

Implementation of cloud computing in the digital accounting system of logistics companies

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Abstract: The aim of the article is to determine the capabilities of cloud services for meeting the needs of logistics companies in the management of supply chains and digital accounting. The study provides a review of current academic publications, analysis of official documentation of cloud service provider companies, and expert opinion of the authors of the study. The study was based on information about the 5 most popular cloud services used by companies to perform mathematical calculations. Amazon Web Services focus on reliability and scalability, providing a wide range of data storage and processing services, as well as performing serverless mathematical calculations. Microsoft Azure stands out for its integrated solutions, as well as data management and analytics services. Google Cloud offers a wide range of development and analytics tools, including data visualization and data sharing. Oracle Cloud provides comprehensive financial and database management solutions. SAP Cloud Platform specializes in financial management and analytics solutions. The results of the research open up prospects for studying the problems of integrating services built on different platforms and finding optimal solutions for combining the existing system of mathematical calculations in a logistics company with the offered cloud-based services.

1 Introduction

Digitalization of business life transforms the usual approaches to business. It has become the main trend of business transformation during the coronavirus pandemic, and the activities of logistics companies underwent drastic changes. As personal contact between people was limited, the introduction of digital technologies ensured conducting operations and functioning of business processes. In this aspect, the use of cloud computing has become decisive for ensuring the functioning of logistics companies. However, cloud technologies not only solved the problem of complying with pandemic restrictions, they also opened up new opportunities in the use of information about business processes, in particular, performing mathematical calculations and managing this information. The accounting system of logistics companies that use cloud technologies can reach a higher level of providing management information needs.

The advantage of cloud computing is the ability to use remote servers belonging to providers of these

technologies or data storage companies. Companies around the world, including supply chain actors, accumulate significant amounts of data every day. However, they do not always have the proper resources, infrastructure and qualified personnel to effectively use this data.

One of the main obstacles for companies that use cloud computing is the lack of properly trained personnel. However, cloud service providers can help solve this financial, cultural, and practical challenge. In other words, they offer expertise in building and securing cloud environments that an in-house team with extensive credentials and experience doesn't have.

Another problem of the implementation of cloud computing is the inconsistency of the functionality of cloud services with the needs of logistics companies. In this regard, there is a need for a comprehensive study of the functionality of cloud computing services and the possibilities of their use in logistics companies for cloud-based supply chain management and digital accounting. So, the aim of this study is to determine the capabilities of

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cloud services to meet the needs of logistics companies in the management of supply chains and digital accounting based on cloud computing.

Cloud services are gaining more and more popularity for their use in accounting. This is because they ensure the reliability of accounting data storage and the possibility of accessing them anywhere in the world. In addition, cloud services offer the possibility of automating certain accounting processes. This reduces the workload on accounting department employees and increases their productivity.

The aim involved the fulfilment of the following research objectives:

- Study the existing models of cloud service maintenance.
- Analyse the functionality of the most popular cloud services for their use for computing in the field of supply chain management and digital accounting in logistics companies.

2 Literature review

Author states that global supply chains are undergoing significant transformations caused by the use of cloud technologies, [1]. The concept of cloud computing and machine learning can be effectively used in the field of supply chain management, facilitating collaboration between supply chain stakeholders through the integration of supply chain activities and predictive analytics. Cloud computing enable building optimized delivery routes, analysing the stage of delivery in real time, and make adjustments to the planned route to take into account changes in circumstances.

The use of cloud technologies enables the transition to Industry 4.0, which is a powerful impetus in the development of customer satisfaction for logistics companies. Authors noted that Logistics 4.0 is a relatively new field of research that requires the development of scalable and effective software solutions and their deployment for successful business process transformations, [2]. In this aspect, the transformation of the information subsystem of logistics companies, in particular digital accounting, is worth noting. The use of cloud computing and the implementation of Industry 4.0 elements enables receiving operational information online, which significantly increases the effectiveness of information support for decision-making.

Researchers indicate that the integration of supply chain participants through cloud systems provides each participant with access to important information and facilitates the synchronization of supply chains [3]. Logistics capacity management becomes more efficient due to the full use of available assets and resources. Global freight planning enables companies to exercise better control and ensure timely decision-making, which provides greater flexibility in the supply chain. The cloud technologies and software are applied to integrate all aspects of the supply chain thanks to the accounting

system, which becomes automated to a certain extent. In this sense, the accountant's role is being transformed, shifting from the performance of traditional accounting functions of recording the economic facts to the management of available information.

In the dissertation, author notes that the use of cloud computing can have a number of positive effects for logistics companies, but the effectiveness depends to a large extent on how the use of these technologies has been organized [4]. The author notes that the correctly chosen model of the introduction of cloud computing is adapted to a specific logistics company and the specifics of the organization of information flows is decisive in the effectiveness of the transition to the use of cloud technologies. It is also necessary to take into account the organization of digital accounting in the logistics company, and cloud technologies should maximally provide the needs of the accounting system in particular.

Dfreight [5] detailed the issue of the advantages of using cloud computing by logistics companies. The general advantages, such as reducing costs, increasing efficiency, and improving the decision-making process, also include those directly related to the accounting system — receiving data in real time, automating the process of placing orders, implementing a data-based management system. So, the accounting system at the logistics enterprise also undergoes transformations, which contributes to its improvement.

After the coronavirus pandemic, many logistics companies have transformed their business models in response to new risks. This is why cloud software products should also be adaptive and meet the adaptation needs when necessary, [6,7]. Many software products do not take into account current trends in changing business models of logistics companies, which makes it necessary to identify modern needs in mathematical calculations of users of cloud computing platforms.

Cloud computing significantly increases the efficiency of decision-making, [8,9]. Previously, logistics companies had to invest a lot of resources to ensure the transparency of the logistics process, while cloud technologies make it completely transparent. Customers can monitor freight movement in real time. Cloud technologies also decentralize the decision-making process. Each section of the logistics chain becomes independent in making current decisions, which significantly increases the flexibility and speed of the decision-making system. Flexibility is provided by a well-established accounting system, which also becomes decentralized. Most of the data are registered on the spot, the storage and processing of information becomes automated, and the reporting is provided on demand at any management level.

An important aspect of the implementation of cloud computing is the transformation of information flows within the logistics company and between the logistics company and its customers, [10,11]. Cloud computing gives external employees the ability to access information

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and download data and documents from or to a particular storage space via a web link on any device. The information network of a logistics company can be significantly expanded, and the information system can contain information entry points at almost every stage of the logistics chain. This structure of the information system makes it extremely flexible, which ensures the completeness of information even in the most complex logistics channels.

Cloud technologies provide digitalization of business, [9,12]. Digitization allows not only to optimize individual business processes through the use of digital mathematical calculations based, but also to change the very concept of the company's interaction with its customers. The use of cloud computing optimizes the logistics company's business processes in terms of interaction with customers and obtaining the necessary information from them. The customers upload all necessary links to the system. Moreover, they can monitor freight movement. Access to the necessary documentation is provided in a similar way — each customer can independently download the contract and other documents from the information system. Any changes in the terms of delivery are automatically recorded and updated in the relevant documentation.

3 Methods

The research will be conducted in two stages. The first stage involves the study of the existing cloud services maintenance models, as the logistics company's decision to use such a service and the ability to meet the needs of the logistics company in performing mathematical calculations may depend on this.

The second stage provides for the analysis of the functionality of the most popular cloud service providers for their use for mathematical calculations in the field of supply chain management in logistics companies. The opportunities that the cloud services offer for improving the digital accounting system in logistics companies will also be analysed separately. The research sample included 5 of the most popular cloud services used by companies, [13]:

1. Amazon Web Services [14].
2. Microsoft Azure [15].
3. Google Cloud Platform [16].
4. Oracle Cloud [17].
5. SAP Cloud Platform [18].

The criteria for the ability of cloud services to meet the needs for improving the digital accounting of logistics companies include the following:

- Data storage on cloud service.
- Data scaling of the accounting system in case of increasing data volumes.
- Mathematical calculations for automation of accounting processes related to data processing.
- Registering economic transactions and economic facts automatically using the Internet of Things.

- Visualization of accounting data.
- Specialized financial blocks for work on planning, control, budgeting, etc.
- Data exchange with other services.
- Managing cash flows and financial calculations.
- Real-time monitoring and cost management capabilities.

The capabilities of each cloud service to meet the requirements for improving the accounting system in logistics companies through computing will be determined based on the analysis and comparison of the capabilities of cloud services of different provider companies.

The analysis of literature and official documentation on the possibilities of cloud computing services to meet the needs of improving the accounting of logistics companies involved the following scientific methods:

Review of current academic publications: this method allows for a selection, review and analysis of academic publications related to the possibilities of cloud computing for accounting. It includes a thorough literature search, selection of relevant studies, and analysis of the results to determine the current state of research in this field.

Analysis of official documentation. This method includes reviewing the official documents of the provider companies about the functionality of their products. This analysis will help to identify the requirements to be met to use cloud computing in accounting, and the opportunities it provides.

Expert evaluation. This method involves the use of the authors' opinion about the possibilities of using cloud computing to meet the accounting needs of logistics companies.

A parametric modeling method for building a model of the influence of the functionality of cloud services on the level of meeting the needs of the accounting system of logistics companies. The conceptual basis of the parametric model consists of determining the level of satisfaction of the needs of the accounting system of logistics companies as a function of the parameters and capabilities of cloud services. The available functionality of the considered cloud services represents Independent variable models.

4 Result

In this study, cloud services are supposed to mean a technology that provides access to a set of configurable mathematical computing resources, such as networks, servers, data stores, applications and/or services. Our understanding is based on a combination of conceptual principles of building cloud services, [19], types of mathematical calculations provided by cloud services, [20], and predictive assessments of the development of cloud computing technologies and services, [21]. The users can quickly use these resources for their tasks, reducing the number of interactions with the service provider or their

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own management resources. Cloud services include three service models (Figure 1).

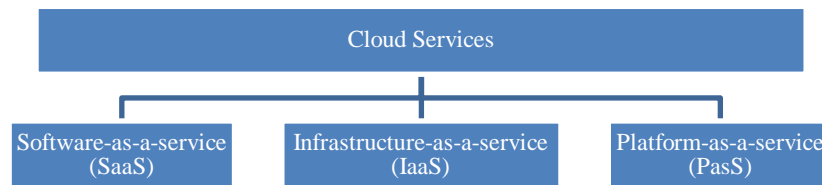


Figure 1 Cloud services maintenance models

The SaaS model involves a company using programmes or web applications that are developed, hosted, and maintained by a third party. For example, it can be programmes for planning and managing company flow of resources.

The IaaS model involves a business model where a company uses cloud computing for data management and analysis of logistic flows. This infrastructure can include various components such as Internet of Things (IoT) sensors, virtual machines, networking technologies, and energy management infrastructure.

The PaaS model is designed for application developers who need a stable cloud environment to test cloud services and verify their compatibility with existing products and application programming interfaces (APIs).

The use of cloud computing plays an important role in the transformation of digital accounting of logistics companies when transitioning to the use of such services. Cloud services enable storing accounting data in a centralized cloud storage, which provides access to them from any place and device. This makes it easier to share and collaborate with data and flow of information between

different departments and employees. Cloud services typically have high security standards, including data encryption, backups, and tamper protection. This is important for accounting of sensitive financial data.

The use of cloud services partially automates accounting processes. Cloud services often have built-in automation features, such as electronic invoicing, automatic tax accounting, and payroll. This helps reduce manual work and errors, while increasing the efficiency of accounting processes. Besides, cloud services enable integrating the existing accounting platform with other systems.

Cloud services can be integrated with other systems, such as supply chain management systems (SCM), warehouse management systems (WMS) and others. This allows for automatic data exchange and provides a single information platform for accounting and other functional areas.

The most popular cloud services used by logistics companies are considered and the solutions they offer for improving digital accounting are analysed below (Figure 2).

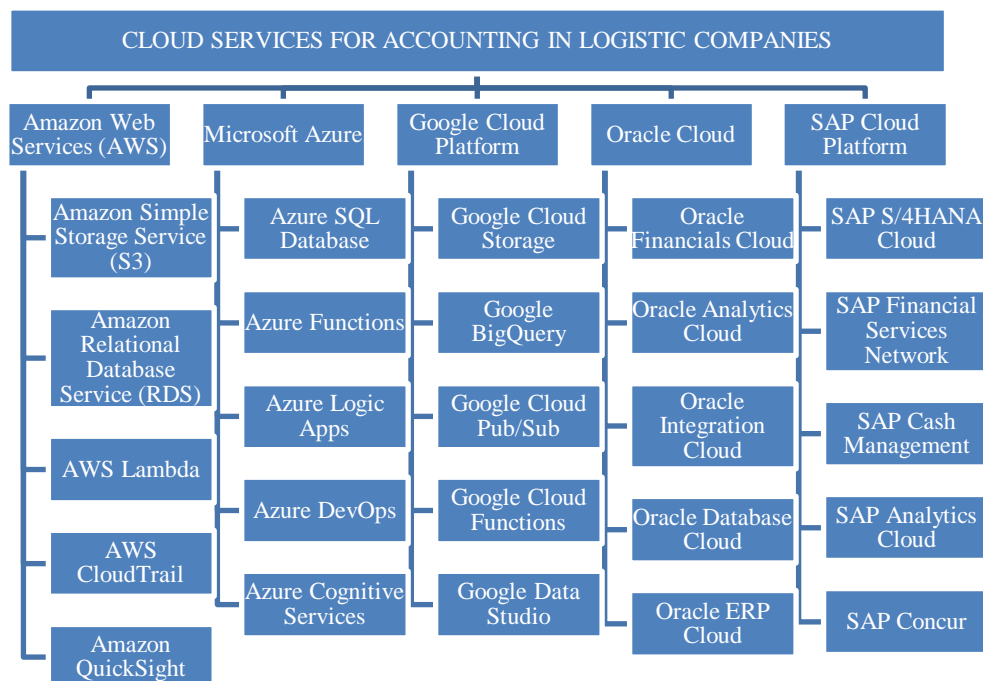


Figure 2 Cloud services that can be used to improve the accounting system in logistics companies

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1. Amazon Web Services (AWS).

Amazon EC2 (Elastic Compute Cloud) is a highly scalable cloud computing service. It provides resizable virtual servers that enable companies to quickly scale their computing resources according to their needs. For logistics and supply chain management, EC2 enables companies to deploy their applications and systems, such as inventory management software or transportation optimization tools, on a reliable and scalable infrastructure.

Amazon S3 (Simple Storage Service) provides companies with a reliable platform for storing and retrieving any amount of data at any time. In the context of logistics and supply chain management, S3 can be used to store large data volumes, such as product information, shipment records, or sensor data from IoT devices, enabling easy access, analysis, and integration with other systems.

Amazon Redshift is a fully managed petabyte-scale storage service. It enables companies to efficiently analyse large data volumes to gain valuable insights and make data-based decisions. In logistics and supply chain management, Redshift can be used to store and analyse huge amounts of historical data related to inventory levels, sales trends, customer behaviour or supplier performance. It enables businesses to run complex queries, generate reports and run analytics to optimize various aspects of the supply chain, such as demand forecasting, inventory management or supply chain risk assessment.

Amazon Web Services offers a variety of services and solutions that can contribute to the improvement of accounting in a logistics company that is transiting to the use of cloud services. The company's products that can be directly used to improve the accounting system will be detailed below.

Amazon Simple Storage Service (S3) in a logistics company can be used to store accounting data, such as financial statements, payments, invoices, as well as other documentation related to financial transactions. S3 ensures data reliability and availability, as well as the ability to easily backup and restore data when needed.

Amazon Relational Database Service (RDS) enables creating and managing relational databases in the AWS cloud environment. This can be useful for storing and managing accounting data in a structured format. RDS supports different types of databases, such as MySQL, PostgreSQL, or Oracle, and provides scalable resources to ensure performance and data availability.

AWS Lambda is a serverless computing service that executes code without the need to manage infrastructure. This can be useful for automating accounting processes and performing routine tasks. For example, a Lambda function can be created to automatically account for payments or generate financial reports based on input data.

AWS CloudTrail is a monitoring and event accounting service used to monitor, verify, and analyse activities in the

AWS cloud environment. This can be useful for ensuring compliance and security of accounting transactions. CloudTrail logs all events related to operations in AWS services, thereby enabling to establish monitoring of changes, identify potential problems or unauthorized access.

Amazon QuickSight is a data visualization service to create interactive reports and charts based on accounting data. It makes the analysis of financial data more understandable and accessible to various stakeholders. QuickSight provides a variety of visualization tools and the ability to share reports with colleagues and partners.

2. Microsoft Azure.

Azure IoT Hub is a cloud service that provides secure connection and management of devices. It provides a centralized platform for managing IoT devices in logistics and supply chains. The companies use IoT Hub to securely connect, monitor, and remotely manage a wide range of devices such as sensors, trackers or gateways involved in the supply chain ecosystem. It enables the acquisition, processing and analysis of data in real-time, allowing companies to track and monitor assets, monitor the state of the environment or detect anomalies. IoT Hub also integrates with other Azure services, such as Azure Functions or Azure Machine Learning providing real-time decision making, predictive analytics, and automation of supply chain processes.

Azure Functions is a serverless computing service used by companies to run event-based applications and workflows. This enables businesses to execute code or functions driven by particular events or triggers without worrying about the underlying infrastructure. Logistics companies can use Azure functions to automate a variety of processes and tasks, such as order processing, inventory replenishment, or shipment tracking. For example, businesses can create functions that trigger inventory alerts when inventory levels reach a threshold, or functions that process incoming orders and initiate execution processes. Azure functions provide flexibility, scalability and cost-effectiveness by running code only when needed, enabling companies to build efficient and responsive supply chain management systems.

Azure Machine Learning is a cloud service used by companies to build, deploy, and manage machine learning models. It provides a complete set of tools and services for all stages of the machine learning lifecycle, including data preparation, model development, training, evaluation, and deployment. In logistics and supply chain, Azure machine learning can be used to perform mathematical calculations to develop predictive models to forecast demand, optimize inventory levels, or optimize route and transportation planning. The analysis of historical data enables businesses to build machine learning models that accurately predict demand patterns, optimize inventory allocation to reduce shortages or overstocks, or optimize delivery routes to minimize costs and improve customer satisfaction. Azure

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Machine Learning integrates with other Azure services, such as Azure IoT Hub or Azure Databricks, to use IoT data or big data analytics for learning and insights, enabling companies to make data-based decisions and improve supply chain efficiency.

Microsoft Azure offers a variety of services and solutions that can contribute to the improvement of accounting in a logistics company. For example, Azure SQL Database is a fully managed database that offers high levels of security, availability, and scalability. It can be used to store and manage accounting data in a cloud environment.

Azure Functions is a serverless service used to execute code driven by events or triggers. It can be applied to automate accounting processes and perform routine tasks. For example, you can create an Azure Functions feature that automatically processes and records accounting transactions, such as payments or logging business transactions.

Azure Logic Apps is a service for creating automated workflows driven by events and actions. This can be used to integrate accounting data and perform various actions such as sending payment notifications or generating financial reports.

Azure DevOps is a set of tools and services for software development and development lifecycle management. It can be used to develop and maintain internal accounting systems or integrate external accounting data processing solutions.

Azure Cognitive Services offers a set of intelligent services that can be used to analyse and process text data, including financial reports and payments. For example, the Form Recognizer service can automatically extract and analyse structured information from accounting documents, such as the text part of a report.

3. Google Cloud Platform (GCP).

Google Cloud Platform is a scalable and highly available object storage service used by companies to store and access their data from anywhere in the world. It provides security and performance for storing different types of data, including unstructured and structured data. Logistics companies can use Google Cloud Storage to store large data volumes, such as product catalogues, shipment records, or sensor data from IoT devices. Data can be easily accessed, shared, and integrated with other Google Cloud services or third-party applications. Google Cloud Storage provides different classes of storage according to different access models and cost, enabling businesses to cost-effectively store their data while maintaining high availability, perform appropriate mathematical calculations.

Google BigQuery is a fully managed serverless data storage for companies to rapidly analyse large data volumes. It offers a highly scalable and distributed architecture for executing SQL queries for large datasets. BigQuery can be used in logistics and supply chains to

perform advanced analytics, generate reports, and gain insights from large volumes of historical data related to sales, inventory, customer behaviour, or supplier performance. By analysing these data, businesses can identify trends, make data-based decisions, and optimize various aspects of the supply chain, such as demand forecasting, inventory management, or supplier selection. BigQuery perfectly integrates with other Google Cloud services and tools, enabling companies to ingest and analyse data from multiple sources and gain valuable insights to improve supply chain operations.

Google Cloud Pub/Sub is a messaging service used by companies to build event-driven real-time systems. It provides reliable and scalable messaging capabilities to decouple and integrate different components of the supply chain ecosystem. Cloud Pub/Sub can be used in logistics and supply chain management to stream real-time data, such as order updates, inventory alerts, or sensor data, to different systems and applications. For example, companies can use Pub/Sub to send notifications to inventory management systems about changes in inventory levels or to trigger notifications to transportation management systems about delayed deliveries. Cloud Pub/Sub provides durability, reliability and low latency for message delivery, ensuring a continuous flow of critical information throughout the supply chain, enabling real-time monitoring, decision-making, and automation.

Google cloud services offer similar opportunities for improving accounting in logistics companies as other services. Google Cloud Storage is a reliable object storage used to store accounting data and documents in a secure environment. With flexible storage options, companies can store, organize and back up data for accounting, and provide easy access to it for analysis and processing.

Google BigQuery is a data storage and analytics service for efficient analysis of large data volumes based on mathematical calculations. With powerful processing tools and fast queries, BigQuery can be used to analyse financial data, reports, transactions and other accounting data. This enables companies to obtain valuable insights and perform detailed analysis to make financial and management decisions.

Google Cloud Pub/Sub is a messaging service that enables streaming data exchange between different systems and components. This can be used to communicate updates in the accounting system, notifications or updates between different accounting and reporting systems. Pub/Sub provides reliable and scalable communication that facilitates efficient real-time data exchange. This is especially relevant in a dynamic external environment, where the speed of decision-making is an important component of business success.

Google Cloud Functions is a serverless cloud computing service that used to execute code and functions according to programmed events. It can be used to automate accounting processes and perform accounting routine tasks. For example, Cloud Functions feature can be

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created that automatically processes and analyses event-based accounting data or generate reports.

Google Data Studio is a free data visualization tool for creating interactive reports and charts based on accounting data. It helps to analyse financial data making them more understandable to various stakeholders. Data Studio enables creating customized reports, charts, infographics, and dashboards for tracking and displaying key performance indicators.

4. Oracle Cloud.

Oracle Supply Chain Management (SCM) Cloud is a comprehensive set of programmes designed to optimize supply chain operations. It covers a wide range of functions, including inventory management, order execution, procurement, logistics and transportation management. Oracle SCM Cloud enables companies to obtain comprehensive analytics and control over their supply chain processes. It provides tools for demand planning, supply planning, and inventory optimization, helping businesses to optimize inventory levels, minimize inventory shortages, and reduce transportation costs. The businesses use the capabilities offered by this cloud service based on mathematical calculations in terms of order execution allows to effectively manage orders, track shipments, and ensure timely delivery. Oracle SCM Cloud also offers features for supplier management, enabling companies to collaborate with suppliers, manage contracts, and track supplier performance. Businesses use Oracle SCM Cloud to improve supply chain efficiency, improve customer satisfaction, and reduce costs by optimizing various aspects of their supply chain operations.

Oracle Cloud also offers a variety of services and solutions that can improve accounting in a logistics company. Oracle Financials Cloud is a fully integrated financial management system that provides extensive accounting, financial planning, and analysis capabilities. This system is designed to store, track and analyse financial transactions, including payment accounting, reporting, budget control, and asset management.

Oracle Analytics Cloud is a service for analytics and visualization of mathematical calculations used to analyse accounting data, create informative reports and charts. This service helps logistics companies to obtain important data on financial status, profitability, costs, and other financial indicators.

Oracle Integration Cloud is a digital solution for data and application integration. This service enables communication between different accounting systems used in the logistics company and data exchange between them. This contributes to the automation of accounting and ensuring the relevance of data in various systems.

Oracle Database Cloud provides a digital environment for storing and managing accounting data. This allows the logistics company to ensure security, availability and efficient management of financial data.

Oracle ERP Cloud is a comprehensive enterprise management solution that includes modules for accounting, finance, inventory management, procurement management and many others. This service allows the logistics company to keep accounting records, track financial information and make adjustments according to requirements.

5. SAP Cloud Platform.

SAP Integrated Business Planning (IBP) is a cloud service designed for businesses to match supply and demand, optimize inventory levels, and improve overall supply chain performance based on mathematical calculations. It provides a common environment for sales and operations planning, demand planning, inventory optimization and management. With SAP IBP, companies can use advanced analytics, machine learning, and modelling capabilities to accurately forecast demand, optimize inventory levels, and balance supply and demand. It provides real-time visibility of the supply chain, enabling companies to identify potential bottlenecks, mitigate risks, and make proactive decisions. SAP IBP integrates with other SAP solutions such as SAP S/4HANA, enabling comprehensive supply chain integration and data synchronization. SAP IBP helps companies to achieve better supply chain visibility, increase operational efficiency, reduce costs, and improve customer service.

SAP Extended Warehouse Management (EWM) is another comprehensive warehouse management solution that provides advanced features for efficient and optimized warehouse operations. SAP EWM offers functions for inbound and outbound processes, inventory management, storage optimization, workforce management, and transportation integration. Businesses use SAP EWM to effectively manage the processes of goods receipt, receiving, order picking, packing, and shipping, ensuring accurate and timely order execution. The solution provides real-time visibility of warehouse operations, enabling businesses to optimize the use of warehouse space, improve inventory accuracy and labour productivity. SAP EWM integrates with other SAP solutions, such as SAP S/4HANA or SAP Transportation Management, providing comprehensive visibility and synchronization of the supply chain. The companies use SAP EWM to increase warehouse throughput, reduce errors, improve inventory accuracy and customer satisfaction.

SAP Cloud Platform offers various services and solutions for the accounting system of logistics companies. SAP S/4HANA Cloud is a cloud version of an integrated enterprise management system that includes finance, accounting, inventory control and other modules. This allows the logistics company to effectively keep accounting records, manage financial processes and ensure the accuracy and integrity of financial information.

SAP Financial Services Network (FSN) is a network of electronic data exchange and collaboration between companies in the financial services industry. It helps

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logistics companies to connect with banks, financial service providers and other counterparties to automate accounting operations such as paying bills, accounting for payments and feedback to financial institutions for settlement reconciliation, among other things.

SAP Cash Management is a cash flow management and forecasting solution. This service enables the logistics company to effectively monitor, manage and forecast cash flows, including incoming and outgoing payments, ensuring accuracy and flexibility in managing cash resources.

SAP Analytics Cloud is a data analytics and visualization service based on relevant mathematical calculations designed to analyse financial data and create reports, charts and infographics. The logistics companies use this service to receive data on financial status, profitability, costs, and other financial indicators.

SAP Concur is a cloud-based solution for cost and transportation management. It helps logistics companies to effectively track, manage, and report on expenses related to accounting operations, transportation, and business trips. This improves cost efficiency and ensure cost accounting accuracy across activities.

Table 1 Capabilities of cloud services for improving the accounting system in logistics companies based on mathematical calculations

Service capabilities	Cloud service				
	Amazon Web Services (AWS)	Microsoft Azure	Google Cloud	Oracle Cloud	SAP Cloud Platform
Data storage - storage of accounting data and documents	Amazon Simple Storage Service (S3)	Google Cloud Storage	Google Cloud Storage	-	-
Database - storage, management and scaling of accounting data	Amazon Relational Database Service (RDS)	Azure SQL Database	-	Oracle Database Cloud	-
Serverless mathematical calculation - automation of accounting processes and performance of routine tasks	AWS Lambda	Azure Functions	Google Cloud Functions	-	-
Monitoring and accounting of the economic facts - tracking, analysis and security of accounting operations	AWS CloudTrail	-	-	-	-
Data visualization – creation of interactive reports and charts based on accounting data and mathematical calculations	Amazon QuickSight	-	Google Data Studio	-	SAP Analytics Cloud
Financial management – accounting, financial planning, budget control and asset management	-	-	-	Oracle Financials Cloud	SAP S/4HANA Cloud
Electronic data exchange – automation of accounting operations and accounting of payments	-	-	-	-	SAP Financial Services Network (FSN)
Cash flow management – tracking, managing and forecasting cash flows	-	-	-	-	SAP Cash Management
Cost and transportation management - tracking, management and reporting of costs related to accounting operations, transportation, and business trips	-	-	-	-	SAP Concur

The analysis of the capabilities of the leading cloud platforms gives grounds to conclude that there are several common capabilities that can contribute to the improvement of accounting in logistics companies. All these platforms provide various services for data storage, such as object storage and databases, as well as serverless computing, to automate accounting processes and perform routine tasks. They also offer data visualization services to help understand financial data and create reports on flow of financial information.

However, each of these platforms has its peculiarities. For example, Amazon Web Services focuses on reliability

and scalability, providing a wide range of data storage and processing services. Microsoft Azure stands out for its integrated solutions and services for data management and analytics. Google Cloud offers a wide range of tools for development and analytics, including data visualization and data sharing. Oracle Cloud provides comprehensive financial and database management solutions. Finally, SAP Cloud Platform specializes in financial management and analytics solutions.

To decide on choosing a cloud service to improve the organization of accounting in the company, we suggest using a parametric model of compliance of the

functionality of cloud services with the needs of the accounting system (1):

$$EOA = f(|DSEi + DBEi + SEi + MEi + DVEi + FMEi + EDEi + CFMEi_EMEi|/n) \quad (1)$$

where:

EOA – Efficiency of accounting;

DSE – Data Storage Efficiency;

DBE – Database Efficiency;

SE – Serverless Efficiency;

ME – Monitoring Efficiency;

DVE – Data Visualization Efficiency;

FME – Financial Management Efficiency;

EDE – Electronic Data Efficiency;

CFME – Cash Flow Management Efficiency;

EME – Expense Management Efficiency;

i – cloud service;

n – the number of parameters of cloud services.

Each parameter is assigned a coefficient from 0 to 1, where 0 does not fully meet the needs of the company's accounting system, and 1 fully meets the needs of the company's accounting system. This coefficient is determined by specialists in the company's accounting department, who conduct such an evaluation of cloud services. Based on the calculation results, a parameter is determined that reflects the level of compliance of cloud services' functionality with the accounting system's needs.

In general, the choice of a cloud accounting platform depends on the specific needs of the company. It is important to consider functional requirements, security level, availability, and integration capabilities. Each of these platforms has its own advantages and unique capabilities that help logistics companies improve accounting and make better financial and management decisions.

5 Discussion

The results of this research indicate broad prospects for the use cloud computing by the logistics companies, not only in supply chain management, but also in accounting organization. Analysis of the implementation of cloud computing of the most common cloud platforms revealed significant prospects for improving the accounting of logistics companies. Our conclusions are supported by the results of a study on the impact of cloud computing on accounting in companies, [22]. The authors note that cloud technologies became widespread in accounting during the coronavirus pandemic. Companies tried to comply with quarantine restrictions and introduced cloud services. For accounting, this has opened up significant opportunities in terms of automation of routine processes.

The study [23] on the process of transition to cloud services is interesting. The authors established that the most significant factor in the success of using cloud services in accounting is their compatibility with the

company's systems and technologies. This conclusion is confirmed by the results of our research, because the use of different cloud service platforms can be difficult. Each company that provides access to its cloud services tries to provide a complete ecosystem that does not involve the use of third-party components.

Another study [24] proved that cloud computing provides cost reduction and increased productivity of accounting departments. Furthermore, it improves such business processes as communication, working with documents, and the corporate information system. We agree with this conclusion, as the analysis of cloud services identified specialized products and modules for optimizing such business processes. Similar conclusions are drawn in the study [25,26], where the authors note that cloud technologies and artificial intelligence provide such significant advantages that accounting will be completely transferred to cloud services.

Ou and Zhang [27] point out that cloud services are more suitable for small and medium-sized businesses. Small and medium-sized businesses are more flexible and adaptable, which facilitates their transition to cloud services. However, the results of our research indicate that the cloud infrastructure is more focused on large companies, providing great opportunities for the analysis of accounting data and the automation of accounting processes.

Other studies [28,29] analyse the benefits and risks of using cloud computing. One of the most common risks is data insecurity. However, our research showed that large cloud service providers ensure reliable data storage and encryption to minimize insecurity risks. This gives grounds to conclude that cloud services designed for small companies may have certain problems with data insecurity, but large companies that offer a complete cloud computing infrastructure significantly minimize such risks. The advantages over the disadvantages of cloud computing for its use in accounting are also reported in [30,31]. The main advantages include routine tasks automation and reduction of resources for performing analytical functions of accountants. The novelty of the obtained results is the generalization and structuring of information about the possibilities of cloud computing to satisfy the need for supply chain management and for the organization of accounting of logistics companies.

6 Conclusions

The increasing amounts of data on the activities of logistics companies necessitates the search for technical solutions for managing these data. Cloud computing services offer various data management options not only for managing supply chains of logistics companies, but also for accounting system data.

AWS and Google Cloud offer a wide range of data storage and processing services, such as object storage and databases. Azure and Oracle Cloud also provide these

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capabilities, but focus on integrated data management solutions. SAP Cloud Platform has limited capabilities in this area. AWS, Azure, and Google Cloud offer serverless math computing services that allow you to automate accounting processes and perform routine tasks. SAP Cloud Platform provides limited capabilities in this area, while Oracle Cloud does not have direct serverless computing services. AWS, Azure, Google Cloud, and SAP Cloud Platform offer services for analysing and visualizing accounting data for better understanding of financial information and creating reports. Oracle Cloud has limited capabilities in this area. Oracle Cloud and SAP Cloud Platform focus on finance, accounting and financial process management solutions, providing comprehensive integrated solutions. Other platforms also have some capabilities in this area, but not as broad and integrated. Consider cloud services that can satisfy the vast majority of logistics companies' accounting system needs. If there are specific needs, the provider companies offer opportunities to develop additional modules to solve such tasks. In addition, these services are constantly being improved, and are flexible in their orientation to meet customers' needs.

In general, each of the cloud platforms has its own advantages and unique capabilities in supporting management of information flows. AWS and Google Cloud provide a wide range of data storage and processing services, Azure and Oracle Cloud offer integrated solutions for data management and analytics, and Oracle Cloud and SAP Cloud Platform specialize in solutions for managing finances and financial processes. The choice of a cloud platform depends on the company's specific needs and its accounting priorities.

The proposed parametric model can be used by logistics companies' accounting department employees when choosing cloud services. Based on a subjective assessment of the accounting system needs of their company, they can use this model to identify the cloud service that best meets their needs. The obtained results can be applied in the development of a model for the transformation of databases of logistics companies and the selection of a cloud computing service for the information system migration.

The conducted research opens up prospects for further research, in particular, regarding the problems of integrating services built on different platforms and finding optimal solutions for combining the information system existing in a logistics company with the offered cloud computing services.

References

- [1] KAKKAR, P.: Revolutionizing Supply Chain with Cloud Based Applications, *American Journal of Computer Architecture*, Vol. 8, No. 1, pp. 1-5, 2021.
- [2] STIETENCRON, M., HRIBERNIK, K., LEPENIOTI, K., BOUSDEKIS, A., LEWANDOWSKI, M., APOSTOLOU, D., MENTZAS, G.: Towards logistics 4.0: An edge-cloud software framework for big data analytics in logistics processes, *International Journal of Production Research*, Vol. 60, No. 19, pp. 5994-6012, 2021.
<https://doi.org/10.1080/00207543.2021.1977408>
- [3] GOMEZ, M., GRAND, M., GRIVAS, S.G.: Digitalisation in logistics and the role of cloud computing: How cloud computing will change the game, *Logistics Innovation*, Vol. 2, pp. 1-18, 2021.
<http://dx.doi.org/10.13140/RG.2.2.16826.93128>
- [4] AVILES, M.E.: *The Impact of Cloud Computing in Supply Chain Collaborative Relationships, Collaborative Advantage and Relational Outcomes*, Electronic Theses and Dissertations, Vol. 1244, 2015.
<https://digitalcommons.georgiasouthern.edu/etd/1244>
- [5] Dfreight, How Cloud Computing Benefits the Logistics Industry, [Online], Available: <https://dfreight.org/blog/cloud-computing-benefits-for-logistics-industry/> [24 May 2023], 2022.
- [6] SAMSIN, I., KOVALKO, N., KOVALENKO, A., ZABZALIUK, D., KURANDO, K.: Legal aspects of identity transactions involving entities with foreign elements, *Journal of Legal, Ethical and Regulatory Issues*, Vol. 24, No. 5, pp. 1-10, 2021.
- [7] WANG, J., ZHANG, H., HU, H., ZHAO, J.: Cloud logistics service mode and its several key issues, *Journal of Logistics, Informatics and Service Science*, Vol. 2, No. 1, pp. 58-73, 2015.
- [8] MATKOVIC, P., TUMBAS, P., PAVLICEVIC, V.: Decision Making in Logistics Processes Supported by Cloud Computing, *International Scientific Journal of Management Information Systems*, Vol. 9, No. 1, pp. 11-20, 2014.
- [9] TEMJANOVSKI, R., BEZOVSKI, Z., APASIEVA, J. T.: Cloud computing in logistic and Supply Chain Management environment, *Journal of Economics*, Vol. 6, No. 1, pp. 23-32, 2021.
<https://doi.org/10.46763/JOE216.10023t>
- [10] DUBEY, S., JAIN, S.: Logistics Information System and Cloud Computing, *International Journal of Operations and Logistics Management*, Vol. 3, No. 1, pp. 42-47, 2014.
- [11] SALEH, I., MAREI, Y., AYOUSH, M., AFIFA, M.M.A.: Big Data analytics and financial reporting quality: Qualitative evidence from Canada, *Journal of Financial Reporting and Accounting*, Vol. 21, No. 1, pp. 83-104, 2022.
<https://doi.org/10.1108/JFRA-12-2021-0489>
- [12] ABU AFIFA, M.M., VO VAN, H., LE HOANG VAN, T.: Blockchain adoption in accounting by an extended UTAUT model: empirical evidence from an emerging economy, *Journal of Financial Reporting and Accounting*, Vol. 21, No. 1, pp. 5-44, 2023.
<https://doi.org/10.1108/JFRA-12-2021-0434>
- [13] CHAND, M.: *Top 10 Cloud Service Providers*, [Online], Available: <https://www.c->

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- sharpcorner.com/article/top-10-cloud-service-providers/ [24 May 2023], 2023.
- [14] Amazon Web Services, [Online], Available: <https://aws.amazon.com> [24 May 2023], 2023.
- [15] Azure, [Online], Available: <https://azure.microsoft.com/en-us/homepage-b/> [24 May 2023], 2023.
- [16] Google, *Google Cloud*, [Online], Available: <https://cloud.google.com> [24 May 2023], 2023.
- [17] Oracle, *Oracle Cloud Infrastructure*, [Online], Available: <https://www.oracle.com/cloud/> [24 May 2023], 2023.
- [18] SAP, *SAP Business Technology Platform*, [Online], Available: <https://www.sap.com/products/technology-platform.html> [24 May 2023], 2023.
- [19] AHMED, S.T., KHADHIM, B.J., KADHIM, Q.K.: *Cloud services and cloud perspectives: A review*, IOP Conference Series Materials Science and Engineering, Vol. 1090, No. 1, Article 012078, 2021. <http://dx.doi.org/10.1088/1757-899X/1090/1/012078>
- [20] RAJESWARI, Ms.N.: Overview of cloud computing and its types, *Journal of Emerging Technologies and Innovative Research*, Vol. 6, No. 3, pp. 61-67, 2019.
- [21] GARCIA, G.J.: *Past, present, and future of cloud computing: An innovation case study*, A Case Project Presented to Malayan Colleges Laguna College of Computer and Information Science, pp. 1-18, 2021. <http://dx.doi.org/10.13140/RG.2.2.16826.93128>
- [22] MIHAI, M.S., DUTESCU, A.: *How cloud accounting and integrated services based on AI can impact accounting companies?*, Proceedings of the International Conference on Business Excellence, Vol. 16, No. 1, pp. 849-858, 2022. <http://dx.doi.org/10.2478/picbe-2022-0079>
- [23] TAWFIK, O.I., DURRAH, O., HUSSAINEY, K., ELMAASRAWY, H.E.: Factors influencing the implementation of cloud accounting: Evidence from small and medium enterprises in Oman, *Journal of Science and Technology Policy Management*, Vol. 14, No. 5, pp. 859-884, 2022. <https://doi.org/10.1108/JSTPM-08-2021-0114>
- [24] AL-ZOUBI, A.M.: The effect of cloud computing on elements of accounting information system, *Global Journal of Management and Business Research: D Accounting and Auditing*, Vol. 17, No. 3, Version 1.0, pp. 1-9, 2017.
- [25] TARBOUSH S.A.: Cloud Accounting as a new business model and its influence on accounting process, *Multi-Knowledge Electronic Comprehensive Journal for Education And Science Publications*, Vol. 2017, No. 2, pp. 1-14, 2017.
- [26] ALSHAREEF, H.N.: Current Development, Challenges and Future Trends in Cloud Computing: A Survey, *International Journal of Advanced Computer Science and Applications*, Vol. 14, No. 3, pp. 329-338, 2023.
- [27] OU L., ZHANG Z.: Research and analysis on cloud accounting of enterprises under the background of new economy, *Journal of Physics: Conference Series*, Vol. 1852, Article 042077, 2021. <https://doi.org/10.1088/1742-6596/1852/4/042077>
- [28] RAHMAN, M.J., YANGFAN, G., HOSSAIN, M.M., RANA, T.: *Cloud Accounting: A New Business Model in Challenging Context of China*, In: Rana, T., Svanberg, J., Öhman, P., Lowe, A. (eds) Handbook of Big Data and Analytics in Accounting and Auditing. Springer, Singapore, pp. 163-175, 2020. https://doi.org/10.1007/978-981-19-4460-4_8
- [29] MOUDUD-UL-HUQ, S., ASADUZZAMAN, Md., BISWAS, T.: Role of cloud computing in global accounting information systems, *The Bottom Line*, Vol. 33, No. 3, pp. 231-250, 2020. <https://doi.org/10.1108/BL-01-2020-0010>
- [30] SINGEROVÁ, J.: Accounting in Cloud, *European Financial and Accounting Journal*, Vol. 13, No. 1, pp. 61-76, 2018. <https://doi.org/10.18267/j.efaj.206>
- [31] PATANKAR, A.D., PATIL, P.P.: Cloud computing and business accounting, *International Journal of Creative Research Thoughts*, Vol. 9, No. 7, 2021.

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