. In Proceedings of the 2022 International Conference of Science and Information Technology in Smart Administration, ICSINTESA 2022, Denpasar, Indonesia, 10–12 November 2022; pp. 194–199. [CrossRef]
115. Xu, D.; Zhu, F.; Liu, Q.; Zhao, P. Improving exploration efficiency of deep reinforcement learning through samples produced by generative model. *Expert Syst. Appl.* **2021**, *185*, 115680. [CrossRef]
116. Hyun Baek, T.; Kim, M. Is ChatGPT scary good? How user motivations affect creepiness and trust in generative artificial intelligence. *Telemat. Inf.* **2023**, *83*, 102030. [CrossRef]
117. Alamleh, H.; Alqahtani, A.A.S.; Elsaid, A. Distinguishing Human-Written and ChatGPT-Generated Text Using Machine Learning. In Proceedings of the 2023 Systems and Information Engineering Design Symposium, SIEDS 2023, Charlottesville, VA, USA, 27–28 April 2023; pp. 154–158. [CrossRef]
118. Kuang, E.; Jahangirzadeh Soure, E.; Fan, M.; Zhao, J.; Shinohara, K. Collaboration with Conversational AI Assistants for UX Evaluation: Questions and How to Ask them (Voice vs. Text). In Proceedings of the Conference on Human Factors in Computing Systems, Hamburg, Germany, 23–28 April 2023. [CrossRef]
119. Manshad, M.S.; Brannon, D.C. Gender-based conversational interface preferences in live chat systems for financial services. *J. Financ. Serv. Mark.* **2022**, *28*, 822–834. [CrossRef]
120. Casadei, A.; Schlogl, S.; Bergmann, M. Chatbots for Robotic Process Automation: Investigating Perceived Trust and User Satisfaction. In Proceedings of the 2022 IEEE International Conference on Human-Machine Systems, ICHMS 2022, Orlando, FL, USA, 17–19 November 2022. [CrossRef]
121. Gao, Z.; Jiang, J. Evaluating Human-AI Hybrid Conversational Systems with Chatbot Message Suggestions. In Proceedings of the International Conference on Information and Knowledge Management, Proceedings, Gold Coast, Australia, 1–5 November 2021; pp. 534–544. [CrossRef]
122. Tai, W.; Zhou, F.; Trajcevski, G.; Zhong, T. Revisiting Denoising Diffusion Probabilistic Models for Speech Enhancement: Condition Collapse, Efficiency and Refinement. In Proceedings of the 37th AAAI Conference on Artificial Intelligence, AAAI 2023, Washington, DC, USA, 7–14 February 2023; Volume 37, pp. 13627–13635.
123. Subramani, M.; Jaleel, I.; Mohan, S.K. Evaluating the performance of ChatGPT in medical physiology university examination of phase I MBBS. *Adv. Physiol. Educ.* **2023**, *47*, 270–271. [CrossRef] [PubMed]
124. Roberts, I.G.; Watumull, J.; Chomsky, N. Universal Grammar. In *Xenolinguistics: Towards a Science of Extraterrestrial Language Universal Grammar*; Taylor and Francis: Abingdon, UK, 2023; pp. 165–181.
125. Xu, M.; Niyato, D.; Chen, J.; Zhang, H.; Kang, J.; Xiong, Z.; Mao, S.; Han, Z. Generative AI-empowered Simulation for Autonomous Driving in Vehicular Mixed Reality Metaverses. *IEEE J. Sel. Top. Signal Process.* **2023**, *17*, 1064–1079. [CrossRef]
126. Radoi, T.-C. Artificial Intelligence in Data Analysis for Open-Source Investigations. In Proceedings of the 15th International Conference on Electronics, Computers and Artificial Intelligence, ECAI 2023, Bucharest, Romania, 29–30 June 2023. [CrossRef]
127. Jiang, F.; Ma, J.; Webster, C.J.; Chiaradia, A.J.F.; Zhou, Y.; Zhao, Z.; Zhang, X. Generative urban design: A systematic review on problem formulation, design generation, and decision-making. *Prog. Plan.* **2023**, *180*, 100795. [CrossRef]
128. Aydin, N.; Ayhan Erdem, O. A Research On The New Generation Artificial Intelligence Technology Generative Pretraining Transformer 3. In Proceedings of the 3rd International Informatics and Software Engineering Conference, IISEC 2022, Ankara, Turkey, 15–16 December 2022. [CrossRef]
129. Perez-Castro, A.; Martínez-Torres, M.R.; Toral, S.L. Efficiency of automatic text generators for online review content generation. *Technol. Forecast. Soc. Chang.* **2023**, *189*, 122380. [CrossRef]
130. Ionuț-Alexandru, C. Experimental Results Regarding the Efficiency of Business Activities through the Use of Chatbots. *Smart Innov. Syst. Technol.* **2022**, *276*, 323–332. [CrossRef]
131. Rawat, B.; Bist, A.S.; Rahardja, U.; Aini, Q.; Sanjaya, Y.P.A. Recent Deep Learning Based NLP Techniques for Chatbot Development: An Exhaustive Survey. In Proceedings of the 2022 10th International Conference on Cyber and IT Service Management, CITSM 2022, Yogyakarta, Indonesia, 20–21 September 2022. [CrossRef]
132. Rzepka, C.; Berger, B.; Hess, T. Voice Assistant vs. Chatbot—Examining the Fit between Conversational Agents' Interaction Modalities and Information Search Tasks. *Inf. Syst. Front.* **2022**, *24*, 839–856. [CrossRef]
133. Borsci, S.; Malizia, A.; Schmettow, M.; van der Velde, F.; Tariverdiyeva, G.; Balaji, D.; Chamberlain, A. The Chatbot Usability Scale: The Design and Pilot of a Usability Scale for Interaction with AI-Based Conversational Agents. *Pers. Ubiquitous Comput.* **2022**, *26*, 95–119. [CrossRef]

134. Camargo, J.; Nunes, J.; Antunes, M.J.; Mealha, O.; Abrantes, C.; Nobrega, L. Building datasets for automated conversational systems designed for use-cases. In Proceedings of the 2022 International Conference on Interactive Media, Smart Systems and Emerging Technologies, IMET 2022, Limassol, Cyprus, 4–7 October 2022. [CrossRef]
135. Lee, Y.K. How complex systems get engaged in fashion design creation: Using artificial intelligence. *Think. Ski. Creat.* **2022**, *46*, 101137. [CrossRef]
136. Mohana, P.P. A Survey of Modern Deep Learning based Generative Adversarial Networks (GANs). In Proceedings of the 6th International Conference on Computing Methodologies and Communication, ICCMC 2022, Erode, India, 29–31 March 2022; pp. 1146–1152. [CrossRef]
137. Kathirvelu, M.; Janaranjani, A.; Navin Pranav, A.T.; Pradeep, R. Voice Recognition Chat bot for Consumer Product Applications. In Proceedings of the IEEE International Conference on Data Science and Information System, ICDSIS 2022, Hassan, India, 29–30 July 2022. [CrossRef]
138. Nadiyah, K.; Dewi, G.S. Quality Control Analysis Using Flowchart, Check Sheet, P-Chart, Pareto Diagram and Fishbone Diagram. *Ind. Syst. Optim. J.* **2022**, *15*, 183–188. [CrossRef]
139. Waltman, L. A unified approach to mapping and clustering of bibliometric networks. *J. Informetr.* **2010**, *4*, 629–635. [CrossRef]
140. George, D.; Lehrach, W.; Kansky, K.; Lázaro-Gredilla, M.; Laan, C.; Marthi, B.; Lou, X.; Meng, Z.; Liu, Y.; Wang, H.; et al. A generative vision model that trains with high data efficiency and breaks text-based CAPTCHAs. *Science* **2017**, *358*, eaag2612. [CrossRef] [PubMed]
141. Grover, T.; Rowan, K.; Suh, J.; McDuff, D.; Czerwinski, M. Design and evaluation of intelligent agent prototypes for assistance with focus and productivity at work. *ACM Int. Conf. Proceeding Ser.* **2020**, 390–400. [CrossRef]
142. Sperlì, G. A Cultural heritage framework using a Deep Learning based Chatbot for supporting tourist journey. *Expert Syst. Appl.* **2021**, *183*, 115277. [CrossRef]
143. Dowling, M.; Lucey, B. ChatGPT for (Finance) research: The Bananarama Conjecture. *Financ. Res. Lett.* **2023**, *53*, 103662. [CrossRef]
144. Ali, H.; Aysan, A.F. What will ChatGPT revolutionize in the financial industry? *Mod. Financ.* **2023**, *1*, 116–129. [CrossRef]