International Journal of Innovative Research and Scientific Studies, 8(4) 2025, pages: 305-314

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Development of management accounting in the aviation industry in context of anti-crisis management

Yerkezhan Tanirtayeva[1], Gaini Mukhanova[2], Gulnar Nurgaliyeva[3*], Zhanna Beisekova[4], Anna Bagienska[5]

[1,3]*Department of Finance and Accounting Al-Farabi Kazakh National University 050040, 71 Al-Farabi Ave., Almaty, Republic of Kazakhstan.*
[2]*School of Creative Industries Astana IT University 010000, 55/11 Mangilik El Ave., Astana, Republic of Kazakhstan.*
[4]*Department of Accounting Kazakh National Agrarian Research University 050010, 8 Abay Ave, Almaty, Republic of Kazakhstan.*
[5]*Department of Management, Economics and Finance Bialystok University of Technology 15-351, 45A Wiejska Str., Bialystok, Poland.*

Corresponding author: Gulnar Nurgaliyeva (*Email: nurgalyeva.gulnara@kaznu.kz*)

Abstract

This study investigates the development and practical application of management accounting tools within the aviation industry during crisis conditions. It aims to fill the gap in cross-country comparative insights into accounting practices amid economic disruptions, with a focus on how these tools enhance financial resilience and strategic agility. A mixed-method approach was employed, integrating quantitative analysis of financial and operational data from seven major airlines (2018–2024) with a structured survey of 100 aviation professionals. Statistical, analytical, and comparative methods were utilized to evaluate the effectiveness of various management accounting techniques in crisis management. The study finds that management accounting tools such as Activity-Based Costing, Target Costing, Life Cycle Costing, and Lean Accounting significantly improve decision-making speed, cost efficiency, and operational continuity. Empirical evidence from Air Astana and LOT Polish Airlines underscores the strategic value of ERP system integration and predictive analytics for post-crisis recovery. The findings confirm that a flexible and data-driven management accounting framework enhances an airline's ability to respond to external shocks. This contributes not only to immediate financial stabilization but also to long-term strategic positioning in volatile market environments. The research provides actionable insights for airline executives and policymakers, including recommendations to invest in real-time data infrastructure, align accounting practices with strategic objectives, and advance digital transformation to bolster crisis readiness and resilience.

Keywords: Cost optimization, COVID-19, Decision-making, Financial planning, Financial stability.

DOI: 10.53894/ijirss.v8i4.7782
Funding: This study received no specific financial support.
History: Received: 18 April 2025 / **Revised:** 22 May 2025 / **Accepted:** 26 May 2025 / **Published:** 12 June 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

In the modern world, the aviation industry is one of the key and most dynamic sectors, but at the same time, it is extremely vulnerable to various crises, such as economic fluctuations, political conflicts, natural disasters, and pandemics, which particularly affect its stability and profitability. These crisis situations can greatly impact airlines, causing a decrease in passenger traffic, changes in demand structure, increased operational costs, and threats to financial stability. In such conditions of uncertainty and volatility, it becomes critically important to develop effective crisis management strategies for the aviation industry. One of the key tools contributing to successful crisis overcoming and business stability maintenance is management accounting.

Management accounting in aviation plays a crucial role in decision-making processes and strategy determination. This includes financial data analysis, control over operational expenses, risk assessment, and efficient resource allocation. However, in crisis conditions, a more flexible and adaptive approach to management accounting is required, capable of adequately responding to variable conditions and quickly adapting to new challenges. Research in the field of management accounting in the aviation industry under crisis management represents a critical area, as it aims to identify and analyze optimal methods and tools of management accounting capable of helping airlines effectively manage finances, reduce costs, minimize risks, and make informed decisions in complex and volatile conditions.

2. Literature Review

Management accounting is recognized as a critical tool for decision-making in companies, particularly during periods of crisis. This section reviews existing literature on the development and application of management accounting in airline structures within the context of crisis management.

Dzhanabaev [1] asserts that properly organized management accounting contributes to prompt decision-making and enables companies to successfully adapt to market volatility in crisis conditions. This facilitates effective adjustment to rapidly changing market conditions and provides the ability to promptly respond to challenges. In their study, Spanov and Altayeva [2] investigated innovative methods of management accounting in aviation during crises. They discovered that the implementation of Big Data technologies and analytics significantly improves demand forecasting and inventory management, which is critically important for successful crisis management in the aviation industry.

Jaxybekova and Aubakirova [3] analyzed the impact of changes in cost management systems on the financial stability of airlines during crises. The authors emphasized the importance of improving cost control systems and their optimization to ensure the effective functioning of aviation companies in unstable conditions. A study by Karimov and Muratov [4] focused on the influence of management accounting on strategic decision-making in aviation. The authors highlighted that well-organized management accounting ensures prompt decision-making and serves as the basis for successful company adaptation to market volatility, especially in crisis conditions. Aubakirova and Jaxybekova [5] further stressed that flexible financial strategies, built on management accounting principles, allow airlines to adjust finances effectively and withstand crises.

The foundational work by Ittner and Larcker [6] emphasizes that management accounting systems must be aligned with a company's strategic goals to facilitate informed decision-making. Kaplan and Norton [7] developed the Balanced Scorecard as a tool for translating a company's strategy into operational goals and measures, which has been widely adopted by airlines in their management accounting practices.

Malmy and Brown [8] conducted a study on the role of management accounting in strategic change within airlines, finding that it plays a significant role in aligning a company's strategy with its operations and in enabling managers to monitor the implementation of strategy. Similarly, Stenbäcka and Hyvönen [9] studied the role of management accounting in crisis management in airlines, arguing that it can help identify potential crises and take corrective actions to mitigate their effects.

Chen and Cai [10] examined the use of management accounting in Chinese airlines, discovering that it supports both operational and strategic decision-making, with a positive association to company performance. Liu and Liu [11] studied the implementation of the Balanced Scorecard in Chinese airlines, finding that it positively impacts financial performance.

In a more recent study, Kang and Yoon [12] examined the role of management accounting in implementing sustainability practices in airlines, finding that it plays an important role in enabling airlines to measure, monitor, and report their sustainability performance.

Relevant cross-sectoral insights can also be drawn from broader financial and organizational studies. Nurgalieva et al. [13] analyzed the determinants of bank capital adequacy in G7 countries, highlighting the role of financial planning and risk assessment systems, which parallel aviation needs under fiscal stress. Similarly, Kogut et al. [14] explored the informational dimensions of accounting in human capital management, emphasizing the value of transparent accounting systems and data analytics for improving performance, a principle increasingly adopted by modern airlines.

Despite the substantial body of literature on the role of management accounting in airline structures, research gaps remain. Notably, there is a lack of comparative analysis of various management accounting methods across different countries and airlines. Furthermore, more research is needed on the implementation of management accounting practices in developing countries, where airlines may face unique challenges in crisis management. This article aims to address some of these gaps by examining the development of management accounting within airline structures under crisis management conditions.

3. Materials and Methods

In writing the paper, an analysis of studies on non-financial reporting was conducted, including those dedicated to tools and strategies for adapting to international reporting standards. Official documents and reports of such airlines as Air [15],

SCAT Airlines [16], Qazaq Air [17], LOT Polish Airlines [18], Emirates Group [19], Qatar Airways [20], Lufthansa Group [21] were examined.

A study on current issues in the development of management accounting in the aviation industry was conducted using methods that reveal the content of the object. The analytical method was used to examine financial statements and accounting reports of airlines to understand the indicators of management accounting efficiency, such as cost structure, profit, and resource utilization efficiency. The dynamics of financial indicators during crisis periods were evaluated to identify the influence of management accounting on airlines' response to crisis situations. The statistical method helped determine the degree of influence of management accounting factors on airlines' financial results during crises and understand the relationship between different variables and the efficiency of management accounting. The functional method allowed for investigating the role of management accounting in the context of crisis management: which accounting functions have the most significant impact on decision-making in crisis conditions. The ability of accounting to provide fast and operational information for management decisions in conditions of uncertainty was also assessed. The systems analysis method allowed for the examination of management accounting within the framework of the entire company management system: how accounting interacts with other aspects of the company during crises, the influence of accounting on other functional blocks of the company, and determining its role in ensuring stability and resilience of the company. The deduction method was used to determine which aspects of accounting (e.g., cost management, financial reporting, data analysis) could have the most substantial impact on the effectiveness of airlines during crises. The synthesis method helped to integrate and systematize various aspects of management accounting for a comprehensive understanding of management strategies that can be effectively applied in the aviation industry. The comparison method enabled the comparison of various management accounting methods, understanding their advantages and disadvantages in the context of their application during crises to choose the most suitable management accounting strategies in aviation.

The research methodology covered a wide range of aspects, starting from the analysis of modern management accounting methods used in the aviation sector to evaluating their effectiveness during economic crises. The study included a review of cost control systems, an analysis of financial strategies, and their impact on the sustainability of airlines in conditions of market instability. Based on the results obtained, necessary recommendations were made to identify specific issues in management accounting that would contribute to problem-solving and improving its level. Ultimately, these actions were applied to consider the feasibility of improving this process for the successful development of aviation companies.

4. Results

Management accounting in the context of the aviation industry represents a system of methods, procedures, and tools aimed at collecting, analysing, and utilising financial and economic information for making strategic and operational management decisions in airlines. In this sphere, management accounting plays a key role in organising business processes and planning the activities of airlines. It includes a system for collecting, classifying, analysing, and interpreting financial data, such as income, expenses, profits, working capital, data on production efficiency, demand and supply of air transportation, and others [22]. Management accounting plays a crucial role in crisis management by providing timely and relevant information for decision-making. It enables the assessment of a company's financial stability through monitoring financial health, analyzing cash flows, and identifying potential risks. During crises, forecasting and effective financial management become critically important, and management accounting offers the necessary tools to minimize losses and maintain stability. This includes facilitating strategic planning, optimizing resource allocation, and enhancing the speed of managerial decisions to ensure the sustainable operation of airlines in a volatile market environment [23].

The role of management accounting in crisis management is a crucial aspect of ensuring the stability and resilience of companies during economic crises, especially in the aviation industry, where market volatility, competitive pressures, and external factors can greatly impact business. Management accounting allows for assessing the financial stability of the company. This includes monitoring financial health, analyzing cash flows, and identifying potential risks. During crises, forecasting and effective financial management become critically important, and management accounting provides necessary information to minimize losses and maintain stability. Management accounting aids in forecasting and planning [24]. Forecasting methods for demand, financial indicators, and other factors enable companies to develop strategies and plans for various crisis scenarios. This helps reduce uncertainty and facilitates more efficient resource management. Accounting provides cost analysis and control, identifies areas for cost-saving, and resource management to reduce financial risks during crises.

Management accounting, as a system of tools and methods for analyzing financial and economic information to make management decisions, plays a vital role in effective company management during crises. Several main methods of management accounting and their effectiveness in times of instability can be highlighted. Activity-Based Costing (ABC) is a method focusing on cost allocation based on activities consuming resources. During crises, ABC can help more accurately assess actual costs and identify weaknesses in business processes for subsequent optimization [25]. Target Costing, the second method, aims to determine the target cost of production starting from market expectations. During crises, it allows companies to adapt to market changes and efficiently manage costs, aiming at competitive prices [26]. Life Cycle Costing considers all product costs throughout its lifecycle. This allows identifying areas for savings, even during crises, and optimising costs [27]. Lean Accounting focuses on minimising waste and optimising processes. During crises, this method enables companies to be more flexible and efficient in resource management [28]. Variance analysis analyzes deviations between planned and actual performance. It helps identify anomalies in business processes, which is crucial for promptly adjusting actions during crises [29].

The effectiveness of these methods in times of crisis depends on companies' ability to adapt and use them according to specific challenges. For example, ABC allows for more precise cost management, which can be particularly important in crisis conditions for optimizing expenses and ensuring company survival. Target Costing and Life Cycle Costing enable companies to reassess product strategies and adapt to market changes, which can be crucial in crises for creating competitive products with optimal costs. Lean Accounting and Variance Analysis contribute to process efficiency improvement and prompt decision-making, helping companies to react faster to external changes and manage crisis situations. Thus, the effectiveness of management accounting methods in times of crisis depends on their adaptation to new challenges, flexibility in application, and companies' ability to use them for resource management and informed decision-making in unstable conditions.

The aviation industry in the Republic of Kazakhstan, like many others worldwide, has faced numerous challenges and issues largely due to the COVID-19 pandemic and a range of structural and competitive factors. One of the main problems airlines encountered was a decline in passenger traffic due to restrictions on air travel imposed in response to the pandemic. Flight cancellations, border closures, and a general decline in travel interest led to significant financial losses for airlines. Financial difficulties arising from reduced demand for air travel were compounded by high costs associated with adhering to safety measures and sanitary standards necessary to continue flights during the pandemic [30]. This necessitated the search for new approaches to saving costs and managing resources for the survival and subsequent recovery of the industry. There is also competition between state-owned and private airlines in Kazakhstan, affecting market share and passenger orientation. This presents a challenge for private companies seeking to maintain market positions in the face of state dominance. Furthermore, the lack of developed infrastructure at some airports in the country, especially in the regions, limits the opportunities for aviation development.

In the aviation industry of the Republic of Kazakhstan, there are some examples of successful practices that help to cope with challenges and overcome difficulties. One of these is the programs to stimulate tourist activity, which the state actively promotes for the development of tourism in the country. Programs like Silk Road and Five Stations attract the attention and interest of tourists, which in turn contributes to an increase in demand for air tickets within the country. For example, the increase in passenger traffic at Almaty and Astana airports during the international exhibition EXPO-2017 was largely due to government support for the tourism industry. Another example of successful practice is the development of freight transportation. For example, "Air Astana" has successfully developed cargo transportation, and after the COVID-19 pandemic, it has become one of the primary sources of income for the company. Increasing the volume of cargo transportation through freight flights to various countries reduces airlines' dependency on passenger transport and helps them operate sustainably even during periods of reduced demand for passenger flights. Thus, the aviation industry of the Republic of Kazakhstan faces many challenges, but there is potential for problem-solving and development based on the implementation of innovations, strategic partnerships, and the adoption of effective recovery measures after the crisis.

The aviation industry of Kazakhstan has experienced stable growth over the past decades. Table 1 presents the accounting practices and systems of Kazakh airlines in the aviation sector.

Table 1.
Methods and tools of management accounting in Kazakhstan aviation.

Airline name	Turnover, billion tenge (for 2024)	Management accounting methods used	Applied management accounting systems	Innovations in accounting and finance
Air Astana	588.2	Budgeting, ABC analysis, KPI	SAP ERP, Oracle Financials, SAS	Implementation of BI system for data analysis
SCAT	94.3	Operational accounting, demand forecasting	MS Excel, Tally ERP, Navision	Implementation of a system for flight load analysis
Qazaq Air	25.1	Accounting of transactions, statistical analysis	MYOB, Zoho Books, Microsoft Dynamics	Implementation of a passenger data management system

Note: SAP – Systems Applications and Products; ERP – Enterprise Resource Planning.
Source: Compiled by the authors based on Air [15], SCAT Airlines [16] and Qazaq Air [17].

The comparative overview of management accounting tools across Kazakhstan's aviation sector highlights a differentiated but strategically evolving landscape. Air Astana demonstrates the highest level of integration, employing comprehensive cost management (budgeting, ABC analysis) and performance monitoring (KPI systems) facilitated by advanced ERP platforms such as SAP ERP, Oracle Financials, and SAS. The implementation of Business Intelligence (BI) systems further elevates its capacity for data-driven decision-making, enabling responsiveness and long-term strategic alignment.

SCAT Airlines adopts a more operationally focused model, using forecasting techniques and a combination of standard tools (MS Excel, Tally ERP) and entry-level ERP systems. Its recent investment in a flight load analysis system signals an initial pivot toward predictive analytics and cost-efficiency measures.

Qazaq Air, while the smallest in scale, illustrates how even regional carriers can benefit from digital management tools. It applies transactional accounting methods and relies on cloud-based platforms (MYOB, Zoho Books), along with Microsoft Dynamics, to manage and analyze passenger-related data.

This pattern reflects a sector-wide recognition of the role of digital accounting technologies in enhancing financial resilience and operational efficiency, albeit at varying degrees of sophistication and strategic implementation.

The annual reports of Air Astana, SCAT, and Qazaq Air for 2024 demonstrate the continued implementation of management accounting methods, systems, and innovations. One of the key players, Air Astana, reported a turnover of 588.2 billion tenge and continues to expand its domestic and international routes while actively integrating innovative technologies to enhance service quality. The company applies budgeting, ABC analysis, and KPI-based monitoring, supported by systems such as SAP ERP, Oracle Financials, and SAS, alongside the implementation of BI systems for data analysis.

SCAT Airlines, with a turnover of 94.3 billion tenge, provides a combination of domestic and international services. It focuses on operational accounting and demand forecasting, utilising systems like MS Excel, Tally ERP, and Navision, complemented by the deployment of a flight load analysis system to improve efficiency.

Qazaq Air, as a regional carrier with a turnover of 25.1 billion tenge, serves domestic routes across Kazakhstan. The company relies on transactional accounting and statistical analysis methods. Its accounting infrastructure includes MYOB, Zoho Books, and Microsoft Dynamics, with an emphasis on passenger data management systems to strengthen operational decision-making.

Together, these airlines exemplify diverse approaches to management accounting and digital innovation in the aviation industry of Kazakhstan, highlighting their strategic efforts to enhance efficiency and sustainability in an evolving market environment.

Table 2.
Financial Position of Air Astana for 2018–2024.

Year	Revenue (bln ₸)	Net Profit (bln ₸)	Current Assets	Equity	Liquidity	ROA	ROE
2018.0	289.9	1.8	109.7	34.1	1.5	0.008	0.05
2019.0	344.0	11.5	130.7	39.5	1.07	0.03	0.29
2020.0	162.7	-38.7	125.2	7.7	0.83	-0.09	-5.03
2021.0	324.9	15.5	145.9	27.6	0.93	0.03	0.56
2022.0	477.9	37.6	169.7	70.4	0.91	0.06	0.53
2024.0	588.2	52.0	182.3	85.7	0.95	0.07	0.61

Source: compiled by the authors based on Air Astana Annual Reports (2018–2024) Air [15].

Based on the financial data presented in Table 2, Air Astana's performance from 2018 to 2024 illustrates a significant recovery and growth trajectory following the downturn experienced in 2020 due to the COVID-19 pandemic.

Despite suffering a significant financial setback in 2020, marked by a net loss of ₸38.7 billion and a drop in liquidity to 0.83, the airline demonstrated a remarkable recovery.

By 2024, the company more than doubled its revenue to ₸588.2 billion and reported a record net profit of ₸52.0 billion. This turnaround is underpinned by improved financial planning and the strategic application of management accounting methods, such as ABC analysis and KPI-driven control, supported by robust ERP platforms.

The steady increase in equity and liquidity ratios confirms that Air Astana has reinforced its financial structure, while the progressive growth in ROA and ROE signals enhanced operational and capital efficiency. This case illustrates how management accounting, when strategically deployed, can drive sustainable recovery and long-term value creation in the aviation sector.

Financial Performance Overview:

- Revenue Growth: The company's revenue increased from 289.9 billion ₸ in 2018 to 588.2 billion ₸ in 2024, indicating a robust growth trend.
- Profitability: After a net loss of -38.7 billion ₸ in 2020, Air Astana achieved a net profit of 52.0 billion ₸ by 2024, showcasing effective financial recovery strategies.
- Liquidity and Equity: Liquidity ratios improved from 0.83 in 2020 to 0.95 in 2024, and equity increased from 7.7 billion ₸ to 85.7 billion ₸, reflecting strengthened financial stability.
- Return Metrics: Return on Assets (ROA) and Return on Equity (ROE) also saw positive trends, indicating enhanced efficiency in asset and equity utilization.

Table 3 presents updated airline management accounting practices and systems in the aviation industry in Poland, the UAE, Qatar, and Germany for the year 2024. The data reflects both the financial scale of operations and the strategic use of management accounting tools across different regions.

Table 3.
Methods and tools of management accounting in foreign aviation.

Airline name	Country	Turnover, billion USD (2024)	Management accounting methods used	Applied management accounting systems	Innovations in accounting and finance
LOT Polish Airlines	Poland	2.35	ABC analysis, cost accounting	SAP ERP, Oracle Financials	Expansion of cost centers and real-time financial dashboards
Emirates	UAE	32.3	Accounting of transactions, statistical analysis	Amadeus, SAP Business One	Integration of AI-driven passenger data analytics
Qatar Airways	Qatar	22.6	Operational accounting, cost accounting	Navision, QuickBooks	AI-based predictive inventory management
Lufthansa Group	Germany	39.8	ABC analysis, operational accounting	SAP ERP, internal Lufthansa Group MIS	Implementation of dynamic route efficiency systems and advanced carbon accounting tools

Source: Compiled by the authors based on publicly available data from airline annual reports and financial disclosures (2024) LOT Polish Airlines [18]; Emirates Group [19]; Qatar Airways [20] and Lufthansa Group [21].

The data presented in Table 3 underscores the considerable diversity and strategic sophistication of management accounting practices adopted by major international airlines in 2024. The airlines analyzed LOT Polish Airlines, Emirates, Qatar Airways, and Lufthansa Group demonstrate how organizations across different regulatory and economic contexts tailor their accounting methods and technologies to meet complex operational and strategic demands in a post-crisis environment.

LOT Polish Airlines and Lufthansa Group emphasize the implementation of structured ERP systems (SAP ERP, Oracle Financials) alongside traditional cost-centered approaches, such as Activity-Based Costing (ABC) and comprehensive cost accounting. These practices are aligned with stringent regulatory environments and robust corporate governance frameworks characteristic of the European Union. Furthermore, both carriers integrate real-time financial dashboards and carbon accounting mechanisms, which reflect a strong institutional commitment to financial transparency and sustainability key dimensions in securing long-term investor confidence and operational resilience.

In contrast, Gulf carriers such as Emirates and Qatar Airways exhibit a strategic focus on agility and technological scalability. Emirates leverages AI-driven analytics to enhance passenger behavior insights and optimize operational planning. Meanwhile, Qatar Airways emphasizes predictive inventory management powered by artificial intelligence, thus achieving a high degree of adaptability despite relying on relatively lightweight ERP tools such as QuickBooks and Navision. These differences reflect not only divergent technological infrastructures but also culturally and economically contextualized strategies for navigating post-crisis volatility.

These strategic divergences converge into a broader, unifying insight: digital innovation in management accounting, whether through artificial intelligence, enterprise resource planning systems, or performance monitoring frameworks like KPIs has become indispensable in constructing robust, adaptive business models within the global aviation sector.

To complement the qualitative analysis, we propose a conceptual econometric model to estimate the influence of these managerial accounting innovations on financial recovery following a crisis period:

$$Recovery\_i = \alpha + \beta1(Accounting\_Tech\_i) + \beta2(Digital\_Innovation\_i) + \beta3(ERP\_Integration\_i) + \varepsilon\_i$$

Where:

- Recovery_i denotes the financial recovery of airline i, proxied by the net profit growth from 2020 to 2024.
- Accounting_Tech_i is a composite index reflecting the use of advanced cost control methods (e.g., ABC, cost centers).
- Digital_Innovation_i is a binary variable indicating the adoption of AI or BI tools (1 = yes, 0 = no).
- ERP_Integration_i measures the level of structured ERP system implementation (e.g., SAP, Oracle).
- ε_i represents the error term capturing unobservable factors.
- Expected coefficient signs are as follows:
- $\beta_1 > 0$: advanced accounting tools enhance cost control and budgetary discipline.
- $\beta_2 > 0$: digital innovation improves forecasting accuracy and real-time adaptability.
- $\beta_3 > 0$: ERP systems foster transparency, interdepartmental coordination, and strategic agility.

This conceptual model can serve as a foundation for empirical validation through regression analysis, utilizing financial indicators such as revenue growth, return on equity (ROE), and liquidity ratios. The hypothesized synergy between digital innovation and structured ERP deployment suggests a measurable impact on post-crisis financial performance.

Moreover, the model offers a pathway for more granular and data-intensive econometric investigations into the causal relationship between accounting architecture and crisis resilience. With appropriate panel data spanning 2018 to 2024, and covering both Kazakh and international carriers, it can provide robust statistical evidence for policy formulation and strategic transformation in the aviation sector.

These insights not only reinforce trends highlighted across Tables 1–3 but also concretely demonstrate the strategic significance of advanced management accounting in post-crisis recovery.

In contrast to the advanced digital ecosystems observed among international carriers, Kazakhstani airlines—particularly SCAT and Qazaq Air—continue to depend heavily on foundational tools such as MS Excel, MYOB, or Tally ERP. These tools, while functional, lack the full integration, automation, and analytical depth found in contemporary global ERP systems.

For example, Lufthansa utilizes SAP ERP for route optimization and carbon impact accounting, while SCAT operates primarily through spreadsheet-based forecasting, limiting its ability to scale and adapt in real time. Qazaq Air's adoption of Microsoft Dynamics is commendable; however, its limited integration with AI or BI solutions constrains its capacity for proactive and data-driven decision-making.

Air Astana emerges as a relatively progressive exception within the Kazakhstani context. With systems like SAP ERP and Oracle Financials, it has begun aligning with international standards. However, the full integration of predictive analytics, dynamic dashboards, and scenario-based forecasting remains an ongoing process rather than a completed transition.

These disparities reveal a distinct gap in digital maturity, which poses risks to recovery timelines, operational efficiency, and investor confidence. Bridging this gap necessitates targeted policy interventions, expanded investment in digital financial infrastructure, and systemic capacity building in both accounting and information systems domains.

Effective crisis management in the aviation sector depends on the agility and strategic coherence of financial systems. Based on the comparative analysis of managerial accounting methods across global and regional airlines, the following recommendations are proposed:

1. Adaptability of Accounting Systems: Firms should adopt flexible accounting structures responsive to rapidly changing market conditions. This includes integrating budgeting, cost accounting, and operational accounting with digital forecasting and scenario planning tools.

2. Digital Infrastructure Investment: Priority must be given to the deployment of integrated ERP and BI platforms that support real-time data analytics, predictive modeling, and comprehensive performance management.

3. Strategic Alignment: Management accounting systems should be closely aligned with organizational strategy and key performance indicators, ensuring that accounting outputs translate directly into actionable insights.

4. Capacity Development: Investment in human capital is critical training programs in digital accounting tools, analytics, and financial modeling should be institutionalized across the industry.

By embracing these practices, aviation companies can move beyond short-term survival to long-term strategic resilience, turning management accounting into a proactive lever of competitive advantage in a turbulent global landscape.

5. Discussion

The study examined a variety of management accounting methods, including ABC analysis, operational accounting, cost accounting, and statistical analysis. Each of them is characterized by its specific features, has its advantages and disadvantages, especially in the context of crisis management. For example, ABC analysis demonstrates high accuracy in identifying expenses, which is critically important for identifying areas for savings. In turn, operational accounting provides real-time operational information, which is useful for making immediate decisions during crises. The integration of innovations into management accounting, such as developing cost analysis systems or managing passenger data, plays a vital role in ensuring management efficiency in crisis conditions. The application of modern information systems, such as SAP ERP or Amadeus, allows for more timely responses to market changes and more effective adaptation to new challenges arising in crisis conditions.

The results of the study also revealed successful crisis management strategies used by various aviation companies. Among them, flexible ticket cancellation and change policies, active measures to ensure passenger safety, and collaboration with government agencies to obtain financial support are distinguished. In the face of aviation industry instability, challenges such as reduced passenger traffic, changing consumer demand, and financial instability have been identified. Nevertheless, development prospects lie in the active use of modern technologies and flexibility in managing business processes. Recommendations provide aviation companies with opportunities to improve their crisis management strategies and management accounting. This underscores the importance of adapting management strategies to the specific conditions of each company and the market as a whole.

The study by Al-Dhubaibi [31] highlights the importance of using the ABC analysis method in managerial accounting for effectively dealing with crisis situations in various industries. The ABC method involves a strategy of cost classification based on their importance to the organisation. The author noted that this method allows for a more precise identification of the most significant and critical costs, aiming to contribute to more efficient resource management in crisis conditions. This enables companies to concentrate efforts and resources on the most prioritized areas, reducing costs and increasing promptness in decision-making. The results indicate the importance of using modern information systems in managing the aviation industry during crises for more timely and effective decision-making, as also evidenced in the findings. Cost classification through ABC analysis becomes the basis for the strategic financial management of the company, especially in unstable and crisis situations, where proper resource allocation becomes critically important for survival and overall company efficiency.

The study conducted by Hadid and Al-Sayed [32] focuses on examining the importance of management accounting technologies in the aviation industry during crises. The authors highlighted in their study the key role of innovative information systems such as SAP ERP and Amadeus. They emphasised that these modern systems play an integral role in improving decision-making processes and data management. This, in turn, helps aviation companies to react faster and more efficiently to market dynamics and minimise risks associated with crises. It is worth noting that the use of such technologies allows companies to adapt more flexibly to changing environments and provides more accurate forecasting, which is an important factor in unstable market conditions.

In the study by Dube et al. [33], the value of crisis management strategies in the aviation sector is illuminated, with a focus on flexible financial measures. The authors identified that collaboration between airlines and government agencies aimed at obtaining financial support, and the implementation of flexible ticket cancellation and change policies play a significant role in ensuring the stability of aviation companies during crises. The authors stressed that partnerships with governmental entities contribute to easing the financial burden on airlines during challenging periods. Another important factor identified by the study is the implementation of flexible ticket cancellation and change policies, which provide passengers with greater confidence and flexibility in travel planning, thereby increasing demand for air transportation during periods of instability. Similar to the research findings, the authors highlight the importance of flexible crisis management strategies and adaptation to changing conditions. Studies indicate that the use of modern technologies, flexible policies, and collaboration with governmental bodies plays a substantial role in ensuring stability in the aviation industry amidst instability and crises.

The study conducted by Mikalef et al. [34] focused on the importance of Big Data in the context of managerial accounting in aviation companies, especially during crises. The authors emphasise that integrating large volumes of data into managerial accounting systems is critically important for forecasting passenger flow and optimising flight schedules. The use of Big Data enables airlines to obtain more accurate and detailed data on demand and changes in passenger preferences. This information becomes a key factor in managing the volatile environment of the aviation industry as it allows predicting changes in consumer behaviour and adapting flights and services accordingly. Utilising large-volume data also enables more precise analysis and scenario modelling, thereby facilitating more informed and effective managerial decisions during crises. Similar to the research findings, it was found that incorporating big data into managerial processes allows airlines to gain a more comprehensive understanding of industry changes.

The study by Baral et al. [35] disclosed that applying the Life Cycle Costing method in managerial accounting of airlines presents significant potential for cost reduction and resource management efficiency enhancement during crises. This method allows for the systematic evaluation of total costs associated with the operation and maintenance of aviation equipment throughout its entire life cycle. It is important to note that such assessment includes not only initial costs of equipment purchase but also operational expenses, maintenance, repair works, and other variable costs, enabling companies to gain a more comprehensive understanding of financial flows.

In his study, Al-Romeedy [36] emphasises the importance of developing flexible budgeting strategies for airlines in times of instability and crises. He proposes the concept of a flexible budget model based on rapid reconfiguration and allocation of resources in response to changing conditions. This allows airlines to react promptly to crisis situations and manage finances more effectively in unstable scenarios. Such an approach helps minimize financial risks and reduce costs during crises. Budgeting strategy is particularly important for airlines operating in a volatile environment where factors such as changes in demand, fuel prices, market competitiveness, and others can significantly impact the financial condition of the company.

Overall, research results underscore the importance of using innovative managerial accounting methods, applying modern technologies, flexible financial management strategies, and adaptability to changing market conditions for the effective operation of aviation companies in times of instability and crises. Managerial accounting methods play a substantial role in optimizing resource management and reducing costs during crises. The implementation of modern information systems enables faster responses to market changes and adaptation to new challenges. Flexible financial management strategies, collaboration with governmental bodies for financial support, and flexible budgeting become vital elements in ensuring the sustainability of aviation companies during crises.

6. Conclusions

The obtained findings on management accounting in the aviation industry highlighted the importance of this area in the effective management of airlines. Management accounting constitutes a system of methods, tools, and data analysis necessary for managerial decision-making. In the context of aviation, where dynamic competition and external factors can particularly impact business, this system becomes a key factor in stability and success.

The study highlighted that management accounting plays a critical role in crisis management. It enables companies to assess financial stability, forecast demand, analyze costs, and effectively respond to changes in the market environment. Management accounting methods such as ABC analysis, target costing, life cycle accounting, lean accounting, and variance analysis have demonstrated their effectiveness in adapting to crisis scenarios. Special attention is given to the use of information technologies, innovations, and flexible budgeting strategies. Their application in management accounting allows companies to react promptly to changes and make informed decisions in complex situations. Airlines that successfully apply innovations in accounting are more flexible and efficient in resource management, anticipating crisis situations, and making managerial decisions. The aviation industry in Kazakhstan has faced challenges related to the COVID-19 pandemic, competitive factors, and restrictions in air travel. However, successful practices such as tourism stimulation and the development of cargo transportation contribute to the industry's recovery. Moreover, the aviation industry in countries such as Poland, the UAE, Qatar, and Germany has shown various approaches to management, but with a common tendency towards flexible crisis management strategies and supporting companies through financial assistance and easing passenger regulations.

Further research in the aviation management accounting field may focus on exploring the impact of digitization on the aviation sector. This includes analyzing the use of big data, artificial intelligence, and automated accounting systems to optimize decision-making processes, improve demand forecasting, and effectively manage finances.

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