

A Comparative Study on The Cost-Benefit Analysis of Cloud-Based Vs on-Premise Twilight IT Solution

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Abstract- This paper presents an analytical comparison of cloud-based and on-premise IT infrastructure models with reference to Twilight IT Solutions Pvt. Ltd. The study aims to identify the financial, operational, and strategic implications of both systems through cost-benefit evaluation. Using secondary data from published reports and case studies, the analysis explores capital and operational expenditures (CAPEX and OPEX), total cost of ownership (TCO), scalability, downtime, and security. The findings suggest that while on-premise infrastructure ensures data control and stability, cloud-based deployment offers improved scalability, reduced capital cost, and operational flexibility. The study concludes that adopting a hybrid or cloud-first strategy can deliver sustainable long-term benefits for mid-sized IT organizations.

Keywords- Cost-Benefit Analysis (CBA), Cloud-Based vs On-Premise Infrastructure, Total Cost of Ownership (TCO)

I. INTRODUCTION

Technological transformation has redefined how organizations manage data and deploy IT infrastructure. The choice between cloud-based and on-premise systems significantly influences cost, performance, and scalability. Cost-Benefit Analysis (CBA) is an essential tool that enables decision-makers to assess whether the benefits of a project outweigh its costs. This study applies CBA to evaluate the economic and operational efficiency of Twilight IT Solutions' infrastructure models. The analysis emphasizes factors such as resource optimization, performance improvement, and long-term financial sustainability, enabling a deeper understanding of infrastructure investment decisions.

II. OBJECTIVESB OF THE STUDY

- To study the total cost of ownership (TCO) of cloud-based versus on-premise data warehousing solutions.
- To evaluate a cost-benefit analysis of migrating IT infrastructure to cloud platforms.

- To compare capital expenditure (CAPEX) and operational expenditure (OPEX) in on-premise and cloud environments.
- To find the costs associated with on-premise and cloud platforms, including downtime, support, and compliance.

III. REVIEW OF LITERATURE

D. Cloud Computing Service Models (Latipah Nordin, 2020)

According to Latipah Nordin (2020), cloud computing services are organized into three main service models and four deployment models. The author emphasized that the level of service provided depends on the cloud architecture and the agreements established between service providers and users. The study described that Software as a Service (SaaS) operates as the top layer, offering ready-to-use software applications over the internet. In contrast, Infrastructure as a Service (IaaS) focuses on outsourcing essential hardware components such as storage, servers, and networks, enabling businesses to manage resources flexibly without heavy capital investment.

Evolution of Cloud Computing (Rahimah Kassim, 2021)

Rahimah Kassim (2021) traced the historical development of cloud computing beginning with grid computing in the 1990s, where interconnected computers were used for large-scale research. This evolved into utility computing, which offered computing power as a metered service, similar to electricity billing. The introduction of SaaS in the early 2000s revolutionized access to business software, making it available online for subscription rather than purchase. The research concluded that cloud computing made advanced technology more affordable and accessible to organizations of all sizes.

Cloud-Based Accounting Software (Sweeta Agrawal, 2021)

Sweeta Agrawal (2021) analyzed the increasing adoption of cloud-based accounting platforms and compared

their performance and usability across organizations. The study found that such systems enhance accuracy, provide real-time access to data, and automate several financial processes. By using cloud accounting, businesses can improve efficiency, streamline financial reporting, and make faster strategic decisions.

Cost Comparison of Cloud and On-Premise Solutions (Abhinav Kalra, 2022)

In his study, Abhinav Kalra (2022) compared the financial and technical aspects of cloud versus on-premise IT infrastructures. The analysis considered both initial investment and long-term expenses. The findings revealed that cloud models reduce upfront costs and support scalability, while on-premise systems offer better control and security. The author concluded that organizations should select models based on operational needs, customization requirements, and long-term cost implications.

Cost-Benefit Analysis of Cloud Migration (Santosh Bhandari, 2023)

Santosh Bhandari (2023) developed a framework for assessing the financial outcomes of moving from traditional IT infrastructure to cloud-based systems. The research considered both visible costs such as software licenses and hidden costs such as data transfer and maintenance. After comparing hybrid, public, and private cloud options, the study found that hybrid models often provide an optimal balance between flexibility, cost efficiency, and risk management.

Cloud Computing in Higher Education (Amadi, 2023)

Amadi (2023) evaluated the use of cloud computing in higher education institutions, particularly those with limited financial and technical resources. Using data from the Federal University of Technology (FUTO), Nigeria, the study found that cloud adoption lowers hardware and maintenance expenses while improving resource accessibility for students and faculty. The research concluded that integrating cloud systems enhances academic productivity and operational efficiency.

Taxonomy of Cloud Storage Costs (Akif Quddus Khan, 2023)

Akif Quddus Khan (2023) explored the structure of cloud storage expenses and designed a taxonomy to simplify cost evaluation. The study classified costs based on factors like redundancy, data protection, and service reliability. The author emphasized that understanding these cost categories is

essential for organizations to manage multi-cloud environments efficiently and to make cost-effective storage decisions.

IV. RESEARCH METHODOLOGY

Research Design:

The study adopts a descriptive and comparative research design to evaluate the financial and operational performance of cloud-based and on-premise IT infrastructure. It focuses on analyzing key indicators such as TCO, CAPEX, OPEX, and ROI to identify patterns, strengths, and weaknesses in cost efficiency and operational effectiveness. The design also includes benchmarking and multi-year analysis to ensure an objective and comprehensive evaluation aligned with Twilight IT’s strategic goals.

Data Collection:

This study relies entirely on secondary data gathered from industry reports, financial statements, academic publications, and company records related to cloud-based and on-premise IT infrastructure. Data sources include documents from Twilight IT, covering performance metrics, cost analyses, and benchmarking reports over multiple years to ensure a comprehensive comparison.

Tools Used For Analysis Of Data

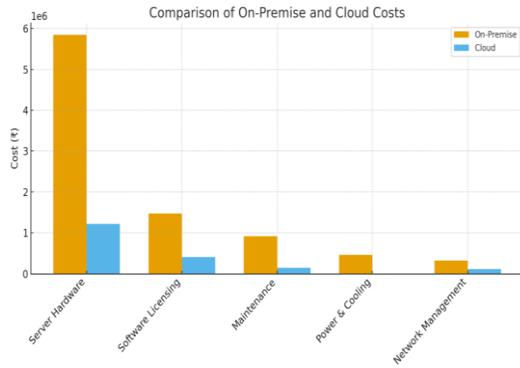
- Cost-Benefit Analysis
- Comparative Cost Statement
- Cost Ratio Analysis

V. DATA ANALYSIS AND INTERPRETATION

1. COMPARATIVE INFRASTRUCTURE COST ANALYSIS (ON-PREMISE VS CLOUD)

Cost Component	On-Premise (?)	Cloud (?)
Server Hardware	58,50,000	12,20,000
Software Licensing	14,75,000	4,10,000
Maintenance	9,20,000	1,45,000
Power & Cooling	4,60,000	0
Network Management	3,25,000	1,10,000
Total	90,30,000	18,85,000

SOURCE: secondary data



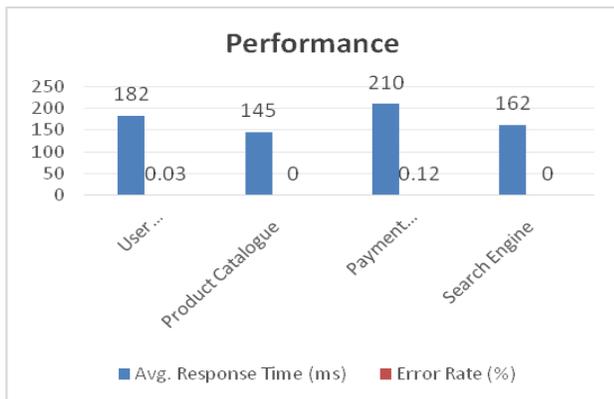
INTERPRETATION

- The data clearly indicates that cloud infrastructure offers substantial cost savings compared to on-premise systems.
- On-premise deployment incurs high costs due to hardware, software licensing, and continuous maintenance.
- Cloud services eliminate expenses related to physical infrastructure, power, and cooling, reducing total cost by nearly 79%.
- This demonstrates that shifting to cloud infrastructure significantly improves cost efficiency while reducing long-term operational burdens.

2.PERFORMANCE BENCHMARKING OF APPLICATION SERVICES

Service Module	Avg. Response Time (ms)	Error Rate (%)
User Authentication	182	0.03
Product Catalogue	145	0
Payment Processing	210	0.12
Search Engine	162	0

SOURCE: secondary data



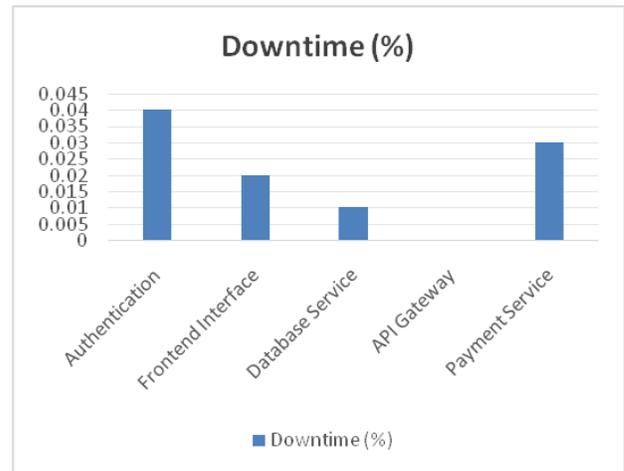
INTERPRETATION

- The performance evaluation shows that all services operate efficiently with response times below 250 ms.
- Payment processing has the highest latency and a slightly elevated error rate (0.12%), which may require optimization due to its critical nature.
- The product catalogue and search engine show excellent stability with zero failure rates, reflecting strong backend performance.
- Overall, the system delivers reliable performance, but further enhancements to the authentication and payment modules can ensure smoother user experience.

3. DOWNTIME ANALYSIS OF SYSTEM SERVICES (MONTHLY OBSERVATION)

Service	Downtime (%)
Authentication	0.04
Frontend Interface	0.02
Database Service	0.01
API Gateway	0
Payment Service	0.03

SOURCE: secondary data



INTERPRETATION

- The downtime analysis indicates that all services maintain excellent uptime, with downtime well below 0.1%.
- The database and API gateway show perfect or near-perfect availability, strengthening overall system reliability.
- Authentication and payment modules have slightly higher downtime but remain within acceptable limits.
- These results indicate a highly stable environment suitable for continuous operations, though minor

improvements in critical user-facing services can further enhance system availability.

V. FINDINGS

- On-premise systems are far more expensive (₹90.30 lakh) than cloud deployment (₹18.85 lakh). Cloud saves nearly **79%** by eliminating hardware, maintenance, and power costs.
- All modules perform efficiently with response times below 250 ms. Payment processing shows slightly higher latency and error rate, while catalogue and search modules perform flawlessly.
- All services maintain excellent uptime (<0.1% downtime). The API gateway has zero downtime, while authentication and payment modules need minor improvements.

VI. SUGGESTION

- Improve critical modules like payment processing and authentication to reduce delays and downtime.
- Consider full or hybrid cloud migration to leverage cost savings and better scalability.
- Use real-time monitoring tools to detect service issues early and maintain high system reliability.
- Optimize database and API performance through regular load testing and maintenance.
- Review cloud licensing and resource usage to avoid unnecessary costs.

VII. CONCLUSION

Cloud deployment provides major financial and operational benefits, reducing costs and improving scalability. System performance and uptime remain strong overall, with only minor enhancements needed in critical modules. By improving monitoring, optimizing resources, and strengthening key services, the organization can achieve higher efficiency, stable performance, and long-term sustainability.

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