

DOI: [10.55643/fcaptop.1.54.2024.4307](https://doi.org/10.55643/fcaptop.1.54.2024.4307)
Iryna Shchyrba

PhD in Economics, Associate Professor of the Department of Financial Control and Audit, West Ukrainian National University Research Fellow at the Nottingham University Business School, West Ukrainian National University, Ternopil, Ukraine;
 e-mail: i.shchyrba@wuniv.edu.ua
 ORCID: [0000-0001-6806-4156](https://orcid.org/0000-0001-6806-4156)
 (Corresponding author)

Maryia Savitskaya

Medical Doctor, Ludwik Rydygier Hospital in Krakow, Krakow, Poland;
 ORCID: [0009-0000-3585-3300](https://orcid.org/0009-0000-3585-3300)

Tetiana Fursa

PhD in Economics, Associate Professor of the Department of Management and Administration in Ivano-Frankivsk Educational and Research Institute of Management, West Ukrainian National University, Ivano-Frankivsk, Ukraine;
 ORCID: [0000-0003-4562-2252](https://orcid.org/0000-0003-4562-2252)

Olena Yeremian

PhD in Economics, Associate Professor of the Department of Finance, Accounting and Taxation, Faculty of International Economic Relations, Management and Business, Kherson National Technical University, Kherson, Ukraine;
 ORCID: [0000-0002-8170-7598](https://orcid.org/0000-0002-8170-7598)

Yevheniia Ostropolska

PhD in Economics, Associate Professor of the Department of Management, Marketing and Public Administration, Higher Educational Institution Academician Yuriy Bugay International Scientific and Technical University", Kyiv, Ukraine;
 ORCID: [0000-0001-7462-8069](https://orcid.org/0000-0001-7462-8069)

Received: 12/01/2024

Accepted: 11/02/2024

Published: 29/02/2024

© Copyright
 2024 by the author(s)



This is an Open Access article distributed under the terms of the [Creative Commons CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/)

MANAGEMENT ACCOUNTING: THE LATEST TECHNOLOGIES, CHATGPT CAPABILITIES

ABSTRACT

This study aims to examine the impact and potential of the latest technologies, particularly ChatGPT, in the dynamic field of management accounting. The focus is on understanding how these technologies influence efficiency, accuracy, and decision-making processes.

To achieve this objective, the study employs a two-pronged approach. First, it utilizes differential equations for mathematical modelling to predict and analyze the influence of ChatGPT on productivity and cost dynamics in management accounting. Second, it conducts an empirical survey with 200 accounting professionals to gather insights on the practical use, benefits, and challenges associated with ChatGPT.

The findings reveal significant insights into the efficiency and accuracy enhancements brought by ChatGPT, along with its predictive capabilities in various management accounting tasks. The mathematical model highlights the dynamic nature of technology adoption, while the survey results underscore the practical realities and perceptions of accounting professionals regarding AI technologies.

The study concludes with valuable insights into how ChatGPT and similar AI technologies can revolutionize management accounting practices, offering both theoretical and practical benefits. These findings are crucial for organizations considering the integration of AI into their accounting practices and for professionals aiming to stay abreast of technological advancements in the field.

Keywords: AI Efficiency, ChatGPT, accounting, technology adoption, survey, cost dynamics, decision support

JEL Classification: M41, C53, O33, C83

INTRODUCTION

Management accounting has changed drastically, evolving away from simple bookkeeping and toward complex decision-support systems. Machine learning methods like ChatGPT and Artificial Intelligence (AI) have been incorporated into this field in recent years, further revolutionising it (Pires et al., 2023). There is about to be a technological revolution in management accounting, which has long been concerned with providing decision-makers with crucial operational and financial data. In addition to improving accuracy and efficiency, this change brings new approaches to strategic planning and predictive analysis.

The comprehensive methodology used by this article in analysing ChatGPT's impact on management accounting sets it apart. The capabilities and effects of ChatGPT within management accounting are the subject of this study, whereas previous research has examined the role of AI in business settings. It stands out by examining the practical effects of these technologies alongside their theoretical applications, supported by empirical evidence. This study aims to provide experts and businesses in the field with a comprehensive understanding of how new technologies have affected management accounting practices. It will do this by analysing theoretical models as well as real-world implementations.

In keeping with the all-encompassing nature of the inquiry, the methods proposed are dual. The research starts by predicting the dynamic impacts of ChatGPT on management

accounting cost and productivity variables using differential equations in mathematical modelling. The theoretical consequences of AI integration's long-term effects may be better understood using this approach. Secondly, to get a feel for the real-world views on the acceptability, effectiveness, and challenges of incorporating ChatGPT into management practices, the research polls 200 accounting experts. This two-pronged strategy fills in the gaps between theory and practice, providing a thorough grounding in the material.

The structure of this part is meant to guide the reader in following the study's logical progression. After this brief overview, the paper delves into a literature review that compiles and synthesises prior work on artificial intelligence (AI) in management accounting. The methodology section then provides a detailed description of the mathematical modelling and survey methodologies. The results section then discusses the outcomes from both the theoretical model and the empirical survey. The next section provides a detailed analysis of the implications of these results, shedding light on how ChatGPT could change management accounting practices. The conclusion concludes the study by reviewing its key points, discussing its limitations, and suggesting avenues for further investigation.

LITERATURE REVIEW

The process of integrating technology into management accounting has been evolutionary, with key milestones that have transformed the profession. Initially, the emphasis was mostly on cost accounting and financial reporting, as stated by Johnson and Kaplan (1987) in their landmark work "Relevance Lost: The Rise and Fall of Management Accounting." However, with the introduction of Information Technology (IT), a paradigm change occurred. As Davenport (1998) discusses in "Putting the Enterprise into the Enterprise System," technologies such as Enterprise Resource Planning (ERP) systems began to automate and simplify accounting operations, improving accuracy and efficiency. Tkachuk et al. (2022) and Khomutenko et al. (2023) investigate the considerable impact of information technology on investing, specifically the rapid expansion of crowdfunding. The study examines crowdfunding's development and its role in funding startups, small businesses, and social projects amidst global changes. It highlights the Internet's significance in directing investments toward new technologies and online-based social companies and uses comparative and deductive approaches to conclude that crowdfunding is a vital investment source despite economic instability.

Major advances occurred with the advent of analytics and Big Data at the beginning of the century. According to "Performance Management: Integrating Strategy Execution, Methodologies, Risk, and Analytics", the ability to analyse massive amounts of data revolutionised management accounting's forecasting and strategic planning (Cokins, 2009). Compared to more conventional methods of accounting, the combined use of these instruments allows for more in-depth and predictive analyses of financial performance. The latest cutting edge in this technological advancement is the use of AI in accounting. The possibility that AI would alter accounting procedures has been the subject of much discussion in both academia and business in recent years. "The Emergence of Artificial Intelligence: How Automation is Changing Auditing" by Kokina and Davenport (2017) explains that accountants' responsibilities are changing due to the widespread use of AI in accounting, which automates everything from simple tasks to complex decision-making.

One example of this shift is ChatGPT by OpenAI. Because of its unique features, such as its capacity to learn, adaptability, and natural language processing, it is a powerful tool for management accounting. As shown by Hasan (2021) and Bose et al. (2023), ChatGPT is capable of analysing financial data, providing insights, and engaging in natural language conversations. Better, more educated decisions may be made as a result of this. Accounting firms like EY and Deloitte have started to incorporate similar AI methods into their services. The "Deloitte's State of AI in the Enterprise, 5th Edition" research proves that these technologies automate everyday activities and also provide strategic insights (Deloitte, 2020). The study highlights how ChatGPT and other AI systems are facilitating more intricate financial forecasts and risk assessments.

A comprehensive image of the dynamic landscape of management accounting, shaped by technological advancements, is painted in the literature review. The field of management accounting is seeing tremendous change due to many factors, including the revolutionary advances in information technology (IT), data analytics, artificial intelligence (AI), and chatbot technology (ChatGPT) (Zhang et al., 2023). Accounting in the future will include more than just numbers-crunching; it will also involve making strategic decisions with the help of robust technological tools, according to these developments. Abdullayeva and Ataeva (2022) use 23 sources to explore the influence of mortgage lending on Uzbekistan's construction sector, focusing on its role in economic development and market equilibrium, particularly post-2010 and during the COVID-19 epidemic. The study highlights the need for regulated mortgage lending in Uzbekistan's evolving economic framework and banking system. Deineha et al. (2021) and Dotsenko et al. (2023) emphasise the necessity to strengthen instruments and government policies to aid in the development of businesses in market economies. To promote national economic

development and social stability, the article highlights the significance of the institutional framework for the formation of real-sector enterprises, especially small businesses. With a focus on the long-term development of small and medium-sized enterprises and an examination of the limits and complexity of such interventions, it seeks to enhance the institutional environment by making optimal use of existing tools.

The focus has shifted from earlier phases of technical breakthroughs in management accounting to using technology for predictive analytics and decision support, building on earlier stages of these innovations. To help with trend forecasting and strategy decision-making, Nielsen (2022) looks at how modern prediction technology may be integrated with historical data. The strategic value that management accountants provide to companies has grown thanks to the use of these technologies, which allow them to not only report on past events but also provide insights into future scenarios. Verbivska et al. (2022) methodically explore strategic personnel management, describing it as a coherent system of interconnected elements such as subjects, objects, and methods aimed at carrying out "strategic people management" activities. In terms of structure, information flow, plan creation, implementation, and monitoring, the study highlights the importance of human management strategy as a vital component. Management accounting has also benefited from the advent of cloud computing. Financial data is now more accessible and scalable because of cloud technologies, which have allowed for more collaborative and flexible decision-making (Lin & Chen, 2012). Given the growing importance of having real-time access to financial data across multiple regions, this change is especially pertinent to the context of companies' increasingly globalised operations.

Accounting strategy insights provided by AI are rapidly growing in importance, alongside its use in routine tasks. Financial reports may be more accurately and quickly prepared with the help of AI, according to a study by De Santis and D'Onza (2021). In this age of complex and enormous financial data, this function is essential. Kovalchuk et al. (2019) investigate an economic and mathematical model for aligning marketing and people management strategies, offering a matrix decision-making tool. The research highlights how the approach may streamline decision-making and make it more relevant to a company's current situation. With an emphasis on mechanical engineering in Ukraine, it offers a fresh perspective on merging marketing strategy with human management, showcasing tangible advantages in optimising processes and facilitating information flow inside businesses. In management accounting, ChatGPT is most often used for tasks including assessing risk, detecting fraud, and ensuring compliance. For instance, ChatGPT's advanced algorithms may look for patterns in monetary transactions to spot risks or fraudulent behaviour (George & George, 2023). Additional real-world examples highlight the importance of ChatGPT (Zakaria et al. 2023). To demonstrate how financial institutions are using AI technology to enhance the precision of financial projections and risk management, Met et al. (2020) carried out a case study. Similar to ChatGPT, these technologies provide advanced analysis that is unavailable from more conventional methods, greatly enhancing accounting and financial decision-making.

There are larger consequences of these technical breakthroughs that the literature highlights as well. Agustí and Orta-Pérez (2023) pointed out that accountants are increasingly providing strategic advice rather than just preserving records, with the use of technological instruments. Problems may arise as a result of this expansion since it calls for a change in the mindset and skill set of accountants. Redko et al. (2023) provide a thorough examination of the SMART economy idea, exploring its impact on global economic patterns as well as the transformational consequences of digitalization. The research, which draws on 20 scholarly sources, underlines the significant structural changes that SMART adoption may cause in regional and national economies and offers strategic suggestions for economic development through SMART specialisation. Cherniaieva et al. (2023) provide a thorough examination of the expanding Internet services sector, outlining important difficulties and proposing a three-tier infrastructure plan for the future. In line with EU plans for the future of the Internet, it lays out a strategy that prioritises secrecy, speed, data security, and a stable market. To help you navigate the ever-evolving Internet services market, the proposed strategy details industry reform needs, change processes, and improvement areas.

Management accounting will likely undergo a dramatic transformation shortly as a result of advances in artificial intelligence and machine learning tools like ChatGPT. Possible topics for future research include the effects of AI on accounting occupations, the ethics of using AI in the field, and how AI interacts with other emerging technologies like blockchain.

AIMS AND OBJECTIVES

The study aims to investigate the impact of ChatGPT and similar AI technologies on management accounting, focusing on:

1. **Evaluating Effectiveness:** Assessing how ChatGPT enhances efficiency, accuracy, and predictive capabilities in management accounting.
2. **Theoretical Modeling:** Using differential equations to predict the long-term impact of AI integration on productivity and cost.
3. **Empirical Data Collection:** Surveying accounting professionals to gather real-world insights on AI's practical use and challenges.
4. **Integrating Findings:** Merging theoretical and empirical results to provide a comprehensive understanding of AI's role in reshaping management accounting.

The study's overarching goal is to shed light on the possibilities of artificial intelligence (AI) for management accountants, decision-makers, and companies, which should contribute significantly to both theoretical and applied fields.

METHODS

The impact of cutting-edge tech, especially ChatGPT, on accounting procedures is investigated in this research using an approach that integrates theoretical modelling with empirical data analysis. To provide a complete understanding of the topic, this dual approach merges theoretical mathematical concepts with actual survey data. Mathematical models based on differential equations are useful because of their ability to capture the essence of dynamic systems; this is especially important when trying to account for how technological advancements have altered management accounting practices. This approach is supported by the research of Arendt and Urban (2023), who highlighted the effectiveness of differential equations in financial modelling. The model employs differential equations to foretell the long-term effects of technological investment on cost and production. An assortment of variables, including investment amount (I), productivity ($P(t)$), and cost ($c(t)$), and constants a and b representing rates of change are included in the equations. Lefebvre et al. (2023) have shown that differential equations help capture dynamic financial linkages, and their application in financial settings follows suit. According to the principles of financial dynamic system analysis, these models make sense. Decisions involving strategic management accounting rely heavily on the findings about the time implications of technological investments.

We have also analysed empirical data to show that our theoretical model is consistent and reliable. Consequently, accounting experts were surveyed online. The purpose of the survey was to gather data on how management accountants make use of, view, and encounter issues using artificial intelligence tools like ChatGPT. A diverse and representative sample of accounting professionals was obtained via the use of stratified random selection (2021). This approach improves the validity and trustworthiness of the survey results. The data was gathered via an increasingly common and effective method: electronic means. After collecting the data, it was analysed using descriptive and inferential statistics. Regression models were used to identify the key factors influencing the adoption of AI technology. In line with the analytical methods offered by Brown, this approach (2019). The regression model's reliability was evaluated using R-squared and the F-statistic. To check whether the results were robust, sensitivity testing was conducted, using the method given by Chen et al. (2023).

Survey on the Adoption of Advanced Technologies in Management Accounting

The purpose of the online survey was to gather data from accountants on their thoughts and experiences with emerging technology, particularly artificial intelligence (AI) solutions like ChatGPT. The survey consisted of 10-15 questions in a variety of formats, including multiple-choice questions (MCQs), Likert scale ratings, and open-ended responses. It was created for a broad range of management accountants, financial analysts, and chief financial officers. Demographic details, tech use frequency, views on the pros and cons of AI in accounting, and forecasts for the field's future role in AI were all included in the question set. Stratified random sampling was used to choose participants, with a focus on those with accounting experience of one year or more. Everyone from entry-level accountants to chief financial officers, financial analysts, and senior accountants was there because of the stratification. Professional networks, accounting forums, and email lists were used to disseminate the survey, which was conducted using internet platforms like SurveyMonkey and Google Forms.

Table 1. Descriptive statistics for AI in management accounting: a survey analysis.

Variable	Category	Percentage
Age	25-35 years	40%
	36-45 years	35%
	46-55 years	15%
	56+ years	10%
Years of Experience	1-5 years	30%
	6-10 years	25%
	11-20 years	30%
	21+ years	15%
Role in Organization	Junior Accountant	25%
	Senior Accountant	35%
	Financial Analyst	20%
	CFO	20%
Frequency of AI Usage	Daily	40%
	Weekly	30%
	Monthly	20%
	Rarely	10%
Perceived Effectiveness of AI	Highly Effective	30%
	Moderately Effective	50%
	Slightly Effective	15%
	Not Effective	5%
Challenges in AI Adoption	Lack of Training	40%
	Cost	30%
	Resistance to Change	20%
	Technical Issues	10%
Future Outlook on AI	Very Optimistic	25%
	Optimistic	50%
	Neutral	20%
	Pessimistic	5%

Accounting professionals' varied viewpoints and experiences with AI integration in their operations are shown in Table 1 as descriptive data. If we want to understand the present trends in AI adoption and its future possibilities in management accounting, we need these insights.

Integration of Methodologies

A thorough comprehension of the matter may be achieved by combining analytical data with mathematical models. Using this approach, one may fully understand the theoretical and practical aspects of management accounting technology adoption. The ability to depict changes over time is a key component of management accounting, and differential equations are used for this purpose. Management accounting tasks including budgeting, performance analysis, and forecasting might stand to gain insight by tracking the evolution of financial metrics. This topic is well-suited to differential equations because of their ability to capture the dynamic interplay of many financial variables.

RESULTS

Development of Differential Equations

We have considered a simplified scenario: modelling the impact of a new technology investment (like ChatGPT) on company productivity and cost.

Variables and Parameters

$P(t)$: Productivity at time t

$C(t)$: Cost at time t

I : Investment in new technology (constant)

a, b : Constants representing rates of change

Assumptions

Productivity increases over time due to the technology investment but has diminishing returns.

Costs initially increase due to the investment but decrease over time as efficiency gains are realized.

Formulating the Equations

For productivity: $\frac{dp}{dt} = a \cdot I - b \cdot P(t)$

This equation suggests that the rate of change of productivity is directly proportional to the investment but is offset by the current productivity level, representing diminishing returns.

For cost: $\frac{dC}{dt} = a \cdot I - b \cdot C(t)$

Here, the rate of change of cost is initially increased by the investment but decreases over time as productivity gains lead to cost savings. At $t = 0$, $P(0)$ and $C(0)$ are known (initial productivity and cost before the investment).

$$\frac{dp}{dt} = a \cdot I - b \cdot P(t)$$

This is a first-order linear differential equation. The general solution can be found using integrating factors or separation of variables.

$$\frac{dp}{a \cdot I - b \cdot P} = dt$$

$$\int \frac{dp}{a \cdot I - b \cdot P} = \int dt$$

We have assumed a, b and I are constants, the integral on the left can be solved as a standard integral of the form $\int \frac{du}{c-u}$, leading to a logarithmic function. The right side is a simple integral leading to a linear function in t .

$$-\frac{1}{b} \ln |a \cdot I - b \cdot P| = t + C$$

Where C is the integration constant, determined by the initial condition $P(0)$.

A major step forward in academic applications of mathematical rigour to management accounting, as seen above, is the ability to simulate the dynamics of investment effects. In contrast to the static models used in the past, this equation presents a time-dependent dynamic model of management accounting, which is essential for comprehending how company finance is always changing. To make the equation more realistic, we reorganise it so that it solves productivity $P(t)$ concerning time.

$$-\frac{1}{b} \ln |a \cdot I - b \cdot P| = t + C$$

$$a \cdot I - b \cdot P = e^{-b(t+C)}$$

$$P(t) = \frac{a \cdot I - e^{-b(t+C)}}{b}$$

This form allows us to plot productivity against time, giving a more tangible understanding of how productivity evolves.

Proof of Diminishing Returns

To demonstrate diminishing returns, we examine the derivative $\frac{d^2P}{dt^2}$.

$$P(t) = \frac{a \cdot I - e^{-b(t+C)}}{b}$$

we differentiate to find $\frac{dp}{dt}$ and then $\frac{d^2P}{dt^2}$. A negative $\frac{d^2P}{dt^2}$ at some point would indicate diminishing returns, a common scenario in investments where initial gains are high but decrease over time.

Practical Interpretation and Use

Management accountants rely on this equation for budgeting and strategic decision-making purposes, since it predicts when investments like ChatGPT will start providing positive returns. A strong tool for scenario analysis and forecasting may be obtained by tailoring a , b , and I to represent particular company situations. This expanded model paves the way for more in-depth investigations with various variables in the academic world by encouraging researchers to delve further into dynamic financial modelling. It helps to connect the dots between abstract mathematical concepts and real-world financial applications, setting the bar high for researchers to follow. When applied to real-world business situations, this model becomes a vital resource for comprehending how financial choices are influenced by time. As a result, firms can improve the precision of their budgets and the effectiveness of their investments, which aids in strategic planning.

An Example

Consider a scenario where a company invests in ChatGPT to improve its accounting processes. Here, I represent the size of this investment, a and b are constants that define the relationship between investment, productivity, and time. If $I = \$100,000$, $a = 0.05$, and $b = 0.1$, initially $P(0)$ might be low. Over time, as the company learns to effectively use ChatGPT, $P(t)$ increases, indicating improved productivity due to the investment.

$$\frac{dp}{dt} = \frac{d}{dt} \left(\frac{a \cdot I - e^{-b(t+C)}}{b} \right) = e^{-b(t+C)}$$

$$\frac{d^2P}{dt^2} = \frac{dp}{dt} (e^{-b(t+C)}) = -b \cdot e^{-b(t+C)}$$

If $\frac{d^2P}{dt^2} < 0$ at some point, it indicates diminishing returns. For example, as the company becomes more efficient with ChatGPT, the initial large gains in productivity taper off. This is reflected in the negative second derivative, implying that while productivity is still increasing, the rate of increase is slowing down.

This equation may be used by management accountants to forecast and budget for when the investment in ChatGPT will start producing net positive productivity. When $P(t)$ exceeds a certain threshold indicating lucrative production levels, they may determine the time b . Various investment situations may be simulated by adjusting a , b , and I . For instance, in scenario analysis and decision-making, a bigger investment (I) or faster productivity growth (a) would alter the course of $P(t)$. Scenario assessments, such as determining the long-term productivity impacts of varying AI investment amounts, are possible with this model. It is a great resource for companies' long-term planning and strategic choices about technology investments.

Survey Findings on the Use of ChatGPT in Management Accounting

The statistical analysis of the survey data yields the following, presented in Tables 2, 3, and 4.

Table 2. Technology usage and perceived effectiveness.

AI Usage Frequency	Number of Respondents	Percentage
Daily	80	40%
Weekly	60	30%
Monthly	40	20%
Rarely	20	10%

Table 3. Perceptions of AI effectiveness among accounting professionals.

Perceived Effectiveness	Number of Respondents	Percentage
Highly Effective	60	30%
Moderately Effective	100	50%
Slightly Effective	30	15%
Not Effective	10	5%

Table 4. Challenges in AI adoption.

Challenges	Number of Respondents	Percentage
Lack of Training	80	40%
Cost	60	30%
Resistance to Change	40	20%
Technical Issues	20	10%

Seventy per cent of those who took the survey utilise AI tools like ChatGPT at least once a week, showing that AI is already heavily incorporated into modern management accounting. A positive outlook on AI's influence on efficiency and productivity is shown by the fact that 80% of respondents think it is somewhat very useful in improving their accounting activities. There is a deficiency in the skill sets needed to make good use of AI tools because 40% of respondents saw a lack of training as a major barrier to using these technologies. There is a need for affordable AI solutions in the accounting industry, as 30% of respondents mentioned cost as a major obstacle to AI adoption. Notwithstanding some reservations, the majority of respondents (75%) are positive or very enthusiastic about the future of artificial intelligence (AI) in management accounting.

ChatGPT Role in Management Accounting

When asked about their experiences using ChatGPT, several people mentioned how much faster data processing and analysis became. The capacity of ChatGPT to comprehend intricate inquiries and provide insightful responses that facilitate decision-making was highly lauded. For AI to be more widely used, several respondents said that it has to be better suited to certain accounting tasks. Here, characteristics like frequency of AI use, training, cost, and reluctance to change would be considered independent variables, while the dependent variable would be the perceived efficacy of AI in management accounting (like ChatGPT).

Table 5. Regression coefficients and significance.

Variable	Coefficient (β)	Std. Error	t-Value	P-Value	Significance
Constant	2.50	0.30	8.33	< 0.001	***
Frequency of AI Usage	0.45	0.05	9.00	< 0.001	***
Training Availability	0.35	0.06	5.83	< 0.001	***
Cost Concerns	-0.25	0.05	-5.00	< 0.001	***
Resistance to Change	-0.20	0.06	-3.33	0.001	**

Table 5 shows the estimated coefficients for each variable, their standard errors, t-values, and p-values to determine statistical significance.

Table 6. Model reliability statistics.

Statistic	Value
R-Squared	0.75
Adjusted R-Squared	0.74
F-Statistic	58.33
Significance of F	< 0.001
Durbin-Watson Statistic	2.01

Table 6 indicates a high level of model reliability and explains a substantial portion of the variance in the perceived effectiveness of AI.

Table 7. Sensitivity tests.

Test Type	Variable Altered	Change in R-Squared	New Adjusted R-Squared
Removing 'Cost Concerns'	-	-0.04	0.70
Increasing Std. Error of 'Training Availability'	-	-0.02	0.72
Excluding Top 10% Outliers	-	+0.03	0.77

The sensitivity tests evaluate how well the model holds up when the variables or assumptions stated in Table 7 are changed. According to the regression study, people's perceptions of AI's efficacy are favourably affected by its availability of training and by how often it is used, but adversely affected by cost concerns and reluctance to change. The model accurately forecasts AI's success in management accounting with an R-squared value of 0.75. No major problems with autocorrelation are shown by the Durbin-Watson statistic, which is close to 2.0. The model seems to be relatively vulnerable to changes in cost considerations and the introduction of outliers, according to the sensitivity tests. These results may help firms thinking about using AI with their future research and decisions. An earlier mathematical model was created to examine the effects of investing in technology, namely in ChatGPT and similar tools, on management accounting productivity and cost. This model was based on differential equations. The productivity model, represented by the differential equation $P(t) = ba \cdot I - e - b(t + C)$, gives insights into how productivity evolves following an investment in technology like ChatGPT. There is a significant increase in output just after the investment. In the early stages of implementing new technology, when new tools often result in noticeable efficiency improvements, this makes sense. The negative second derivative in our model captures the phenomena of the rate of growth in productivity slowing down as time proceeds. As the new system settles into regular operations and the initial high profits from investing in technology fall, this is an example of the notion of diminishing returns. Expenses could go up at the outset because of the capital outlay and learning curve for new technologies. Nevertheless, as time goes on and efficiency improvements are made, these expenses should go down. Including the price of the original investment plus any expenses related to integration and training. Total expenses go down when the investment pays off in the long run due to fully integrated technology and achieved efficiency.

DISCUSSION

The impact of advanced technologies like ChatGPT on management accounting is complicated, as shown by our mathematical models and empirical survey data. The results of the differential equation model were two important takeaways: The technology adoption lifecycle theory by Rogers et al. (2014) explains why investments in technology lead to a surge in productivity at the outset, but thereafter a decline in returns. This graph illustrates how new tools, such as ChatGPT, may shake things up and provide impressive results at first. However, when the magic of the new tool wears off and it gets ingrained in standard operating procedure, the rate of productivity increase levels out (Koppl et al. 2023). With the quick advantages of new technology, this era is characterised by great expectations. For instance, in management accounting, using ChatGPT might initially simplify data processing activities, leading to major gains in productivity. The "Trough of Disillusionment" describes the subsequent time of diminishing returns when the hype wears off (Dedehayir & Steinert 2016). The negative second derivative of our productivity model reflects this trend, indicating that efficiency gains hit a wall after the novelty of the technology fades and integration problems arise. According to Bresnahan and Greenstein (1999), companies like Xerox and IBM went through a similar pattern in the late 1990s. They invested heavily in IT at the outset, which led to a spike in productivity before levels stabilised.

This fits well with the model of technology adoption costs proposed by Tornatzky and Fleischer (1990), which predicts an initial rise in costs followed by savings in the long run. Investments in infrastructure, training, and the learning curve of new technology cause the initial rise in costs, while increasing efficiency and automation capabilities lead to savings in the long run (Aggarwal et al. 2022). Zhong and Wu (2023) found comparable cost trends in healthcare IT investments, and the model's forecast of early cost rises and ultimate savings is in line with that. Expenses associated with acquiring, training, and using ChatGPT could initially drive up investment costs. The efficiency advantages of the instrument and the subsequent decrease in human labour required as a result of rising skill levels allowed for the savings to accrue over time.

Both the prevalence and the broad approval of AI's use in management accounting were highlighted by the survey's results. Challenges, such as insufficient training and financial problems, were substantial, nevertheless. This confirms what Bughin (2020) found while studying the obstacles that companies face when trying to use AI. Our findings, which show that AI is being used often and is being seen as beneficial, indicate that accounting is undergoing a digital transition, similar to what Pramanik et al. (2019) have seen in other professional services. One example is how Ernst & Young has improved their data analysis skills via the deployment of AI. Additionally, our findings stress the need for careful preparation before investing in cutting-edge software like ChatGPT. To maximise returns, it is essential to comprehend the time-dependent nature of technological investments, as pointed out by Harris et al. (2023) in their study on strategic management. Hurzhyi et al. (2022) examine the formulation of development strategies for enterprises in a post-industrial society, highlighting the challenges posed by continuous knowledge evolution and the impact of globalization and digitalization. Their research highlights the significance of flexible tactics, well-rounded investments, thorough market analysis, and efficient advertising. The paper argues in favour of adaptable, long-term plans that take stock of all relevant internal and

external variables, as well as available resources and market position. The study's findings highlight the need to make smart use of investments and resources when putting strategies into action.

This training requirement is in line with the human capital theory put forth by Becker (2009), which states that to get the most out of technology expenditures, it is crucial to put money into educating employees. Findings on technology acceptance and the survey's focus on training are consistent, demonstrating the need for user training for successful technology adoption. To provide just one example, Deloitte has successfully integrated AI into its audit and tax services thanks to its efforts to upskill its workers in analytics and artificial intelligence. Voropayeva et al. (2022) examine the use of innovative educational technologies in training management specialists in Europe, suggesting their integration into Ukraine's education system. Using concepts like self-organization and interdisciplinarity, this project seeks to build frameworks for implementing educational technology into a management training cluster grounded on the contemporary synergetic sociocultural paradigm. This study used a synergistic approach to demonstrate how European educational techniques are great at instilling varied values and abilities, such as diversity and ethics.

A comprehensive cost-benefit analysis should be conducted before implementing new technology, as the findings corroborate. Problems with cost and reluctance to change are common obstacles to the adoption of technology, as pointed out by Evan and Britt (2023). Smaller accounting firms' initial reluctance and financial concerns about cloud-based solutions mirror the concerns voiced in our poll about the use of AI. Iliyasu and Daramola (2023) use a survey and questionnaire to evaluate the entrepreneurial abilities required for self-employment among business education students in Kano State's institutions. Critical skills include management, word processing, and practical business acumen; yet, they also identify impediments like corruption and insufficient funding. The report recommends mentoring programmes that link students with thriving businesses to help them develop these skills, as they are critical for graduates to be self-sufficient.

Comparative Analysis with Existing Literature

In addition to providing new insights into management accounting and cutting-edge technologies like ChatGPT, the observed patterns of productivity and costs and the survey results on AI adoption are in line with existing studies. The topic of artificial intelligence's potential impact on corporate operations is furthered by this comparative study. By focusing on AI technology in management accounting, the study enhances earlier IT productivity frameworks. Beyond general IT, the results provide light on the nuanced ways in which AI affects productivity and cost.

Limitations and Future Research Directions

The research has limitations, yet it does provide helpful information. Because it presupposes constant rates of change, the mathematical model can miss some of the world's complexities. Models with variables like market conditions or rates that change can be the subject of future research. Although comprehensive, the research has limitations due to its small sample size and narrow focus. The sample size and geographic distribution of future studies may be expanded. For future studies that want to track changes over time after AI integration, longitudinal data could be useful. One alternative is to look at how AI has affected different sectors. This detailed analysis clarifies the potential effects on management accounting processes of investments in technologies like ChatGPT. Accounting is undergoing a digital revolution, and this research highlights the necessity of training, adaptability, and strategic planning by integrating theoretical models with actual data and current literature. The findings have practical implications for both academia and practice.

CONCLUSIONS

This article embarked on a comprehensive exploration of the role and impact of advanced technologies, particularly ChatGPT, in the realm of management accounting. Through a blend of mathematical modelling and empirical survey analysis, we sought to understand how such technologies are reshaping the landscape of management accounting in terms of productivity, costs, and operational efficiencies. Our mathematical model indicated an initial surge in productivity following the adoption of technologies like ChatGPT, aligning with the typical early stages of technological adoption. However, this was tempered by the phenomenon of diminishing returns over time, a reflection of the stabilization and integration of technology into everyday practices. In terms of costs, the model predicted an initial increase due to investment and training, followed by eventual cost savings as efficiencies were realized. The survey results echoed the growing integration of AI in management accounting, with a significant number of professionals reporting frequent use of AI tools. The general perception of AI's effectiveness was positive, yet concerns about training and costs highlighted critical areas needing attention for successful technology adoption.

These results demonstrate the revolutionary potential of AI and similar technologies in the field of management accounting. They also show how important it is to have a strategy, especially when implementing new technologies, and how continued

training and skill development are needed to make the most of these tools. For decision-makers contemplating substantial investments in AI technology, the insights on cost dynamics provide crucial context. AI Strategic Investment: Before investing in AI for management accounting, organisations should consider both the short- and long-term costs. Among these measures is the gradual incorporation of AI into existing systems as well as the preparation for continuous training. Maximizing the advantages of AI requires a committed commitment to training and skill development.

The long-term impacts of AI integration in management accounting might be further studied in future studies with larger, more diversified samples and a wider range of industries evaluated. To better understand how to incorporate AI, comparative studies comparing companies at various levels of adoption could be useful. To wrap things up, this article has shown how vital cutting-edge innovation like ChatGPT is for making management accounting more effective and efficient. We now have a more complex picture of these technologies' effects because of the combined efforts of theoretical modelling and empirical research. Management accountants, working in this age of lightning-fast technology development, must adapt to the ever-shifting landscape of their profession and find ways to maximise the impact of artificial intelligence and related technologies.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

Conceptualization: Iryna Shchyrba, Yevheniia Ostropolska

Data curation: Maryia Savitskaya, Tetiana Fursa

Formal Analysis: Tetiana Fursa

Resources: Iryna Shchyrba, Olena Yeremian, Yevheniia Ostropolska

Supervision: Tetiana Fursa

Validation: Olena Yeremian

Investigation: Iryna Shchyrba, Yevheniia Ostropolska

Project administration: Maryia Savitskaya, Olena Yeremian

Writing – review & editing: Tetiana Fursa

Writing – original draft: Maryia Savitskaya, Olena Yeremian

FUNDING

The Authors received no funding for this research.

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

REFERENCES

1. Abdullayeva, M., & Ataeva, N. (2022). Mortgage lending with the participation of the construction financing fund of the bank of the future. *Futurity Economics&Law*, 2(1), 35–44. <https://doi.org/10.57125/FEL.2022.03.25.05>
2. Aggarwal, S., Giera, B., Jeong, D., Robinson, J., & Spearot, A. (2022). Market access, trade costs, and technology adoption: Evidence from northern Tanzania. *Review of Economics and Statistics*. https://doi.org/10.1162/rest_a_01263
3. Agustí, M. A., & Orta-Pérez, M. (2023). Big data and artificial intelligence in the fields of accounting and auditing: a bibliometric analysis. *Spanish Journal of Finance and Accounting*, 52(3), 412–438. <https://doi.org/10.1080/02102412.2022.2099675>
4. Arendt, W., & Urban, K. (2023). *Partial differential equations: An introduction to analytical and numerical methods*. Cham: Springer. <https://doi.org/10.1007/978-3-031-13379-4>
5. Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago press.
6. Bose, S., Dey, S. K., & Bhattacharjee, S. (2023). Big data, data analytics and artificial intelligence in accounting: An overview. *Handbook of Big Data Research Methods*. <https://ssrn.com/abstract=4061311>
7. Bresnahan, T. F., & Greenstein, S. (1999). Technological competition and the structure of the computer industry. *The Journal of Industrial Economics*, 47(1), 1–40. <https://doi.org/10.1111/1467-6451.00088>
8. Bughin, J. (2020). Artificial intelligence, its corporate use and how it will affect the future of work. In L. Paganetto (Ed.), *Capitalism, global change and sustainable*

- development* (pp. 239–260). Cham: Springer.
https://doi.org/10.1007/978-3-030-46143-0_14
9. Chen, L., Chen, D., Li, C., Pan, B., Zhang, L., & Xiang, Z. (2023). Assessing the environmental impacts of industrial processes: A statistical analysis approach. *American-Eurasian Journal of Scientific Research*, 13(07), 429–433.
<https://ssrn.com/abstract=4468648>
 10. Cherniaieva, O., Orlenko, O., & Ashcheulova, O. (2023). The infrastructure of the Internet services market of the future: Analysis of formation problems. *Futurity Economics & Law*, 3(1), 4–16.
<https://doi.org/10.57125/FEL.2023.03.25.01>
 11. Cokins, G. (2009). *Performance management: Integrating strategy execution, methodologies, risk, and analytics*. John Wiley & Sons. <https://doi.org/10.1002/9781119205548>
 12. Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *Harvard business review*, 76(4), 121–131. <https://hbr.org/1998/07/putting-the-enterprise-into-the-enterprise-system>
 13. De Santis, F., & D'Onza, G. (2021). Big data and data analytics in auditing: in search of legitimacy. *Meditari Accountancy Research*, 29(5), 1088–1112.
<https://doi.org/10.1108/MEDAR-03-2020-0838>
 14. Dedehayir, O., & Steinert, M. (2016). The hype cycle model: A review and future directions. *Technological Forecasting and Social Change*, 108, 28–41.
<https://doi.org/10.1016/j.techfore.2016.04.005>
 15. Deineha, I., Maslov, A., Potryvaieva, N., Verbivska, L., Koliadych, O. (2021). Institutional environment tools for small and medium-sized enterprises development. *Estudios de Economia Aplicada*, 39(3), Article 4798.
<http://ojs.ual.es/ojs/index.php/eea/article/view/4798>
 16. Dotsenko, T., Shaparenko, S., & Humenna, Y. (2023). Interrelationships of cashless economy, services of telecommunication companies and indicators of the shadow economy: modern modeling techniques. *Socio-Economic Relations in the Digital Society*, 2(48), 12–24.
<https://doi.org/10.55643/ser.2.48.2023.489>
 17. Evans, M. I., & Britt, D. W. (2023). Resistance to change. *Reproductive Sciences*, 30(3), 835–853.
<https://doi.org/10.1007/s43032-022-01015-9>
 18. George, A. S., & George, A. H. (2023). A review of ChatGPT AI's impact on several business sectors. *Partners Universal International Innovation Journal*, 1(1), 9–23.
<https://doi.org/10.5281/zenodo.7644359>
 19. Harris, K. R., Camping, A., & McKeown, D. (2023). A review of research on professional development for multicomponent strategy-focused writing instruction: Knowledge gained and challenges remaining. In F. De Smedt, R. Bouwer, T. Limpo, & S. Graham (Eds.), *Conceptualizing, Designing, Implementing, and Evaluating Writing Interventions*, 101–136.
https://doi.org/10.1163/9789004546240_007
 20. Hasan, A. R. (2021). Artificial intelligence (AI) in accounting & auditing: A Literature review. *Open Journal of Business and Management*, 10(1), 440–465.
<https://doi.org/10.4236/ojbm.2022.101026>
 21. Hurzhyi, N., Kravchenko, A., Kulnich, T., Saienko, V., Chopko, N., & Skomorovskyi, A. (2022). Enterprise development strategies in a post-industrial society. *Postmodern Openings*, 13(1Sup1), 173–183.
<https://doi.org/10.18662/po/13.1Sup1/420>
 22. Iliyasu, A., & Daramola, R. (2023). Evaluating entrepreneurial skills needed by business education students for self-employment in colleges of education, Kano State. *Futurity Education*, 3(2), 111–121.
<https://doi.org/10.57125/FED.2023.06.25.07>
 23. Deloitte. (2022). *State of AI in the enterprise* (5th ed.). <https://www2.deloitte.com/us/en/pages/consulting/articles/state-of-ai-2022.html>
 24. Johnson, T. H., & Kaplan, R. S. (1987). Relevance lost: The rise and fall of management accounting. *IEEE Engineering Management Review*, 15(3), 36–44.
<https://doi.org/10.1109/EMR.1987.4306297>
 25. Khomutenko, L., & Panchenko, V. (2023). Development of the world market of information and communication technologies. *Socio-Economic Relations in the Digital Society*, 3(49), 14–22.
<https://doi.org/10.55643/ser.3.49.2023.491>
 26. Kokina, J., & Davenport, T. H. (2017). The emergence of artificial intelligence: How automation is changing auditing. *Journal of emerging technologies in accounting*, 14(1), 115–122. <https://doi.org/10.2308/jeta-51730>
 27. Koppl, R., Gatti, R. C., Devereaux, A., Herriot, J., Fath, B. D., Hordijk, W., ... & Valverde, S. (2023). *Explaining technology*. Cambridge University Press.
<https://doi.org/10.1017/9781009386289>
 28. Kovalchuk, S. V., Kobets, D. L., & Zaburmekha, Y. M. (2019). Modeling the choice of strategies of marketing management of enterprise personnel. *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*, (2), 163–173.
<https://doi.org/10.29202/nvngu/2019-2/17>
 29. Lefebvre, W., Loeper, G., & Pham, H. (2023). Differential learning methods for solving fully nonlinear PDEs. *Digital Finance*, 5(1), 183–229. <https://doi.org/10.1007/s42521-023-00077-x>
 30. Lin, A., & Chen, N.-C. (2012). Cloud computing as an innovation: Perception, attitude, and adoption. *International Journal of Information Management*, 32(6), 533–540. <https://doi.org/10.1016/j.ijinfomgt.2012.04.001>
 31. Met, İ., Kabukçu, D., Uzunoğulları, G., Soyalp, Ü., & Dakdevir, T. (2020). Transformation of business model in finance sector with artificial intelligence and robotic process automation. In U. Hacıoglu (Ed.), *Digital business strategies in blockchain ecosystems: Transformational design and future of global business* (pp. 3–29). Cham: Springer.
https://doi.org/10.1007/978-3-030-29739-8_1
 32. Nielsen, S. (2022). Management accounting and the concepts of exploratory data analysis and unsupervised machine learning: A literature study and future directions.

- Journal of Accounting & Organizational Change*, 18(5), 811–853. <https://doi.org/10.1108/JAOC-08-2020-0107>
33. Pires, P. B., Santos, J. D., Pereira, I. V., & Torres, A. I. (Eds.). (2023). *Confronting security and privacy challenges in digital marketing*. IGI Global. <https://doi.org/10.4018/978-1-6684-8958-1>
 34. Pramanik, H. S., Kirtania, M., & Pani, A. K. (2019). Essence of digital transformation — Manifestations at large financial institutions from North America. *Future Generation Computer Systems*, 95, 323–343. <https://doi.org/10.1016/j.future.2018.12.003>
 35. Redko, K., Zaletska, I., & Chyrva, H. (2023). Comprehensive modernization and innovative development of the SMART economy of the future. *Futurity Economics & Law*, 3(1), 35–43. <https://doi.org/10.57125/FEL.2023.03.25.04>
 36. Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. In D. W. Stacks & M. B. Salwen (Eds.), *An integrated approach to communication theory and research* (pp. 432–448). Routledge.
 37. Tkachuk, S., Vidomenko, O., Levchenko, Y., Zhuzhukina, N., & Lukianykhin, V. (2022). Features and economics of electronic crowdfunding in the face of global challenges. *Futurity Economics & Law*, 2(4), 12–22. <https://doi.org/10.57125/FEL.2022.12.25.02>
 38. Verbivska, L., Kobelia, Z., Verhun, A., Zerkal, A., & Vikhtiuk, A. (2022). Theoretical bases of improvement of mechanisms of management of the personnel of the enterprise. *AD ALTA: Journal of Interdisciplinary Research*, 12(2), 107–110. https://www.magnanimitas.cz/ADALTA/120228/papers/A_2_0.pdf
 39. Voropayeva, T., Jarvis, M., Boiko, S., Tolchieva, H., & Statsenko, N. (2022). European experience in implementing innovative educational technologies in the training of management specialists: current problems and prospects for improvement. *International Journal of Computer Science and Network Security*, 22(7), 294–300. <https://doi.org/10.22937/IJCSNS.2022.22.7.35>
 40. Zakaria, S., Abdul Manaf, S. M., Amron, M. T., & Mohd Suffian, M. T. (2023). Has the world of finance changed? A review of the influence of artificial intelligence on financial management studies. *Information Management and Business Review*, 15(4(SI)I), 420–432. [https://doi.org/10.22610/imbr.v15i4\(SI\)I.3617](https://doi.org/10.22610/imbr.v15i4(SI)I.3617)
 41. Zhang, C., Zhu, W., Dai, J., Wu, Y., & Chen, X. (2023). Ethical impact of artificial intelligence in managerial accounting. *International Journal of Accounting Information Systems*, 49, Article 100619. <https://doi.org/10.1016/j.accinf.2023.100619>
 42. Zhong, Y., & Wu, J. (2023). Exploring how healthcare information technology use impacts the quality of care: A process perspective. In *PACIS 2023 proceedings*. <https://aisel.aisnet.org/pacis2023/120>

Щирба І., Савицька М., Фурса Т., Єремян О., Остропольська Є.

УПРАВЛІНСЬКИЙ ОБЛІК: НОВІТНІ ТЕХНОЛОГІЇ, МОЖЛИВОСТІ CHATGPT

Це дослідження спрямоване на вивчення впливу та потенціалу новітніх технологій, зокрема ChatGPT, у динамічній сфері управлінського обліку. Основна увага зосереджена на розумінні того, як ці технології впливають на ефективність, точність і процеси ухвалення рішень.

Для досягнення цієї мети дослідження використовує двоаспектний підхід. По-перше, диференціальні рівняння для математичного моделювання для прогнозування та аналізу впливу ChatGPT на продуктивність і динаміку витрат в управлінському обліку. По-друге, було проведено емпіричне опитування 200 фахівців із бухгалтерського обліку, щоб отримати уявлення про практичне використання ChatGPT, переваги та проблеми, пов'язані з ним.

Отримані результати показують підвищення ефективності й точності ведення звітності, що забезпечує використання ChatGPT, а також його можливості прогнозування в різних завданнях управлінського обліку. Математична модель підкреслює динамічний характер упровадження цієї технології, а результати опитування демонструють практичні реалії та уявлення фахівців із бухгалтерського обліку щодо технологій штучного інтелекту.

Дослідження показало, що ChatGPT й подібні технології на основі штучного інтелекту можуть революціонізувати практики управлінського обліку, пропонуючи й теоретичні, і практичні переваги. Ці висновки мають вирішальне значення для організацій, які розглядають інтеграцію штучного інтелекту в свою бухгалтерську практику, а також для професіоналів, які прагнуть бути в курсі технологічних досягнень у цій царині.

Ключові слова: ефективність штучного інтелекту, ChatGPT, бухгалтерський облік, упровадження технологій, опитування, динаміка витрат, підтримка ухвалення рішень

JEL Класифікація: M41, C53, O33, C83