



## Full Length Article

## Analyzing the potential benefits and use cases of ChatGPT as a tool for improving the efficiency and effectiveness of business operations

Rohit Raj<sup>a</sup>, Arpit Singh<sup>b</sup>, Vimal Kumar<sup>a,\*</sup>, Pratima Verma<sup>c</sup>

<sup>a</sup> Department of Information Management, Chaoyang University of Technology, Taichung-413310, Taiwan, China

<sup>b</sup> Department of Information Systems and Analytics, O. P. Jindal Global University, Sonapat, India 131029

<sup>c</sup> Department of Strategic Management, Indian Institute of Management Kozhikode, India, 673570

## ARTICLE INFO

**Keywords:**  
ChatGPT  
benefits  
business  
efficiency  
automation

## ABSTRACT

The study addresses the potential benefits for companies of adopting ChatGPT, a popular chatbot built on a large-scale transformer-based language model known as a generative pre-trained transformer (GPT). Chatbots like ChatGPT may improve customer service, handle several client inquiries at once, and save operational costs. Moreover, ChatGPT may automate regular processes like order tracking and billing, allowing human employees to focus on more complex and strategic responsibilities. Nevertheless, before deploying ChatGPT, enterprises must carefully analyze its use cases and restrictions, as well as its strengths and disadvantages. ChatGPT, for example, requires training data that is particular to the business domain and might produce erroneous and ambiguous findings. The study identifies areas of deployment of ChatGPT's possible benefits in enterprises by drawing on the literature that is currently accessible on ChatGPT, massive language models, and artificial intelligence. Then, using the PSI (Preference Selection Index) and COPRAS (Complex Proportional Assessment) approaches, potential advantages are taken into account and prioritized. By highlighting current trends and possible advantages in the industry, this editorial seeks to provide insight into the present state of employing ChatGPT in enterprises and research. ChatGPT may also learn biases from training data and create replies that reinforce those biases. As a result, enterprises must train and fine-tune ChatGPT to specific operations, set explicit boundaries and limitations for its use, and implement appropriate security measures to avoid malicious input. The study highlights the research gap in the dearth of literature by outlining ChatGPT's potential benefits for businesses, analyzing its strengths and limits, and offering insights into how organizations might use ChatGPT's capabilities to enhance their operations.

### 1. Introduction

As artificial intelligence (AI) continues to grow and become advanced, more businesses are exploring ways to integrate technologies led by AI into their operations [1]. One such technology that has gained significant traction from businesses around the world is chatbots. Chatbots are automated systems that use natural language processing (NLP) algorithms capable of simulating conversations with humans, providing customers with instant support and assistance [2]. Chat-generative pre-trained (ChatGPT) is a popular chatbot that is a large language model trained by OpenAI with the potential of providing several benefits to businesses [3]. ChatGPT is based on a large-scale

transformer-based language model called generative pre-trained transformer (GPT), which was first introduced by OpenAI in the year 2018 [4]. It was trained on a large corpus of text data to learn the patterns and structures of natural language using unsupervised learning methods. This enabled ChatGPT to learn from raw data without any explicit supervision [5]. After the success of GPT, OpenAI created ChatGPT, which is particularly meant to replicate human-like user dialogues. ChatGPT was trained using a vast dataset of online interactions from social media, forums, and other sources. The training data was carefully selected to ensure that the model learned the intricacies of human language and could generate high-quality responses to a variety of questions [6].

Chatbots like ChatGPT are particularly useful for businesses in

\* Corresponding Author: Vimal Kumar, Assistant Professor, Department of Information Management, Chaoyang University of Technology, Taichung, Taiwan, Contact: +886-966620704, +886-4-23323000, Fax: +886-4-23742337

E-mail addresses: [rohitraj2034@gmail.com](mailto:rohitraj2034@gmail.com) (R. Raj), [asingh6@jgu.edu.in](mailto:asingh6@jgu.edu.in) (A. Singh), [vimaljss91@gmail.com](mailto:vimaljss91@gmail.com), [vimalkr@gm.cyut.edu.tw](mailto:vimalkr@gm.cyut.edu.tw) (V. Kumar), [way2pratima@gmail.com](mailto:way2pratima@gmail.com), [pratima@iimk.ac.in](mailto:pratima@iimk.ac.in) (P. Verma).

<https://doi.org/10.1016/j.tbench.2023.100140>

Received 24 June 2023; Received in revised form 28 August 2023; Accepted 29 August 2023

Available online 1 September 2023

2772-4859/© 2023 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

enhancing their customer service by providing instant support and assistance to customers [7]. Since ChatGPT is an automated platform, it can stay operational 24/7 eliminating the need for human customer service representatives to be available around the clock [8]. Customers can be provided with instant services with nearly perfect accuracy without having to wait for human representatives to respond [9]. ChatGPT can also handle multiple customer inquiries simultaneously, providing a scalable solution for businesses with large customer bases [10]. In addition to improving customer service, ChatGPT can prove instrumental in assisting organizations in streamlining their operations thereby reducing costs [11]. ChatGPT can allow human employees to focus on more complicated and strategic duties by automating routine tasks such as order monitoring and billing. Additionally, by reducing the need for extra people to handle customer concerns and requests, ChatGPT can assist cut operational expenses.

To leverage ChatGPT's capabilities effectively, businesses must carefully consider its use cases and limitations. It is paramount that businesses clearly understand how ChatGPT works, its strengths, and its limitations before implementing it [12]. ChatGPT is a language-trained model that is completely based on the raw data supplied to train it. Hence, it requires training data that is specific to the business domain. There are instances where ChatGPT outputs erroneous and vague results particularly involving domain-specific knowledge or context [13]. The possibility of misunderstanding the context thereby leading to erroneous responses is quite high. ChatGPT can learn biases from the training data that it is exposed to, which can lead to erroneous or discriminatory responses. For example, if the training data includes biased language or perspectives, ChatGPT may generate responses that perpetuate those biases [3]. Natural language is often ambiguous, and ChatGPT might encounter issues with disambiguating phrases or sentences, leading to erroneous responses [14]. The ability of ChatGPT to generate human-like responses can be exploited to generate fake news or phishing attacks [15]. Businesses must train and fine-tune ChatGPT to do specific activities, check its responses regularly, and fix any biases or inconsistencies in the training data to reduce these mistakes. It is also critical to establish clear boundaries and constraints for ChatGPT's use, as well as to put proper security measures in place to prevent malicious input [16].

The prospective benefits are considered and prioritized when using the PSI and COPRAS techniques. We employ PSI (Preference Selection Index) and COPRAS (Complex Proportional Assessment) approaches to prioritize the identified areas of deployment for ChatGPT's benefits in enterprises. They also consider potential benefits such as cost savings, Enhanced Customer Experience (ECE), and Greater Human-Computer Collaboration (GHC). However, there seems to be a need for more clarity and detail regarding the methodology used, especially in comparison to related works. The paper proposes the use of PSI and COPRAS approaches to prioritize the potential benefits and use cases of ChatGPT in business operations. The paper would benefit from providing a more detailed explanation of these approaches. This would help readers understand how these methods work, how they are applied to the context of ChatGPT, and how they contribute to the analysis. In this revised manuscript, we have explained the PSI and COPRAS, which were chosen as the analytical tools for prioritization. What specific advantages do these approaches offer in evaluating the potential benefits and use cases of ChatGPT compared to other methods? Highlighting the strengths of these approaches would enhance the rationale behind their selection. The paper mentions that ChatGPT's usage in businesses is presented in related work, but it does not elaborate on how these related works evaluate the benefits. To address this gap, the authors should explicitly compare their chosen methodology with those used in related works. What are the differences and similarities? How does the paper's approach contribute to a better understanding of the benefits compared to existing research? It's important for the paper to clearly outline its contributions compared to existing research. What novel insights or advancements does the paper bring to the field of using ChatGPT in

business operations? How does the combination of PSI, COPRAS, and the specific context of ChatGPT distinguish this study from others? We have explained the methodology section, which provides a detailed step-by-step illustration of how PSI and COPRAS are applied to the context of ChatGPT's benefits and use cases. This includes the data collection process, criteria selection, analysis, and interpretation of results. The more detailed the explanation, the better readers can grasp the study's analytical framework. In a nutshell, the study seems to have a clear focus on analyzing the benefits and use cases of ChatGPT in business operations, it needs to provide more comprehensive explanations of the chosen methodology, highlight the differences from related work, and clearly articulate its contributions to the research field. This will enhance the paper's overall clarity and impact.

Overall, ChatGPT has found immense utility across various fields including language translation, chatbots, and content creation. ChatGPT is continually learning and enhancing its capabilities as a result of user interactions. Its uses include everything from customer service to language translation to creative writing. ChatGPT is an outstanding display of machine learning and artificial intelligence's capabilities in language processing. However, little research has been done to explore ChatGPT's potential benefits for boosting business operations, which represents a significant gap in the literature. This paper aims to fill this gap by identifying ChatGPT's possible benefits for businesses, discussing its strengths and limitations, and providing insights on how businesses might use ChatGPT's capabilities to improve their operations. We hope that this research will help enterprises make informed decisions about using ChatGPT by providing a better knowledge of its possible impact on business operations.

The remainder of the paper presents a detailed literature review and research methodology in Section 2 and Section 3 respectively. Section 4 presents a data analysis and results followed by the discussion and findings in Section 5 with the implications of this study. Finally, Section 6 outlines the conclusions with limitations and the future scope of this study.

## 2. Literature review

The recent limited literature on the subject of ChatGPT's usage in businesses is summarized in the following section.

In a study based on text classification, a corpus of 233,914 English tweets was analyzed using ChatGPT to identify the dominant themes which were collected within the first month of the launch of ChatGPT. Three dominant themes emerged namely news, technology, and reactions. The authors pointed out that the AI chatbot, ChatGPT can be effectively used in five functional domains including critical writing, essay writing, prompt writing, code writing, and answering questions. This research revealed that ChatGPT can have both positive and negative consequences on technology and humans. The major issues generated by the use of ChatGPT include job evolution, changes in the technological landscape, the pursuit of general artificial intelligence, and ethical considerations [17]. ChatGPT can provide efficient services including customer service applications and the creation of virtual assistants for voice and text conversations. It also offers topic detection, emotion detection, and sentiment analysis capabilities to enhance user understanding. It has a positive impact on digital marketing, e-commerce, healthcare, education, and finance [8]. In an interesting research in the domain of finance, it was found that ChatGPT can efficiently generate research studies that are plausible and useful, even in its basic state. The output can be further refined to better quality by adding private data and researcher expertise. Using the peer-review process, the evaluations of the created research give empirical verification of their potential contribution. The ethical implications of employing ChatGPT as a research instrument are unknown, and two points must be considered. On the one hand, ChatGPT might be viewed as a democratizing instrument capable of leveling the research production gaps between the global south and wealthy nations. Yet, it raises problems regarding the

correct credit and ownership of research conducted with its support [18]. The focus of the research article authored by [19] is on the application of ChatGPT for resolving programming bugs. This study explored the utility of ChatGPT in providing debugging aid, bug prediction, and bug explanation to address programming issues. Moreover, the paper emphasizes the incorporation of other efficient debugging tools and techniques to validate and verify the forecasts and explanations provided by ChatGPT [19]. AI has made significant strides in the field of radiology where GPT-based models are providing new opportunities to enhance accuracy, efficiency, and patient outcomes. These models are extensively used for report generation, educational support, clinical decision support, patient communication, and data analysis [20]. The research was conducted that investigated how ChatGPT may be utilized as a learning tool and the advantages and disadvantages it provides to students and teachers in communication, business writing, and composition courses. The researchers ran 30 ChatGPT tests and discovered that it has the potential to replace search engines due to its accuracy and dependability in presenting information to pupils. It also enables teachers to incorporate technology into their classes and hold workshops to analyze and evaluate produced replies. However, the study discovered that unethical usage of ChatGPT by students might result in human unintelligence and unlearning, posing a problem for instructors in measuring learning results. The research recommends teachers minimize using theory-based questions as take-home evaluations, give thorough case-based and scenario-based assessment assignments, use plagiarism detection software, and use ChatGPT-produced replies as examples in classrooms [12].

After reflecting deeply on the literature on ChatGPT and its variety of uses across sectors it can be concluded that the research on the assessment of the utility of ChatGPT in organizations is limited. The research is mostly confined to understanding the uses of ChatGPT in the education sector, healthcare, and academic research. While there is a growing interest in using ChatGPT to improve business operations, there is a gap in understanding how it can be used in specific business contexts. Hence, this study attempts to uncover the potential benefits ChatGPT can provide to businesses. While some research has been undertaken on the use of ChatGPT in certain business contexts, such as healthcare or customer service, additional research on how it may be utilized in other sorts of enterprises or sectors is required. How may ChatGPT be utilized in the industrial, banking, or hospitality industries, for example? What are the potential advantages and disadvantages of utilizing ChatGPT in these situations? Further study is needed to understand the numerous applications of ChatGPT in various sectors and scenarios. Table 1 shows the explanation of different aspects of Benefits and their sub-benefits.

**Table 1**  
Explanation of different aspects of Benefits and their sub-benefits

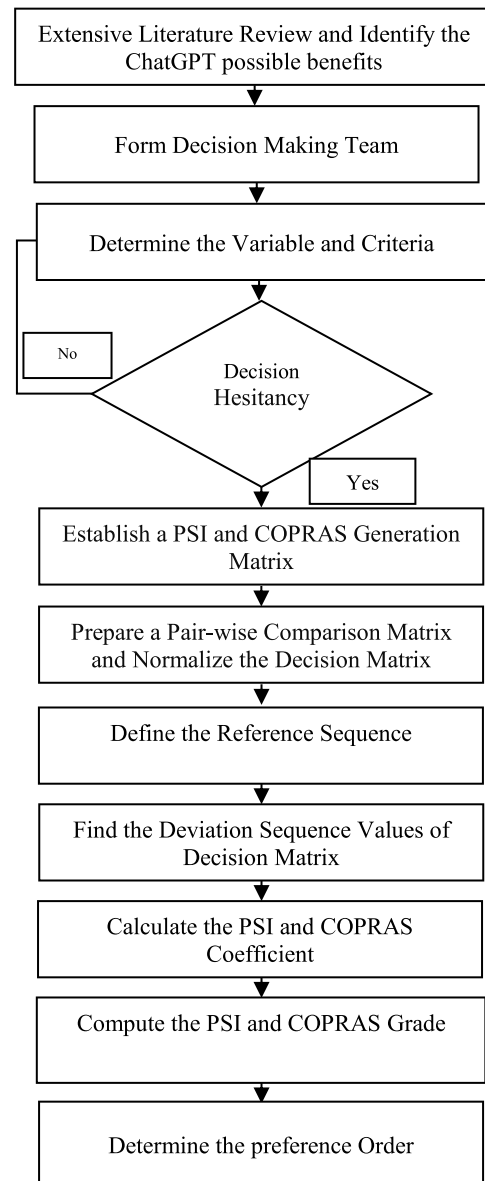
Benefits	Sub- Benefits	References
Cost Savings (CS)	CS1	Increased Efficiency within a business [8,19,21,22]
	CS2	Improved Accuracy within a business [13,23,24]
	CS3	automate repetitive tasks such as answering frequently asked questions [8,25–27]
Enhanced customer engagement (ECE)	ECE1	providing quick, informative, and more natural responses [3,10,17,21,28]
	ECE2	leads to a more positive experience for the customer [29–31]
	ECE3	increased customer satisfaction and loyalty [28,29,32]
Generate high-quality content (GHC)	GHC1	Save businesses time and resources for content creation [8,24,28,33]
	GHC2	ability to generate human-like text [3,23,34]
	GHC3	personalize customer interactions and tailor responses based on the customer's preferences [3,10,21,34,35]

### 3. Research Methodology

Each indicator's weight was determined step-by-step using the preference selection index (PSI) and complex proportional assessment (COPRAS) techniques to prioritize them. The process flow for the research is shown in Fig. 1. Using PSI and COPRAS, the advantages of ChatGPT have been rated in terms of improving business operations. The benefits and their sub-benefits criteria for measurement aspect is given in Table 1. The actual metrics and the demographics of the decision-makers taken into account for the research study are provided in Table 2, respectively.

#### 3.1. Data collection and sample

The data is collected through Google questionnaire-based survey from product designers, service engineers, data scientists, programmers, researchers, and business development. All respondents belong to different positions including executive, supervisor, manager, and senior manager as shown in Table 2. This study emphasizes that the selection of respondents for our study was based on a rigorous criterion of expertise



**Fig. 1.** The flow diagram of the research methodology

**Table 2**  
Respondents' demographic details

Profile	Classification	Count
Sex	Female	8
	Male	7
Age	21-31	4
	32-41	7
	42-52	4
	Above 52	0
	Executive	3
Denomination	Supervisor	3
	Manager	3
	Senior manager	6
	Diploma	0
	Bachelors in Engineering	7
Education	Post Graduate in Computer Science	4
	Doctoral in technical education	4
	1-8 years	6
	9-17 years	5
Present company tenure	18-24 years	3
	above 24 years	1
	Product designer	3
	Service Engineer	4
Department of respondents	Data scientist	3
	Programmer	3
	Research and Business Development	2

within the field of generative AI technologies. Each of the fifteen respondents holds a distinguished track record in the field of generative AI technologies, and their insights are widely recognized as authoritative within the academic and professional community. In the context of our research objectives, we aimed to capture in-depth perspectives from a panel of recognized experts, allowing us to delve into nuanced aspects that are often challenging to access through larger-scale surveys ([36, 37]; et al., 2023; [38–41]). The intention was to prioritize the quality of responses over quantity, as these experts possess a wealth of knowledge and experience that greatly enriches our study [42–44]. The remark about the fifteen respondents is accurate, and this small sample size can help ensure the validity and strength of the study's findings. The sample is adequate in reflecting the population of interest and must be representative. The advice of experts would help to conclude. The outcomes are more likely to represent the group under study's actual features. With a small sample, it is important to recognize the restrictions and potential consequences of the study's sample size.

### 3.2. PSI Method

The PSI approach can be used to determine the objective weights of the various criteria. The following are the PSI method's steps: [45].

Step 1: Building the decision matrix (P) is the first step. This matrix is indicated by using Eq. 1.

$$P = [p_{ij}]_{m \times n} \quad (1)$$

The performance of the  $i$  th alternative on the  $j$  th criterion is shown in Eq. 1 by  $t_{ij}$ .

Step 2: Eq. 2 is used to perform the matrix's values' normalization.

$$p_{ij}^* = \frac{p_{ij}}{\max(p_{ij})} \quad (2)$$

$$p_{ij}^* = \frac{\min(p_{ij})}{p_{ij}} \quad (3)$$

Step 3: Using Eq. 4, the average values of the normalized matrix are calculated.

$$Q_{ij}^* = \frac{\sum_{i=1}^m p_{ij}^*}{m} \quad (4)$$

Step 4: Each alternative's preference variation value ( $\delta_j$ ) is calculated.

$$\delta_j = \sum_{i=1}^m [p_{ij} - Q_{ij}^*]^2 \quad (5)$$

Step 5: Calculated the preference value's deviation ( $\theta_j$ ).

$$\theta_j = |1 - \delta_j| \quad (6)$$

Step 6: The  $k_j$  criteria weights are computed.

$$k_j = \frac{\theta_j}{\sum_{j=1}^n \theta_j} \quad (7)$$

Step-7: Determine the  $P_j$  of for each option: – Each alternative's  $P_j$  is provided as follows:

$$P_j = \sum_{i=1}^m [\delta_j \times k_j] \quad (8)$$

The significance ranks (priorities) of the alternatives are listed in increasing order of  $P_j$  value, i.e., the alternative with a higher  $P_j$  value has top importance than other alternatives.

### 3.3. COPRAS (Complex Proportional Assessment) Method

The “Complex Proportional Assessment” or COPRAS method was developed by Zavadskas and Kaklauskas in 1996. It was used to determine which alternative was superior to others and made it possible to compare them [46]. When more than one parameter needs to be considered in an evaluation, this method can be used to increase or decrease the number of criteria [47]. The COPRAS method ranks and evaluates choices in descending order according to their importance and utility [48]. The following steps are part of the COPRAS method:

Step 1. Decision matrix ( $P = [a_{ij}]_{k \times l}$ ) is normalized by applying Eq. (9).

The normalized decision matrix is denoted by  $N = [p_{ij}]_{k \times l}$ . To compare all criteria, normalization seeks to produce various dimensionless values.

$$p_{ij} = a_{ij} / \sum_{j=1}^l a_{ij} \quad i = 1, 2, \dots, k; j = 1, 2, \dots, l \quad (9)$$

Step 2. The weighted normalized decision matrix  $Z = [z_{ij}]_{n \times m}$  was determined by applying Eq. (10).

$$z_{ij} = w_j a_{ij} \quad i = 1, 2, \dots, k; j = 1, 2, \dots, l \quad (10)$$

Where  $p_{ij}$  is the normalized value of  $j^{\text{th}}$  alternative according to  $i^{\text{th}}$  criterion.

**Table 3**

Normalized Decision Matrix

CS	0.8	1	1	1	0.5	0.8	0.8	0.8	1	0.8	0.6	0.5	1	0.8	1
ECE	1	0.6	0.8	0.6	0.8	1	1	0.8	1	0.8	1	1	0.8	1	0.8
GHC	0.8	0.6	1	0.6	1	1	0.8	1	1	1	1	0.8	1	1	1

**Table 4**

The Results of PSI

$\delta_j$	0.026	0.106	0.041	0.106	0.125	0.041	0.026	0.026	0.000	0.026	0.106	0.125	0.041	0.041	0.041
$\theta_j$	0.973	0.893	0.958	0.893	0.875	0.958	0.973	0.973	1.000	0.973	0.893	0.875	0.958	0.958	0.958
$k_j$	0.068	0.063	0.067	0.063	0.061	0.067	0.068	0.068	0.070	0.068	0.063	0.061	0.067	0.067	0.067

Step 3. The weighted normalized values of the favorable and non-beneficial criteria were added. Calculating sums required the use of Eqs. (11) and (12).

$$Q_{+j} = \sum_{i=1}^k z_{+ij} \quad (11)$$

$$Q_{-j} = \sum_{i=1}^k z_{-ij} \quad (12)$$

where  $z_{+ij}$  and  $z_{-ij}$  are the weighted normalized values for the advantageous and unbeneficial criteria, respectively. The  $Q_{+j}$  the value increases and the  $Q_{-j}$  value decreases as the quality of the alternative increases. The values of  $Q_{+j}$  and  $Q_{-j}$  show how well each option has performed in terms of accomplishing its goals.

Step 4. The characteristics of the both positive and negative alternatives  $Q_{+j}$  and  $Q_{-j}$ , respectively, are described to establish the significance of the alternatives.

Step 5. The relative weighting or priorities of the options were determined. The priorities of the potential choices were established using  $E_j$ . With increasing  $E_j$  value, the alternative's importance grows. The relative relevance of a certain option reveals the extent to which it satisfies a desire. The best choice is the candidate alternative with the highest overall significance value ( $E_{\max}$ ). The comparative statistical significance of the  $j_{th}$  choice,  $E_j$ , was determined using Eq. (13).

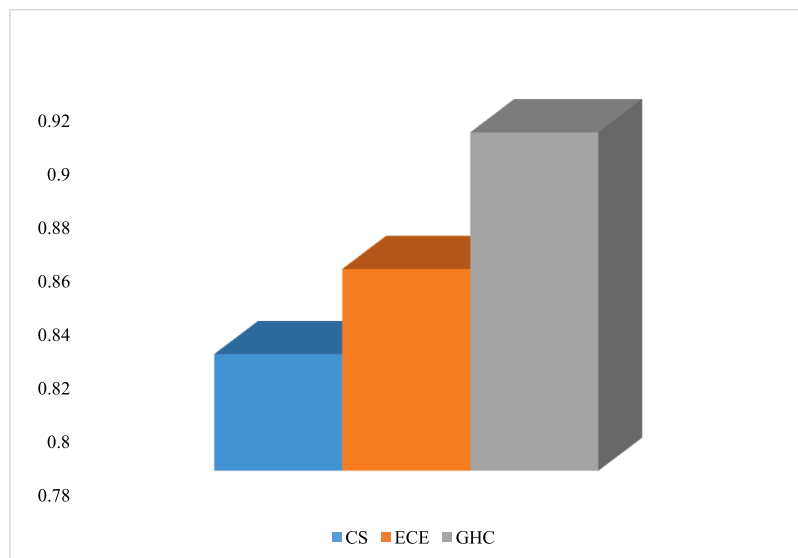
$$E_j = Q_{+j} + \left( \left( Q_{-\min} \sum_{j=1}^l Q_{-j} \right) / \left( Q_{-j} \sum_{j=1}^m (Q_{-\max} / Q_{-j}) \right) \right) \quad (13)$$

Where  $j = 1, 2, \dots, l$  and  $Q_{-\min}$  is the minimum value of  $Q_{-j}$ .

Step 6. The quantitative utility ( $U_j$ ) for the  $j_{th}$  the alternative was calculated. An alternative's utility level is necessarily related to its relative significant level ( $E_j$ ). One can assess an alternative's rank and degree of utility by comparing the efficiency rankings of all available possibilities. It is calculated using Eq. (14).

$$V_j = \left[ \frac{E_j}{E_{\max}} \right] \times 100 \quad (14)$$

where  $E_{\max}$  is the relative significance measure with the maximum value. The utility value of an option increases or decreases proportionally to its relative significance value. The more valuable  $V_j$  is, the higher the priority of the alternative. Depending on the utility ratings of the alternatives, a comprehensive ranking of the competing options can be created.

**Fig. 2.** Illustration of benefits parameters scores



**Table 5**

Final performance score

	$P_j$	Rank
CS	0.8236	3
ECE	0.8554	2
GHC	0.9063	1

#### 4. Data Analysis and Results

##### 4.1. PSI Results

Table 1 displays the PSI-based progress evaluation of the benefits indicators' ordering and prioritization. Think about how to prioritize signs for the PSI technique's validation based on other options. Eq. 1 is used to incorporate all collected data into a decision matrix. After the creation of the choice matrix for the benefits such as cost savings (CS), enhanced customer engagement (ECE), and generating high-quality content (GHC), respectively. For each indicator from Table 1, the normalized value was assessed using equations 2 through 5. The normalization decision matrix is displayed in Table 3. The values of  $\delta_j$ ,  $\theta_j$ , and  $k_j$  were calculated using equations 5 through 7, respectively. The PSI results are shown in Table 4.

In light of scores of  $P_j$ , Fig. 2 shows the impact of performance reviews on the parameter. The consequences of different parametric values are shown in Fig. 2. Using Eq. 8, which highlights the actual results of the study, Table 5 provides the performance score for each of the three benefits. It demonstrates that option GHC has the highest performing score, with indicators ECE and CS coming in at second and last, respectively. As a result, based on the overall performance shown in Table 5.

##### 4.2. COPRAS Results

Table 1 displays the results of utilizing COPRAS to evaluate the sub-benefits indicators' ranking and prioritization progress. In order to validate the COPRAS approach, consider prioritizing sub-benefits based on other options. After constructing the decision matrix for the sub-benefits such as increased efficiency within a business (CS1), improved accuracy within a business (CS2), automate repetitive tasks such as answering frequently asked questions (CS3), providing quick, informative, and more natural responses (ECE1), leads to a more positive experience for the customer (ECE2), increased customer satisfaction

and loyalty (ECE3), Save businesses time and resources for content creation (GHC1), ability to generate human-like text (GHC2), and personalize customer interactions and tailor responses based on the customer's preferences (GHC3) respectively. Eq. (9) was used to calculate the normalized value for each of the sub-benefits from Table 1 that are shown in Table 6. By analyzing Eq. 10, Table 7 shows the weighted normalized choice matrix importance with indicators, with the enhanced optimal values illustrative of the value of all parameter weights.

The positive alternative sum value ( $Q_{+j}$ ) was obtained using Eq. 11, while the negative alternative sum value was obtained using Eq. 12. ( $Q_{-j}$ ). According to Eqs. 13 and 14, Table 8 displays the values of the two consolidated assessment scores,  $E_j$ , and  $V_j$ , along with ranking. Positive alternative sum value ( $Q_{+j}$ ) and negative alternative sum value are used to evaluate this value data ( $Q_{-j}$ ). Based on the two scores  $E_j$ , and  $V_j$ , Fig. 3 demonstrates the impact of performance assessments on the parameter. The consequences of various parameter settings are shown in Fig. 3. Table 8 summarizes the actual results of the study and provides the performance score for each of the nine sub-benefits. It demonstrates that criteria ECE3, GHC1, and CS2 have the poorest performance scores, whereas choice ECE1 has the highest performance score. As a result, based on the overall performance shown in Table 8.

#### 5. Discussion and Findings

Providing quick, informative, and more natural responses (ECE1) under the category of Enhanced customer experience (ECE) is ranked first in the important features of ChatGPT that help boost business operations by accentuating customer satisfaction, improving customer retention, and ultimately, increasing revenue. ChatGPT may help organizations meet customer demands more efficiently and effectively by offering timely and informed responses to client inquiries or concerns, which can lead to improved levels of customer satisfaction [49]. Furthermore, the usage of natural language processing (NLP) technology may assist to make customer interactions feel more customized, which can aid in the development of better connections and increased customer loyalty [50]. Customers who feel satisfied and well-cared for are more inclined to do business with a firm again and may even suggest it to others. This can assist to boost client retention and attract new consumers, resulting in greater revenue and profitability for the company. Some examples of the aforementioned can be when customers need an instant response related to the day of the delivery of their

**Table 6**

Normalization of initial decision matrix for sub-benefits

CS1	0.097	0.128	0.121	0.097	0.097	0.097	0.133	0.069	0.147	0.121	0.100	0.118	0.083	0.125	0.121
CS2	0.097	0.128	0.061	0.097	0.097	0.161	0.100	0.103	0.118	0.091	0.100	0.147	0.111	0.063	0.152
CS3	0.129	0.103	0.121	0.129	0.129	0.065	0.167	0.138	0.088	0.121	0.133	0.118	0.139	0.125	0.091
ECE1	0.129	0.077	0.121	0.065	0.097	0.129	0.067	0.069	0.088	0.121	0.100	0.088	0.139	0.125	0.121
ECE2	0.097	0.128	0.121	0.161	0.161	0.097	0.100	0.138	0.147	0.121	0.100	0.088	0.139	0.125	0.121
ECE3	0.065	0.103	0.121	0.097	0.097	0.129	0.100	0.103	0.147	0.091	0.133	0.118	0.083	0.125	0.121
GHC1	0.161	0.128	0.121	0.129	0.129	0.129	0.100	0.103	0.118	0.121	0.133	0.088	0.111	0.094	0.091
GHC2	0.097	0.128	0.091	0.129	0.065	0.097	0.100	0.172	0.059	0.121	0.133	0.118	0.111	0.094	0.091
GHC3	0.129	0.077	0.121	0.097	0.129	0.097	0.133	0.103	0.088	0.091	0.067	0.118	0.083	0.125	0.091

**Table 7**

Weighted normalized decision matrix

CS1	0.0068	0.0064	0.0024	0.0019	0.0019	0.0029	0.0080	0.0021	0.0118	0.0024	0.0080	0.0094	0.0017	0.0125	0.0109
CS2	0.0068	0.0064	0.0012	0.0019	0.0019	0.0048	0.0060	0.0031	0.0094	0.0018	0.0080	0.0118	0.0022	0.0063	0.0136
CS3	0.0090	0.0051	0.0024	0.0026	0.0026	0.0019	0.0100	0.0041	0.0071	0.0024	0.0107	0.0094	0.0028	0.0125	0.0082
ECE1	0.0090	0.0038	0.0024	0.0013	0.0019	0.0039	0.0040	0.0021	0.0071	0.0024	0.0080	0.0071	0.0028	0.0125	0.0109
ECE2	0.0068	0.0064	0.0024	0.0032	0.0032	0.0029	0.0060	0.0041	0.0118	0.0024	0.0080	0.0071	0.0028	0.0125	0.0109
ECE3	0.0045	0.0051	0.0024	0.0019	0.0019	0.0039	0.0060	0.0031	0.0118	0.0018	0.0107	0.0094	0.0017	0.0125	0.0109
GHC1	0.0113	0.0064	0.0024	0.0026	0.0026	0.0039	0.0060	0.0031	0.0094	0.0024	0.0107	0.0071	0.0022	0.0094	0.0082
GHC2	0.0068	0.0064	0.0018	0.0026	0.0013	0.0029	0.0060	0.0052	0.0047	0.0024	0.0107	0.0094	0.0022	0.0094	0.0082
GHC3	0.0090	0.0038	0.0024	0.0019	0.0026	0.0029	0.0080	0.0031	0.0071	0.0018	0.0053	0.0094	0.0017	0.0125	0.0082

**Table 8**Final performance score  $M_i$  for the criteria.

	$E_j$	$V_j$	Rank
CS1	0.17102625	99.802368	6
CS2	0.17087352	99.713244	9
CS3	0.1711948	99.900726	4
ECE1	0.17136492	100	1
ECE2	0.17116057	99.880749	5
ECE3	0.17092929	99.745785	7
GHC1	0.17092682	99.744346	8
GHC2	0.17125175	99.933955	3
GHC3	0.17127207	99.945815	2

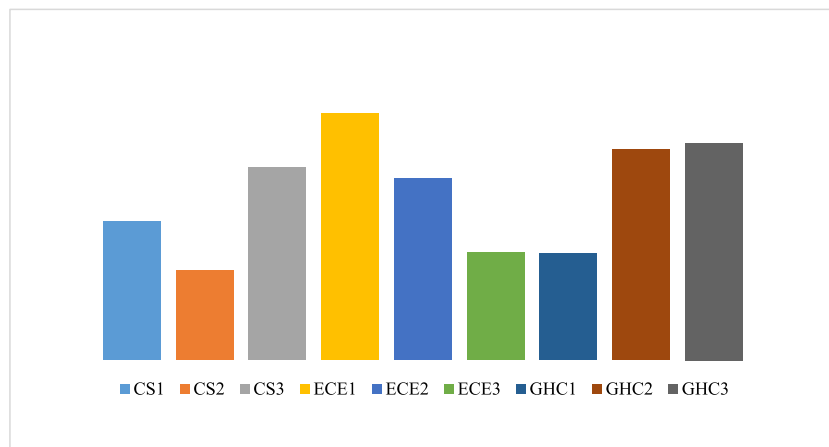
orders. ChatGPT can provide an instant reply to the customers in a personalized way such as “Your order will be delivered in 3 days”. This helps customers in restoring confidence and trust in the organization. Similarly, the response by ChatGPT to the queries like “Can you tell me more about the return policy?” will be of the form “Our return policy allows customers to return items within 30 days of purchase for a full refund. However, some restrictions apply for certain products.” It can be readily observed that the response is sufficiently informative and provides adequate details to the customers regarding the return policy. Customers are more likely to engage with a business if they feel they are having a natural conversation, rather than interacting with a machine. ChatGPT’s NLP technology may help make interactions feel more human-like, which can lead to better customer connections [51]. For example, a consumer may enquire, “Do you provide any discounts?” and ChatGPT can answer naturally, “Sure, we offer a 10% discount to first-time clients.” Do you want to know more?”

“Personalize customer interactions and tailor responses based on the customer’s preferences” (GHC3) under the category “Generate high-quality content” (GHC) acquires the second rank in the list of features of ChatGPT helpful in boosting business operations. Customers want to feel heard and valued by the companies they do business with [52]. By establishing personalized interactions with their customers and providing tailored responses based on preferences, organizations can instill confidence and trust in customers which will lead to increased customer satisfaction and loyalty. This will result in repeat purchases and positive word-of-mouth publicity and referrals thereby boosting business operations. When customers realize that they are being valued and respected they continue to do business with the companies. This leads to increased sales and revenue, as well as a larger customer base. Personalized interactions with customers can help businesses to improve their marketing efforts by providing deeper insights into consumer behavior and preferences. By understanding what customers need, companies can design more effective and targeted marketing campaigns leading to better conversion rates and higher returns on investment for

marketing efforts. Organizations that can personalize customer interactions position themselves uniquely in the marketplace which differentiates these companies from competitors. This enables them to gain a competitive edge in the marketplace and unprecedented profits.

“Ability to generate human-like text (GHC2)” and “Improved Accuracy within a business (CS2)” under the categories of GHC and CS acquire third and fourth place respectively in the overall ranking of features of ChatGPT that are instrumental in boosting business operations. ChatGPT’s ability to create human-like text can help organizations to generate high-quality content more effectively and efficiently [53]. Whether it’s blog posts, social media updates, or product descriptions, ChatGPT can assist businesses to generate content that is more engaging, informative, and targeted to the intended audience. This can lead to increased website traffic, improved search engine rankings, and higher conversion rates [20]. By automating certain tasks, ChatGPT can prove immensely useful in cutting down costs that are incurred on services such as customer care. ChatGPT, for instance, can employ intelligent chatbots to provide customer assistance thereby eliminating the need to have humans do the job. This can help in the reduction of the cost that goes into paying the customer care executives. The automated services are comparatively more accurate than the traditional human-assisted services and thus the chances of errors are considerably reduced resulting in significant cost-savings. The ability of ChatGPT to respond in human-like text results in more personalized and engaging customer interaction. ChatGPT-powered technologies like chatbots can answer frequently asked questions (FAQs), provide recommendations, and resolve issues quickly and efficiently. By leveraging ChatGPT’s natural language processing capabilities, businesses can provide a more natural and human-like interaction, leading to higher customer satisfaction and retention rates [54]. Businesses may obtain a competitive edge in the market by exploiting ChatGPT’s capabilities. ChatGPT can assist businesses in improving their content creation, customer service, and accuracy, resulting in higher customer satisfaction and brand loyalty. Businesses may differentiate themselves from the competition and earn market share by delivering a superior client experience.

“Increased efficiency in the market (CS1)” and “Save businesses time and resources for content creation (GHC2)” are found to be the prominent features of ChatGPT that assist organizations in multiple ways to boost productivity. ChatGPT can help organizations leverage ChatGPT’s natural language processing capabilities to provide human-like responses to customers and make conversations more engaging and productive. The ability of the chatbot enabled by ChatGPT to handle customers’ queries and resolve issues quickly and efficiently can allow a significant amount of time for the employees to streamline and focus attention on addressing issues that are urgent thereby leading to better productivity [55]. Since this technology uses deep learning mechanisms

**Fig. 3.** Illustration of sub-benefits parameters scores

to design responses to queries based on historical data, it can be a useful resource to dig out important and relevant information pertaining to a given problem that occurs in organizations readily. In the case their limited time is available to make presentations to the client, ChatGPT's help can be used to create immensely interactive and informative ones to be presented to the clients. This is yet another way in which ChatGPT can enable employees to focus more on the tasks that require immediate attention. ChatGPT can produce high-quality written material on a wide range of topics. This can save organizations time and resources by eliminating the need for them to conduct their research and writing. ChatGPT may also edit and proofread current material to ensure that it is error-free and fits the requirements of the company. This can save businesses time and money by eliminating the need to recruit extra personnel or contractors to complete these activities. ChatGPT may assist enterprises with keyword research to help them optimize their content for search engines. This may save firms time and dollars by making their material more accessible to potential consumers. ChatGPT may also assist enterprises in improving the readability, clarity, and engagement of their existing material. Instead of having to generate new content from scratch, this can save businesses time and resources by boosting the efficacy of their existing material.

### 5.1. Implications of this study

Based on the findings of the current study, several practical implications are offered to the practitioners and management of business organizations. Some of the notable ones are as follows:

- ChatGPT may assist firms in more efficiently and successfully meeting customer expectations by offering rapid, informative, and natural solutions to client inquiries or problems. Management should think about using ChatGPT as a customer service tool to improve the customer experience and, eventually, revenue.
- Consumers who are happy and well-cared for are more likely to return to a company and may even promote it to others. ChatGPT's NLP technology may help make customer encounters feel more personalized, which can lead to stronger connections and higher customer loyalty. Managers should educate ChatGPT to respond to client inquiries in a customized manner, making them feel heard and appreciated.
- ChatGPT may give customers product and service information such as shipping timeframes, return policies, and discounts. Management should teach ChatGPT to deliver accurate and extensive product and service information to assist consumers to make informed selections. Management should routinely check ChatGPT's performance to verify that it is responding to consumer inquiries satisfactorily. They should also solicit consumer input to identify areas where ChatGPT might be enhanced.
- To offer consumers a consistent experience across all channels, ChatGPT should be connected with other customer care channels such as email and phone assistance. Customers shall receive the same quality of service regardless of the channel via which they contact the business.
- Managers and practitioners may save money by adopting ChatGPT to handle tasks like content development, editing, and proofreading instead of paying extra staff or contractors. This can result in substantial cost reductions for the firm.
- Managers and practitioners may obtain a competitive advantage in the marketplace by leveraging the possibilities of ChatGPT. This can assist firms in distinguishing themselves from the competition and attracting new clients.
- ChatGPT can assist corporate managers and practitioners in improving the efficiency of their operations. Organizations may minimize the time and effort necessary to perform activities by automating common processes and simplifying workflows, resulting in increased efficiency and productivity.

- The capacity of ChatGPT to handle numerous jobs at once makes it a great alternative for enterprises wishing to grow their operations. Organizations may increase their client base and operations without hiring extra staff by exploiting the advantages of ChatGPT.
- ChatGPT can assist company managers and practitioners in personalizing their interactions with clients. Organizations may tailor their offers and communications to better suit the requirements of their consumers by utilizing ChatGPT to collect data on client preferences and behavior.

### 5.2. Key contributions

The study emphasizes the potential benefits of incorporating ChatGPT, a popular chatbot built on a large-scale transformer-based language model, within companies. These advantages encompass enhanced customer service, multitasking capability for handling client inquiries, and operational cost savings. The study underscores the need for thorough analysis before integrating ChatGPT into enterprises. Factors such as domain-specific training data and potential errors in outcomes are highlighted as key considerations for successful deployment. The research draws from existing literature on ChatGPT, massive language models, and artificial intelligence to identify potential deployment areas. The utilization of PSI and COPRAS methodologies to evaluate benefits provides a structured approach for assessment. By elucidating current industry trends and potential advantages, the study offers valuable insights into the practical utilization of ChatGPT's capabilities to augment business operations and research endeavors.

## 6. Conclusions, limitations, and future scope of research

The study proposes to explore the benefits of ChatGPT that foster productivity in the operations of business organizations. Through extant literature review and consultation with experts, this research identified three benefits of ChatGPT which subsequently branched into nine sub-benefits.

The top three benefits revealed after analyzing the survey-based data belonged to the categories "Generate High-quality Content (GHC)" and "Enhanced Customer Engagement (ECE)". The analysis revealed that all three categories of benefits were significant in boosting business operations in their rite. "Providing quick, informative, and more natural responses (ECE1) under the category of Enhanced customer experience (ECE)", "Personalize customer interactions and tailor responses based on the customer's preferences" (GHC3), "Ability to generate human-like text (GHC2)", "Automate repetitive tasks such as answering frequently asked questions (CS3)", and "leads to a more positive experience for the customer (ECE2)" were the top 5 sub-benefits in the overall list of important benefits of ChatGPT in boosting business operations.

There are several limitations to this study which are mentioned below. The research makes no mention of any possible difficulties that may emerge during the implementation of ChatGPT in business processes. For example, problems concerning data protection, technical complexities, or client confidence may present difficulties. The research does not provide a complete cost-benefit analysis of ChatGPT implementation. The expense of implementing and maintaining the technology may be significant, and companies must balance the costs against the possible benefits. The study does not look into the possible risks of using ChatGPT to automate customer support. For example, if the chatbot is unable to correctly answer customer questions or duplicate a human-like exchange, it may create a negative customer experience.

The following could be the research's upcoming plan of action:

Conducting additional research into the feasibility of adopting ChatGPT in various business sectors, as well as finding best practices for tackling possible challenges. Conducting a thorough cost-benefit study to assist companies in making informed choices about ChatGPT implementation. One of the key advantages of ChatGPT fine-tuning lies in its ability to tailor the model's responses to specific industry domains or



niches. By exposing the model to domain-specific data and business jargon, further research can potentially create more contextually relevant and accurate responses. This fine-tuning process has the potential to significantly improve the model's ability to provide valuable insights, assist in decision-making, and enhance customer interactions within business applications. Moreover, conducting an additional study to investigate the possible risks and limitations of automating client support via ChatGPT, as well as developing strategies to handle these risks. The possibility of combining ChatGPT with other technologies such as machine learning, sentiment analysis, and voice recognition to provide a more complete and personalized user experience is being investigated. Evaluating ChatGPT's effect on client happiness, retention, and income, and developing methods to maximize the technology's impact.

## Declaration of Competing Interest

The current manuscript titled "Analyzing the potential benefits and use cases of ChatGPT as a tool for improving the efficiency and effectiveness of business operations" is original work and never published before in any form anywhere. There is no conflict of interest associated with this manuscript with anyone to its publication. All the authors have given their significant contributions to this manuscript. I corresponding author to the manuscript declare that the manuscript has been read and approved by all the associated authors of the manuscript and they all consented to its submission.

## References

- [1] M.M. Mariani, I. Machado, S. Nambisan, Types of innovation and artificial intelligence: A systematic quantitative literature review and research agenda, *Journal of Business Research* 155 (2023), 113364.
- [2] S.J.H. Shah, Chatbots for Business and Customer Support. Trends, Applications, and Challenges of Chatbot Technology, 2023, pp. 212–221, <https://doi.org/10.4018/978-1-6684-6234-8.ch009>.
- [3] S.S. Biswas, Potential Use of Chat GPT in Global Warming, *Annals of Biomedical Engineering* (2023) 1–2, <https://doi.org/10.1007/s10439-023-03171-8>. Accepted.
- [4] Mhlanga, D. (2023). Open AI in Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning. *Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning* (February 11, 2023).
- [5] J. Rudolph, S. Tan, S. Tan, ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning and Teaching* 6 (1) (2023) <https://doi.org/10.37074/jalt.2023.6.1.9>.
- [6] Y. Gao, W. Tong, E.Q. Wu, W. Chen, G. Zhu, F.Y. Wang, Chat with ChatGPT on Interactive Engines for Intelligent Driving, *IEEE Transactions on Intelligent Vehicles* (2023), <https://doi.org/10.1109/TIV.2023.3252571>.
- [7] A. Shafeeg, I. Shazhaev, D. Mihaylov, A. Tularov, I. Shazhaev, Voice Assistant Integrated with Chat GPT, *Indonesian Journal of Computer Science* 12 (1) (2023), <https://doi.org/10.33022/ijcs.v12i1.3146>.
- [8] A.S. George, A.H. George, A Review of ChatGPT AI's Impact on Several Business Sectors, *Partners Universal International Innovation Journal* 1 (1) (2023) 9–23.
- [9] P. Tsigaris, J.A. Teixeira da Silva, Can ChatGPT be trusted to provide reliable estimates? *Accountability in Research* (2023) just-accepted.
- [10] E.A. van Dis, J. Bollen, W. Zuidema, R. van Rooij, C.L. Bockting, ChatGPT: five priorities for research, *Nature* 614 (7947) (2023) 224–226.
- [11] A.T. Gabrielson, A.Y. Odisho, D. Canes, Harnessing Generative AI to Improve Efficiency Among Urologists: Welcome ChatGPT, *The Journal of Urology* (2023) 10–1097.
- [12] M.A. Alafnan, S. Dishari, M. Jovic, K. Lomidze, ChatGPT as an Educational Tool: Opportunities, Challenges, and Recommendations for Communication, Business Writing, and Composition Courses, *Journal of Artificial Intelligence and Technology* (2023), <https://doi.org/10.37965/jait.2023.01>. Accepted.
- [13] T.H. Kung, M. Cheatham, A. Medenilla, C. Sillos, L. De Leon, C. Elepaño, V. Tseng, Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models, *PLOS Digital Health* 2 (2) (2023), e0000198.
- [14] C. Zielinski, M. Winker, R. Aggarwal, L. Ferris, M. Heinemann, J.F. Lapeña, S. Pai, L. Citrome, Chatbots, ChatGPT, and Scholarly Manuscripts-WAME Recommendations on ChatGPT and Chatbots in Relation to Scholarly Publications, *Afro-Egyptian Journal of Infectious and Endemic Diseases* 13 (1) (2023) 75–79.
- [15] J.V. Pavlik, Collaborating With ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education, *Journalism & Mass Communication Educator* (2023), 10776958221149577.
- [16] M. Mijwil, M. Aljanabi, Towards Artificial Intelligence-Based Cybersecurity: The Practices and ChatGPT Generated Ways to Combat Cybercrime, *Iraqi Journal For Computer Science and Mathematics* 4 (1) (2023) 65–70.
- [17] V. Taecharungroj, What Can ChatGPT Do? Analyzing Early Reactions to the Innovative AI Chatbot on Twitter, *Big Data and Cognitive Computing* 7 (1) (2023) 35.
- [18] M. Dowling, B. Lucey, ChatGPT for (finance) research: The Bananarama conjecture, *Finance Research Letters* (2023), 103662.
- [19] N.M.S. Surameery, M.Y. Shakor, Use Chat GPT to Solve Programming Bugs, *International Journal of Information Technology & Computer Engineering (IJITC)* 3 (01) (2023) 17–22. ISSN: 2455-5290.
- [20] A. Lecler, L. Duron, P. Soyer, Revolutionizing radiology with GPT-based models: Current applications, future possibilities and limitations of ChatGPT. *Diagnostic and Interventional Imaging* (2023). Accepted, doi:10.1016/j.diii.2023.02.003.
- [21] A. Haleem, M. Javaid, R.P. Singh, An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges, *BenchCouncil transactions on benchmarks, standards and evaluations* (2023), 100089.
- [22] M. Halaweh, ChatGPT in education: Strategies for responsible implementation, *Contemporary Educational Technology* 15 (2) (2023).
- [23] Y. Shen, L. Heacock, J. Elias, K.D. Hentel, B. Reig, G. Shih, L. Moy, ChatGPT and other large language models are double-edged swords, *Radiology* (2023), 230163.
- [24] M. Sallam, ChatGPT Utility in Health Care Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns, *Healthcare* 11 (6) (2023) 887.
- [25] S.B. Patel, K. Lam, ChatGPT: the future of discharge summaries? *The Lancet Digital Health* 5 (3) (2023) e107–e108.
- [26] B.D. Lund, T. Wang, N.R. Mannuru, B. Nie, S. Shimray, Z. Wang, ChatGPT and a new academic reality: Artificial Intelligence-written research papers and the ethics of the large language models in scholarly publishing, *Journal of the Association for Information Science and Technology* (2023), <https://doi.org/10.1002/asi.24750>. Accepted.
- [27] S.A. Prieto, E.T. Mengiste, B. García de Soto, Investigating the use of ChatGPT for the scheduling of construction projects, *Buildings* 13 (4) (2023) 857.
- [28] B. Rathore, Future of AI & Generation Alpha: ChatGPT beyond Boundaries, *Eduzone: International Peer Reviewed/Refereed Multidisciplinary Journal* 12 (1) (2023) 63–68.
- [29] P. Korzynski, G. Mazurek, A. Altmann, J. Ejdy, R. Kazlauskaitė, J. Paliszkiwicz, E. Ziemia, Generative artificial intelligence as a new context for management theories: analysis of ChatGPT, *Central European Management Journal* (2023), <https://doi.org/10.1108/CEMJ-02-2023-0091>. Accepted.
- [30] T. Sakirin, R.B. Said, User preferences for ChatGPT-powered conversational interfaces versus traditional methods, *Mesopotamian Journal of Computer Science* 2023 (2023) 24–31.
- [31] D. Singh, ChatGPT: A New Approach to Revolutionise Organisations, *International Journal of New Media Studies (IJNMS)* 10 (1) (2023) 57–63.
- [32] H. Du, S. Teng, H. Chen, J. Ma, X. Wang, C. Gou, B. Li, S. Ma, Q. Miao, X. Na, P. Ye, Chat with ChatGPT on Intelligent Vehicles: An IEEE TIV Perspective, *IEEE Transactions on Intelligent Vehicles* (2023), <https://doi.org/10.1109/TIV.2023.3253281>. Accepted.
- [33] S. Badini, S. Regondi, E. Frontoni, R. Pugliese, Assessing the Capabilities of ChatGPT to Improve Additive Manufacturing Troubleshooting, *Advanced Industrial and Engineering Polymer Research* (2023), <https://doi.org/10.1016/j.aiepr.2023.03.003>. Accepted.
- [34] B.D. Lund, T. Wang, Chatting about ChatGPT: how may AI and GPT impact academia and libraries? *Library Hi Tech News* (2023) <https://doi.org/10.1108/LHTN-01-2023-0009>. Accepted.
- [35] M. Aljanabi, ChatGPT: Future directions and open possibilities, *Mesopotamian Journal of CyberSecurity* (2023) 16–17. 2023.
- [36] S. Avikal, R. Pant, K.C.N. Kumar, V. Kumar, M. Ram, Prioritizing the Barriers of Manufacturing during COVID-19 using Fuzzy AHP, from the book title *Advances in Soft Computing Applications*, River Publishers, New York, USA, 2023, pp. 205–213, chapter 11 ISBN 978-87-7022-817-6.
- [37] S.M. Vadiel, A.H. Sequera, V. Kumar, V. Chandana, Performance Evaluation of Manufacturing Product Layout Design Using PROMETHEE II-MCDM Method, from the book title *Intelligent Systems Design and Applications*, Nature Switzerland (2023) 1–11, [https://doi.org/10.1007/978-3-031-27440-4\\_24](https://doi.org/10.1007/978-3-031-27440-4_24).
- [38] A. Mittal, S. Sachan, V. Kumar, S. Vardhan, P. Verma, M.S. Kaswan, J.A. Garza-Reyes, Essential organizational variables for the Implementation of Quality 4.0: Empirical evidence from the Indian furniture industry, *The TQM Journal* (2023), <https://doi.org/10.1108/TQM-06-2023-0189>. Ahead-of-Print.
- [39] V. Kumar, A. Mittal, P. Verma, J. Antony, Mapping the TQM Implementation Approaches and their Impact on Leadership in Indian Tire Manufacturing Industry, *The TQM Journal* (2023), <https://doi.org/10.1108/TQM-08-2022-0258>. Ahead-of-Print.
- [40] Singh, A., Kumar, V., & Verma, P. (2023), Sustainable Supplier Selection in a Construction Company: A new MCDM method based on Dominance-based Rough Set Analysis, *Construction Innovation: Information, Process, Management*, Ahead-of-Print. 10.1108/CI-12-2022-0324.
- [41] A. Mittal, V. Kumar, P. Verma, A. Singh, Evaluation of Organizational Variables of Quality 4.0 in Digital Transformation: The Study of an Indian Manufacturing Company, *The TQM Journal* (2022), <https://doi.org/10.1108/TQM-07-2022-0236>. Ahead-of-Print.
- [42] G. Guest, A. Bunce, L. Johnson, How many interviews are enough? An experiment with data saturation and variability, *Field Methods* 18 (1) (2006) 59–82, <https://doi.org/10.1177/1525822X05279903>.
- [43] R. Raj, V. Kumar, P. Verma, Big data analytics in mitigating challenges of sustainable manufacturing supply chain, *Operations Management Research* (2023) 1–15.
- [44] V. Kumar, N.K. Sharma, A. Mittal, P. Verma, The Role of IoT and IIoT in Supplier and Customer Continuous Improvement Interface. *Digital Transformation and Industry 4.0 for Sustainable Supply Chain Performance*, Springer International Publishing, Cham, 2023, pp. 161–174.

- [45] K. Maniya, M.G. Bhatt, A selection of material using a novel type decision-making method: Preference selection index method, *Materials & Design* 31 (4) (2010) 1785–1789.
- [46] E.K. Zavadskas, A. Kaklauskas, T. Vilutiene, Multicriteria evaluation of apartment blocks maintenance contractors: Lithuanian case study, *International Journal of Strategic Property Management* 13 (4) (2009) 319–338.
- [47] V. Podvezko, The comparative analysis of MCDA methods SAW and COPRAS, *Engineering Economics* 22 (2) (2011) 134–146.
- [48] A. Kaklauskas, E.K. Zavadskas, J. Naimaviciene, M. Krutinis, V. Plakys, D. Venskus, Model for a complex analysis of intelligent built environment, *Automation in construction* 19 (3) (2010) 326–340.
- [49] D. Gursoy, Y. Li, H. Song, ChatGPT and the hospitality and tourism industry: an overview of current trends and future research directions, *Journal of Hospitality Marketing & Management* 32 (5) (2023) 579–592.
- [50] M. Javaid, A. Haleem, R.P. Singh, ChatGPT for healthcare services: An emerging stage for an innovative perspective, *BenchCouncil Transactions on Benchmarks, Standards and Evaluations* 3 (1) (2023), 100105.
- [51] Sohail, S. S., Farhat, F., Himeur, Y., Nadeem, M., Madsen, D. Ø., Singh, Y., ... & Mansoor, W. (2023). Decoding ChatGPT: A Taxonomy of Existing Research, Current Challenges, and Possible Future Directions. *Journal of King Saud University-Computer and Information Sciences*, 101675.
- [52] M.R. Kuchnik, *Beyond Model Efficiency: Data Optimizations for Machine Learning Systems*, Carnegie Mellon University, 2023. Doctoral dissertation.
- [53] E. Kasneci, K. Seßler, S. Küchemann, M. Bannert, D. Dementieva, F. Fischer, G. Kasneci, ChatGPT for good? On opportunities and challenges of large language models for education, *Learning and Individual Differences* 103 (2023), 102274.
- [54] A. Haleem, M. Javaid, R.P. Singh, An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges, *BenchCouncil transactions on benchmarks, standards and evaluations* 2 (4) (2022), 100089.
- [55] P. Budhwar, S. Chowdhury, G. Wood, H. Aguinis, G.J. Bamber, J.R. Beltran, A. Varma, Human resource management in the age of generative artificial intelligence: Perspectives and research directions on ChatGPT, *Human Resource Management Journal* (2023).