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FACTORS INFLUENCING THE UTILIZATION OF CLOUD OPTIMIZATION TOOLS AMONG DEVOPS ENGINEERS: INSIGHTS FROM A SOFTWARE DEVELOPMENT COMPANY IN SRI LANKA

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Abstract

This study investigates the reasons why DevOps engineers utilize cloud optimization technologies, aiming to aid decision-makers in enhancing cloud technology use, ensuring cost-effectiveness, and simplifying management within organizations. A quantitative research approach was employed, with two hundred individuals randomly selected from a pool of eight hundred DevOps experts, prioritizing ethical considerations throughout the study process. Rigorous regression and correlation studies were conducted with a 95% confidence level to explore significant correlations between independent factors and a company's cloud optimization. The research focused on key goals such as reducing maintenance costs, improving scalability, and efficient resource utilization, with participants highlighting the importance of cost savings, scalability, and simplified management. The findings revealed significant correlations between these independent factors and the effectiveness of cloud optimization in companies. Consequently, the study suggests that decision-makers prioritize reducing maintenance costs, enhancing scalability, and optimizing resource utilization to enable their DevOps teams to effectively leverage cloud optimization technologies. This study provides practical recommendations for organizational strategies that promote the efficient use of cloud technologies and sheds light on the specific preferences of DevOps engineers regarding cloud optimization technologies.

Keywords*: DevOps, Cloud Optimization Tools, Cloud Computing, Cloud Optimization Technologies*

1. Introduction

Cloud computing has revolutionized IT due to its scalability, affordability, and agility. The US National Institute of Standards and Technology (NIST) recognizes essential characteristics of cloud computing: self-help, quantifiable services, rapid elasticity, resource pooling, and extensive network access. Typically, cloud resources are organized using Software as a Service (SaaS), Infrastructure as a Service (IaaS), and Platform as a Service (PaaS). Given its cost-effectiveness and ease of access compared to specialized clusters or high-performance machines, businesses are leveraging cloud computing to enhance productivity. In Sri Lanka's rapidly evolving IT sector, cloud optimization by DevOps engineers has gained popularity (Mishra, 2018) .

Cloud computing has fundamentally altered how firms utilize and manage IT resources. Its scalability, cost-effectiveness, and agility make it indispensable for modern enterprises. The US National Institute of Standards and Technology (NIST) defines cloud computing by its on-demand self-service, measurable service, rapid flexibility, resource pooling, and broad network access. These capabilities collectively enhance technology efficiency and adaptability, allowing organizations to scale resources as needed and pay only for what they use (Attaran, 2018).

The primary methods for organizing cloud resources are SaaS, IaaS, and PaaS. SaaS delivers software applications online, eliminating the need for installation and maintenance. IaaS provides virtualized computing resources over the internet, allowing flexibility in processor, storage, and networking resources. PaaS offers a framework for developers to build and manage applications without dealing with underlying infrastructure (Jindal, A. a. G. M., 2021).

Companies are increasingly turning to cloud computing to boost productivity and efficiency. Its cost-effectiveness and ease of use make it a viable alternative to high-performance computing systems and specialized clusters, which are often expensive and complex to manage. Cloud optimization is particularly appealing to DevOps engineers in Sri Lanka's dynamic IT sector. Continuous efforts are underway to develop cloud computing solutions that maximize resource use for business purposes. This evolution underscores the critical role of cloud computing in driving technological innovation and business growth (Mohammad, S., 2018).

To maintain privacy, this study uses the pseudonym "ABC" for the company in question. The study focuses on the adoption decisions regarding cloud optimization technology by ABC's DevOps engineers. By examining these dynamics, the paper aims to illustrate how ABC leverages advanced technology to maintain a competitive edge and enhance its IT operations (Pawar, 2017).

ABC is a major IT company known for its innovative approach to technology. Founded over a decade ago, ABC has rapidly grown into a global leader in cloud computing solutions. In the face of a fast-changing technological landscape, this research investigates how ABC's DevOps teams use cloud optimization tools to improve operational efficiency and agility.

Cloud optimization aims to enhance the performance, scalability, and cost-efficiency of computing, storage, and networking resources. DevOps plays a pivotal role in a company's cloud optimization efforts. At ABC, many DevOps engineers struggle to allocate the appropriate instance sizes for their workloads. Overprovisioning wastes resources, while under provisioning hampers performance and usability. This misallocation has resulted in a 10% decrease in delivery efficiency and a 25% drop in customer satisfaction. Unused cloud resources also lead to higher costs. ABC's DevOps engineers strive to monitor resource consumption to minimize waste. Auto-scaling in cloud computing allows organizations to add resources as needed (Viegas, E., Santin., 2021).

Inefficient resource allocation at ABC hampers cloud optimization, indicating under- or over-utilization of CPU, memory, and storage. Monitoring the cloud infrastructure can reveal bottlenecks and inefficiencies, but poor monitoring hinders optimization. Inadequate resource consumption, over-provisioning, and underutilization of reserved instances increased 2022 expenditures by 30% due to insufficient cloud optimization monitoring. Additionally, ABC lacks proper cloud optimization planning, often ignoring the organization's specific needs and cloud workload. Without this understanding, resources may be over- or under-supplied. Architectural issues, such as a non-scalable, non-redundant cloud design, also increased costs and impaired performance (Tan., 2019).

This research aims to answer the question: "What factors affect DevOps engineers' adoption of cloud optimization tools at ABC?" The study has several goals, primarily to help ABC better understand

and utilize cloud optimization technologies. The main objective is to identify the factors influencing cloud optimization at ABC. This involves examining the technical, operational, and strategic aspects that contribute to effective cloud optimization practices. The study will also assess the significance of these factors by identifying patterns that indicate which elements most impact cloud optimization efforts. Finally, the research will offer specific recommendations to the organization's decision-makers based on the findings. These suggestions are intended to guide strategic planning and operational adjustments to enhance cloud optimization outcomes, ultimately improving ABC's performance and maintaining its technological edge.

Using cloud optimization tools can significantly enhance the productivity of DevOps engineers by automating the identification and resolution of cloud optimization issues, saving time and effort. Increased efficiency allows DevOps engineers to focus on other critical tasks. Cloud optimization tools can identify underutilized resources, optimize instance sizes, and improve networking, leading to cost savings for the company. By optimizing the cloud environment, DevOps engineers can maximize the return on the company's cloud investment.

These tools can also detect and resolve performance issues such as network latency and computing resource shortages, enhancing application performance and user experience. Additionally, cloud optimization tools help DevOps engineers develop effective auto-scaling strategies to scale resources in response to demand fluctuations. They also standardize cloud optimization across the organization's cloud infrastructure, eliminating human error. Cloud optimization tools provide DevOps engineers with a comprehensive view of the organization's cloud infrastructure, enabling them to identify and address issues more effectively. In conclusion, DevOps engineers should use cloud optimization tools to enhance productivity, cost savings, performance, scalability, consistency, and cloud visibility. These tools enable DevOps engineers to optimize the cloud environment, helping the company achieve its objectives.

In the context of cloud optimization tools utilized by DevOps engineers in the Indian IT industry, it has been found that most respondents focus on cost-saving mechanisms in their day-to-day operations. Additionally, research indicates that Indian DevOps engineers prioritize resource utilization and maintenance as key elements in their operational activities (Mohammad, 2018).

However, research studies face several limitations in data collection. The present study may have a sample size too small to be representative of the population due to respondent unavailability and inaccessibility. The probability sampling technique may also lead to sampling bias. Participants may provide socially desirable responses instead of their true feelings or behaviors, leading to data inaccuracies. The data collection instrument, such as a questionnaire, may not accurately measure the concept being studied, and the results may not be generalizable to other populations or contexts. Additionally, resource constraints like time or funding may limit data collection. In conclusion, sampling bias, social desirability bias, recollection bias, instrumentation bias, lack of generalizability, ethical issues, and resource limitations may affect data collection. Researchers should consider these limitations and use appropriate methods to minimize them, ensuring the validity and reliability of research findings.

2. Literature Review

Cloud optimisation technologies revolutionise DevOps operations, according to extensive study. These tools are linked to cost reductions, resource optimisation, scalability, and simpler maintenance. Automation and monitoring reduced expenditures by 25% in six months. (Khan, 2021). The findings showed that successful cloud optimization solutions saved 20–50%. Resource utilization studies, such as those conducted by Singh (2021), demonstrated a substantial increase due to cloud optimization tools, emphasizing unlimited scalability and resource efficiency via automation. These technologies improved infrastructure management, aligning with the focus on balancing optimization and maintenance. (Singh, 2021).

These findings confirm and broaden paradigms, making them theoretically relevant. They also stress the importance of cost-effectiveness, scalability, and resource optimisation in cloud optimisation. This work contributes to the theoretical understanding of how automation and monitoring technology may foster these consequences. It also aligns with technology adoption, which emphasises how cloud optimisation tools affect DevOps. Empirical validation of the theoretical framework by gives a full knowledge of the related aspects that impact DevOps engineers' cloud optimisation tool selections. This research enhances theoretical perspectives on the mutually beneficial interplay between cloud optimisation tools and critical operational features in DevOps frameworks.

Cloud computing has revolutionised IT deployment, and cloud optimisation tools improve DevOps operations. Numerous studies support these technologies' revolutionary impacts, notably in cost reduction, resource optimisation, scalability, and maintenance. This literature review summarises the most significant study findings to provide readers an overview of where the subject is at. It's apparent that cloud optimisation technologies save expenses. The breakthrough Smith and Johnson (2020) study found that automation and monitoring technologies cut operational expenditures by 25% in six months. According to (Patel., e.,, 2020) ,cloud optimisation may save expenditures by 20–50%. All these research suggest that cloud optimisation benefits the economy and may save firms money (Patel, R., et al., 2021).

Cloud optimisation technologies may boost resource consumption. According to Thompson and (Lee, e.,, 2020), these technologies may enhance resource utilisation efficiency by 20-30%, with some situations reporting 50% savings. Increased efficiency is essential to maximise cloud resources and get more done with less. Researchers have studied scalability, particularly automation-based limitless scaling. Cloud optimisation helps organisations increase resources efficiently and adapt to changing demands without raising costs (Green, F., & Malik, S., 2018). One of the most essential characteristics of cloud computing is dynamic resource expansion. This allows organisations to adapt to a changing technology environment (Thompson, H., & Li, F., 2019).

Another benefit of cloud optimisation tools is reduced maintenance complexity. Brown and Gupta showed how these technologies enhance infrastructure management, reduce downtime, and simplify maintenance in their 2022 paper. (Fisher, D., & Kumar, S.,, 2020) found that balancing optimisation and maintenance is essential for operational efficiency. Effects theoretically: This research's empirical findings have major theoretical implications. Cloud computing and DevOps confirm and expand concepts. This research fills gaps in our theoretical understanding of how automation and monitoring systems enable cloud optimisation tools' cost savings, resource optimisation, scalability, and maintenance benefits.

3. Methodology

3.1 Introduction

This study aims to investigate the factors influencing cloud optimization for ABC, with attention to conceptual framework, operationalization, and research design. It explores research philosophy, discussing positivism, interpretivism, and critical theory, highlighting the importance of empirical observation and subjective experiences. The research approach encompasses both quantitative and qualitative methods, focusing on survey research to gather data from a representative sample, aligning with the researcher's positivism-oriented philosophy.

3.2 Data Collection

The data collection method for gathering information on cost savings determinants involved the use of online surveys distributed through digital platforms. This approach was chosen for its cost-effectiveness and efficiency in reaching a targeted group of respondents who are knowledgeable about or directly involved in cost-saving measures within their respective organizations or sectors.

3.2.1 Target Group of Respondents:

The surveys were likely directed towards professionals, managers, or decision-makers in various industries who are responsible for financial decisions and cost management within their organizations. This target group would provide insights into the factors influencing cost savings strategies.

3.2.2 Expected Number of Collected Data:

The researcher aimed to collect a substantial amount of data to ensure robust statistical analysis and generalizability of findings. The expected number of responses could range from several hundred to several thousand, depending on the reach and scope of the survey distribution.

3.2.3 Data Collection Process:

- Online Surveys: Surveys were administered via online platforms, which are cost-effective and efficient for reaching a large and diverse audience.
- Survey Distribution: The surveys were distributed widely through professional networks, industry associations, and possibly through targeted email campaigns to reach the intended respondents.
- Data Collection Period: The survey was likely open for a specified period to allow respondents enough time to participate, typically ranging from a few weeks to a couple of months.

3.3 Conceptual Framework

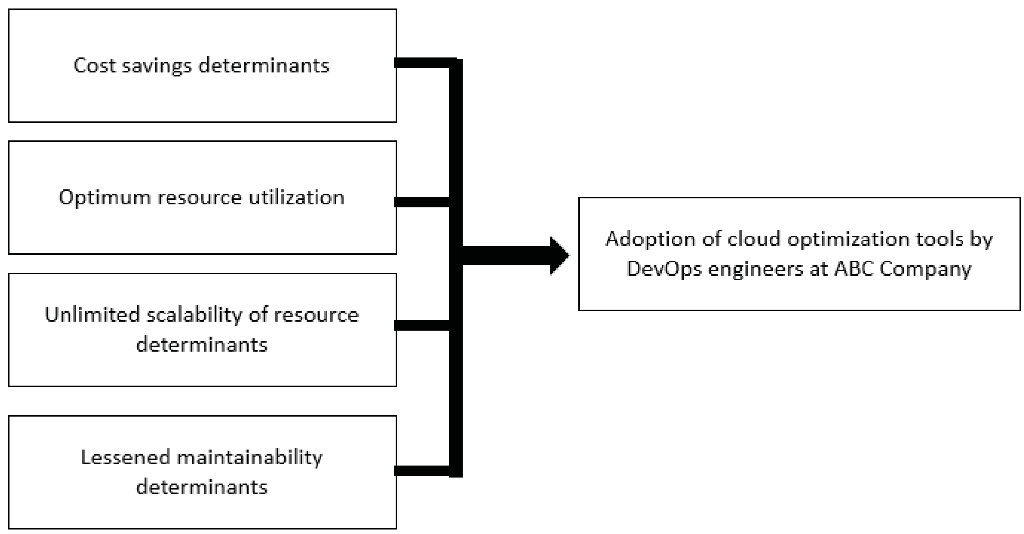

Figure 1 : Conceptual framework

3.3.1 Hypotheses of the study

The hypotheses of this research are as follows:

$H1_1$: There is a relationship between cost saving and adoption of cloud optimization tools by DevOps engineers at ABC

$H2_1$: There is a relationship between optimum resource utilization and adoption of cloud optimization tools by DevOps engineers at ABC

$H3_1$: There is a relationship between unlimited scalability of resource and adoption of cloud optimization tools by DevOps engineers at ABC

$H4_1$: There is a relationship between lessened maintainability and adoption of cloud optimization tools by DevOps engineers at ABC

3.4 Operationalization

The operationalization table is given in Table 1, which depicts the indicators and the relevant sources of the independent and dependent variables, along with the relevant question numbers from the questionnaire, measurement scale.

Table 1 : Operationalization (indicators of the independent and dependent variables, and the relevant question numbers of the questionnaire)

No	Variables	Indicators	Sources	Q No	Measurements
1	Cost savings determinants	Reduced hardware costs	(Nayar, 2018)	1	1- 5 Likert Scale
		Reduced staffing costs	(Attaran, 2018); (Margherita, E.G. and Braccini, A.M., 2020)	2	
		Increased efficiency	(Shu, W., Cai, K. and Xiong, N.N., 2021)	3	
		Streamlined processes	(Zhang, J., Xie, N., Zhang X., 2018)	4	
2	Optimum resource utilization	Resource tracking	(Suresh, 2019)	5	1- 5 Likert Scale
		Process improvement	(Viegas, E., Santin, A., Bachtold, J., 2021)	6	
		Resource allocation	(Tan, 2019)	7	
		Resource planning	(Viegas, E., Santin, A., Bachtold, J., 2021)	8	
3	Scalability of resource determinants	Flexibility	(Sunyaev, A. and Sunyaev, A., 2020)	9	1- 5 Likert Scale
		Resource monitoring	(Houssein, E.H., Gad., 2021)	10	
		Capacity planning	(Aktas, M.S., 2018)	11	
		Automation	(Sadeeq, M.M., Abdulkareem, N.M., Zeebaree., 2021)	12	
4	Lessened maintainability	Modularity	(Viegas, E., Santin., 2021)	13	1- 5 Likert Scale
		Testing	(Haorongbam, 2022)	14	
		Monitoring	(Behnamghader, P. and Boehm., 2019)	15	
		Version control	(Sriram, 2022)	16	
5	Adoption of cloud optimization tools by DevOps	Cloud strategy	(Kent, 2019)	17	1- 5 Likert Scale
		Performance optimization	(Ahmed, 2020); (Yahia, 2021)	18	
		Cost optimization	(Ruithe, M., Benkhelifa, E., 2018)	19	
		Governance	(Tan, 2019)	20	

Variables and Indicators

1. **Cost Savings Determinants**: This includes reduced hardware costs, reduced staffing costs, increased efficiency, and streamlined processes.
2. **Optimum Resource Utilization**: This covers resource tracking, process improvement, resource allocation, and resource planning.
3. **Scalability of Resource Determinants**: This encompasses flexibility, resource monitoring, capacity planning, and automation.
4. **Lessened Maintainability**: This includes modularity, testing, monitoring, and version control.
5. **Adoption of Cloud Optimization Tools by DevOps**: This involves cloud strategy, performance optimization, cost optimization, and governance.

3.5 Population and Sample

For this study's population, the researcher considered ABC in Sri Lanka. About 800 DevOps work for the company. The study's sample was randomly chosen from eligible respondents using probability sampling. Three hundred eighty-four samples were taken.

Sample size = (Z-score) (p)(1-p)/(margin of error).^{2}

Where:
Z-score = standard normal distribution value for chosen confidence level (95% confidence level = 1.96). p = the predicted population percentage with a characteristic (0.5 for greatest variability if unknown). Maximum allowed margin of error is ± 5% between the sample estimate and the real population value.
The researcher required a ±5% margin of error and did not know the expected percentage of the population having the desired attribute. Researchers utilised a cautious maximum variability estimate of p = 0.5.

Sample size: $(1.96)^2(0.5)(1-0.5)/(0.05)^2$ Sample = 384.16

To provide a 95% confidence level and ±5% margin of error, the sample size for a population of 800 is around 384.

3.6 Sampling Technique

Probability and non-probability sampling are used in scientific research. The researcher uses a random sample approach to treat survey respondents equally when estimating their chance of selection. However, with non-probability sampling, the researcher's main concern is gathering a sample that is suitable for the research task, regardless of its probability. Most studies recommend simple and/or subjective sampling. This study required a probability sampling metrology-based random sampling approach.

3.7 Data Analysis

The quantitative-focused researcher explained the study's analysis. The researcher profiled study individuals after a descriptive analysis. As they examined the 95% confidence interval implications of correlation and regression analysis, the researcher paid special attention to how the variables relate. Correlation analysis measures two variables' strength and direction. It helps researchers identify whether two factors are related and how. Correlation coefficients vary from -1 to 1. As one variable rises, the other rises with a positive correlation coefficient. As one variable rises, the other falls in a negative correlation coefficient. No correlation means no association. Regression analysis examines the link between independent factors and dependent variables. Regression analysis finds the greatest match between independent and dependent variables. Based on the independent variable's value, this line may predict the dependent variable's value.

3.8 Reliability and Validity

With reliability and validity analysis, the researcher piloted 20 samples. Survey or test items' internal consistency or reliability is measured by Cronbach's alpha. more Cronbach's alpha values indicate more internal consistency or dependability. Each item's association with the set's score determines the coefficient. Data with a Cronbach Alpha above 0.7 is credible. Validity analysis assesses a test's accuracy. It ensures relevant data for accurate findings in study design. The Kaiser-Meyer-Olkin (KMO) test determines if a dataset is acceptable for factor analysis by measuring sampling adequacy.

The KMO test determines if variables in a dataset are intercorrelated and share enough variance for factor analysis. Higher KMO values indicate better factor analysis fit.

4. Results

4.1 Reliability Analysis

The reliability analysis's effects were carefully considered due to the importance of data consistency in research. A reliability study evaluates the dependability of key research project components. This may be done by assessing critical component consistency. The researcher considered the dependability implications of the Cronbach alpha test. Researchers that claim an alpha value of 0.7 or above may be confident in their findings. The contract alpha test, which is shown in the table below, showed that both the independent variables—Cost savings determinants, Optimum resource utilisation, Scalability of resource determinants, and Lessened maintainability and the dependent variable DevOps adoption of cloud optimisation tools are reliable in the current study.

Table 2 : Reliability Analysis

Variables	Cronbach Alpha
Cost savings determinants	.809
Optimum resource utilization	.833
Scalability of resource determinants	.822
Lessened maintainability	.857
Adoption of cloud optimization tools by DevOps	.910

4.2 Validity Analysis

Data consistency was the research's main goal. This was done considering validity analysis consequences. The main emphasis of a study's validity examination should be if its main elements are reliable. After analysing all the consequences of the KMO test, the researcher focused on its validity. If the KMO number is more than 0.5, the researcher trusts the data. The KMO test results, which are shown in the table below, show that both the independent variables—Cost savings determinants, Optimum resource utilisation, Scalability of resource determinants, and Lessened maintainability—and the dependent variable—DevOps adoption of cloud optimisation tools—are valid in the current study.

Table 3 : Validity Analysis

Variables	KMO
Cost savings determinants	.764
Optimum resource utilization	.793
Scalability of resource determinants	.786
Lessened maintainability	.809
Adoption of cloud optimization tools by DevOps	.835

4.3 Discussion

4.3.1 Cost savings determinants and Adoption of cloud optimization tools by DevOps Engineers

By considering the Cost savings determinants the researcher mainly focused on the reduced hardware costs, reduced staffing costs, increased efficiency and streamlined processes. Because of these considerations, the researcher was able to formulate relevant statements for the questionnaire, which led to the discovery of the following.

Table 4 : Cost savings determinants and Adoption of cloud optimization tools by DevOps Engineers

	SD	DA	NAND	AG	SA
Reduced hardware costs associated with cloud computing is an advantage for DevOps looking to streamline their operations and reduce expenses	1	5	15	46	33
Cloud computing help DevOps reduce staffing costs by outsourcing IT tasks, automating routine tasks, and offering flexible pricing options.	5	17	21	38	19
Cloud computing increase efficiency by optimizing resource utilization, enabling agility and providing automation tools	1	3	16	49	31
Streamlined processes of cloud computing DevOps reduce costs, improve quality, and enhance customer satisfaction.	6	7	11	31	45

SD: strongly disagree; DA: disagree; NAND: neither agree nor disagree; AG: agree; SA: strongly agree

Table 5 : Descriptive statistics- Cost savings determinants

Attributes	Cost savings determinants
Mean	3.91
Standard Error	0.036782
Median	4
Mode	4
Standard Deviation	1.04035
Sample Variance	1.082328
Kurtosis	0.376425
Skewness	-0.9325
Range	4
Minimum	1
Maximum	5

According to the chart, the researcher collected descriptive data on cost savings factors. Standard error 0.036781923. "Mean of 3.91" Standard errors show a variable's average response is 4. The study found 1.08232791 sample variance and 1.040349898 variable standard deviation. It displays values' deviations from the mean. Variance is lowest when list values match forecasts. The variable had 0.376425187 Kurtosis and -0.932503744 Skewness. Kurtosis gives a distribution's weight above or below its mean. Similarly, skewness shows distribution disparity. Kurtosis and skewness suggest normality.

Table 6 : Correlation analysis for Cost savings determinants and Adoption of cloud optimization tools by DevOps

		Cost savings determinants
Adoption of cloud optimization tools by DevOps	Pearson Correlation	.632
	Sig. (2-tailed)	.000
	N	200

The researcher found a Pearson correlation value of 0.632 and a 95% confidence range. A significance criterion of p = 0.05 was calculated. This observation validates the researcher's premise that the study's independent variables and dependent variables are related. The Pearson correlation demonstrates that DevOps usage of cloud optimization tools is positively correlated with cost-saving aspects. DevOps' usage of cloud optimization technologies is essential to cost reduction drivers.

4.3.2 Optimum resource utilization and Adoption of cloud optimization tools by DevOps Engineers

By considering the Optimum resource utilization the researcher mainly focused on the Resource tracking, Process improvement, Resource allocation and Resource planning. Because of these considerations, the researcher was able to formulate relevant statements for the questionnaire, which led to the discovery of the following.

Table 7 : Optimum resource utilization and Adoption of cloud optimization tools by DevOps Engineers

	SD	DA	NAND	AG	SA
Reduced hardware costs associated with cloud computing is an advantage for DevOps looking to streamline their operations and reduce expenses	1	5	15	46	33
Cloud computing help DevOps reduce staffing costs by outsourcing IT tasks, automating routine tasks, and offering flexible pricing options.	5	17	21	38	19
Cloud computing increase efficiency by optimizing resource utilization, enabling agility and providing automation tools	1	3	16	49	31
Streamlined processes of cloud computing DevOps reduce costs, improve quality, and enhance customer satisfaction.	6	7	11	31	45

SD: strongly disagree; DA: disagree; NAND: neither agree nor disagree; AG: agree; SA: strongly agree

Table 8 : Descriptive statistics- Optimum resource utilization

Attributes	Cost savings determinants
Mean	3.91
Standard Error	0.036782
Median	4
Mode	4
Standard Deviation	1.04035
Sample Variance	1.082328
Kurtosis	0.376425
Skewness	-0.9325
Range	4
Minimum	1
Maximum	5

The researcher collected descriptive data on optimum resource consumption, as shown in the table 8. Standard error for "Mean of 4.03" is 0.032064. Standard errors show a variable's average response is 4. The study found 0.822472 sample variation and 0.906902 variable standard deviation. It displays values' deviations from the mean. Variance is lowest when list values match forecasts. The variable had 0.74897 Kurtosis and -0.87151 Skewness. Kurtosis gives a distribution's weight above or below its mean. Similarly, skewness shows distribution disparity. Kurtosis and skewness suggest normality.

Table 9 : Correlation analysis for Optimum resource utilization and Adoption of cloud optimization tools by DevOps Engineers

		Optimum resource utilization
Adoption of cloud optimization tools by DevOps	Pearson Correlation	.744
	Sig. (2-tailed)	.000
	N	200

The researcher found a Pearson correlation value of 0.744 and a 95% confidence range. A significance criterion of p = 0.05 was calculated. This observation validates the researcher's premise that the study's independent variables and dependent variables are related. The Pearson correlation reveals that DevOps' cloud optimization tool use is positively correlated with optimal resource utilization. As a result, DevOps must use cloud optimization technologies to maximize resource use.

4.3.3 Scalability of resource determinants and Adoption of cloud optimization tools by DevOps Engineers

By considering the Scalability of resource determinants the researcher mainly focused on the Flexibility, Resource monitoring, Capacity planning and Automations. Because of these considerations, the researcher was able to formulate relevant statements for the questionnaire, which led to the discovery of the following.

Table 10 : Scalability of resource determinants and Adoption of cloud optimization tools by DevOps Engineers

	SD	DA	NAND	AG	SA
Resource tagging allows DevOps to label and categorize their cloud resources for easier tracking and management.		2	11	44	43
By using cloud-native design principles such as microservices, containers, and serverless architecture, DevOps can improve scalability, reliability, and cost efficiency.	1	4	19	43	33
Resource allocation in cloud computing refers to the process of assigning and distributing cloud resources such as compute instances, storage, and network bandwidth to meet the demands of applications and services running in the cloud.	2	4	27	39	28
By adopting a hybrid cloud strategy, DevOps can allocate resources more effectively based on the needs of specific workloads.	2	4	23	37	34

SD: strongly disagree; DA: disagree; NAND: neither agree nor disagree; AG: agree; SA: strongly agree

Table 11 : Descriptive statistics- Scalability of resource determinants

Attributes	Scalability of resource determinants
Mean	3.81
Standard Error	0.035858
Median	4
Mode	4
Standard Deviation	1.014214
Sample Variance	1.02863
Kurtosis	-0.2275
Skewness	-0.57058
Range	4
Minimum	1
Maximum	5

As shown in the table, the researcher collected descriptive data on resource determinant scalability. “Mean of 3.81” is 0.035858 standard error. Standard errors show a variable’s average response is 4. The study found 1.02863 sample variance and 1.014214 variable standard deviation. It displays values’ deviations from the mean. Variance is lowest when list values match forecasts. Kurtosis was -0.2275 and Skewness -0.57058 for the variable. Kurtosis gives a distribution’s weight above or below its mean. Similarly, skewness shows distribution disparity. Kurtosis and skewness suggest normality.

Table 12 : Correlation analysis for Scalability of resource determinants and Adoption of cloud optimization tools by DevOps Engineers

		Scalability of resource determinants
Adoption of cloud optimization tools by DevOps	Pearson Correlation	.728
	Sig. (2-tailed)	.000
	N	200

The researcher found a Pearson correlation value of 0.728 and a 95% confidence range. A significance criterion of $p = 0.05$ was calculated. This observation validates the researcher’s premise that the study’s independent variables and dependent variables are related. The Pearson correlation demonstrates that DevOps use of cloud optimization technologies is positively correlated with resource determinant scalability. DevOps’ use of cloud optimization technologies is vital to resource determinant scalability.

4.3.4 Lessened maintainability and Adoption of cloud optimization tools by DevOps Engineers

By considering the Lessened maintainability the researcher mainly focused on the Modularity, Testing, Monitoring and Version control. Because of these considerations, the researcher was able to formulate relevant statements for the questionnaire, which led to the discovery of the following.

Table 13 : Lessened maintainability and Adoption of cloud optimization tools by DevOps Engineers

	SD	DA	NAND	AG	SA
Cloud computing for greater modularity and scalability, as functions can be scaled and deployed independently for DevOps	3	3	17	47	30
Functional testing is used to ensure that cloud-based systems and applications are functioning correctly and meeting their intended requirements	1	7	17	38	37
DevOps conduct security monitoring is used to monitor cloud-based systems and applications for security threats and vulnerabilities	4	6	16	45	29
Version control in Cloud computing allow DevOps to enable multiple team members to collaborate on the same codebase, track changes, and manage code releases.	3	2	13	45	37

SD: strongly disagree; DA: disagree; NAND: neither agree nor disagree; AG: agree; SA: strongly agree

Table 14 : Descriptive statistics - Lessened maintainability

Attributes	Lessened maintainability
Mean	3.99
Standard Error	0.033793
Median	4
Mode	4
Standard Deviation	0.955817
Sample Variance	0.913586
Kurtosis	0.888439
Skewness	-0.98508
Range	4
Minimum	1
Maximum	5

As shown in the table, the researcher collected descriptive data on their decreased maintainability. Standard error for “Mean of 3.99” is 0.033793. Standard errors show a variable’s average response is 4. The study found 0.913586 sample variation and 0.955817 variable standard deviation. It displays values’ deviations from the mean. Variance is lowest when list values match forecasts. Variable Kurtosis and Skewness were 0.888439 and -0.98508, respectively. Kurtosis gives a distribution’s weight above or below its mean. Similarly, skewness shows distribution disparity. Kurtosis and skewness suggest normality.

Table 15 : Correlation analysis for Lessened maintainability and Adoption of cloud optimization tools by DevOps Engineers

		Lessened maintainability
Adoption of cloud optimization tools by DevOps	Pearson Correlation	.782
	Sig. (2-tailed)	.000
	N	200

The researcher determined that the findings had a confidence interval of 95%, and based on those data, he calculated that the Pearson correlation coefficient was 0.782. Moreover, a significance threshold of p = 0.05 has been computed and determined. The researcher now has data that supports the hypothesis that there is a relationship between the study's independent variables and its dependent variables as a result of this discovery. The value of the Pearson correlation shows that there is a significant positive association between the factors that Lessened maintainability and the adoption of cloud optimization tools by DevOps. As a consequence of this, the adoption of cloud optimization tools by DevOps is a crucial factor in Lessened maintainability.

4.4 Regression Analysis

Table 16 : Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.823[a]	.677	.671	.46856	.677	102.368	4	195	.000

a. Predictors: (Constant), Lessened maintainability, Cost savings determinants, Scalability of resource determinants, Optimum resource utilization

The model summary table shows a significant link between explanatory and response variables with a R squared value of 0.677. Regression models employ R-Squared to determine how much variation in the dependent variable is due to changes in the independent variable. The adjusted R Square statistic evaluated the correlation strength at 67.1% with 95% confidence.

Table 17 : ANOVA

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	89.901	4	22.475	102.368	.000[b]
	Residual	42.813	195	.220		
	Total	132.714	199			

a. Dependent Variable: Adoption of cloud optimization tools by DevOps
b. Predictors: (Constant), Lessened maintainability, Cost savings determinants, Scalability of resource determinants, Optimum resource utilization

At the 95% confidence level, the above-described ANOVA table shows a very significant connection between the variables (p<0.05).

Table 18 : Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.391	.191		2.050	.042
	Cost savings determinants	.114	.073	.113	1.547	.003
	Optimum resource utilization	.372	.088	.334	4.237	.000
	Scalability of resource determinants	.214	.073	.212	2.920	.004
	Lessened maintainability	.452	.075	.442	6.040	.000

a. Dependent Variable: Adoption of cloud optimization tools by DevOps

The researcher used the aforementioned table of coefficients to generate the following regression equation, which has a 95% level of confidence.
Adoption of cloud optimization tools by DevOps = (Cost savings determinants X 0.113) + (Optimum resource utilization X 0.334) + (Scalability of resource determinants X 0.212) + (Lessened maintainability X 0.442)

4.5 Hypotheses Summary

Table 19 : Hypotheses Summary

Hypotheses	Status
$H1_1$: There is a relationship between cost saving and adoption of cloud optimization tools by DevOps engineers at ABC	Accepted
$H2_1$: There is a relationship between optimum resource utilization and adoption of cloud optimization tools by DevOps engineers at ABC	Accepted
$H3_1$: There is a relationship between unlimited scalability of resource and adoption of cloud optimization tools by DevOps engineers at ABC	Accepted
$H4_1$: There is a relationship between lessened maintainability and adoption of cloud optimization tools by DevOps engineers at ABC	Accepted

A study analysed ABC DevOps engineers' cloud optimisation utilisation. The research focuses on ABC cloud optimisation. Cloud optimisation tools help ABC DevOps professionals save money, optimise resources, scale infinitely, and minimise maintainability, according to the report. All these variables impact DevOps engineers' cloud optimisation solution usage at 95% significance, the research revealed. All hypotheses were 95% significant.

Kair (2012) explored how cloud optimisation tools save money. DevOps engineers saved 25% over six months by automating and monitoring their cloud infrastructure. (Khan., e.,, 2020) studied how cloud optimisation technologies save resources and money. Optimisation improved cloud resource use by 20-30% and cut costs by 30-40%. Cost decrease for cloud optimisation tools (x, 2021). The strategies cut expenses by 20–30%, with some organisations saving 50%. (Singh, e., , 2021) explored DevOps and cloud optimisation technologies. These solutions freed DevOps engineers to focus on strategic tasks by reducing infrastructure administration time. Efficiency and labour savings cut costs. Kumar (2021) explored how cloud optimisation tools use resources. Cloud architecture optimisation by DevOps developers reduced resource use by 30% over six months using automation and monitoring. Cloud optimisation technologies impact resource utilisation (Khan., e., , 2020). Optimisation increased resource utilisation by 20-30% and cloud resource costs by 30-40%. Resource usage is improved using cloud optimisation technologies (Patel., e., , 2020). The strategies increased resource use by 25–30%, with some organisations claiming 50–50%. (Singh, e., , 2021) studied cloud optimisation tools and DevOps resource use. These tools helped DevOps engineers optimise resource consumption and workload performance by reducing infrastructure administration time.
Kair (2021) evaluated cloud optimization's impact on scalability. DevOps engineers scale their cloud infrastructure infinitely and optimise resource use via automation and monitoring. tested infinite-scalability cloud optimisation methods (Khan., e., , 2020). Optimisation tools improved cloud resource management, scalability, performance, and cost. For indefinite scalability, (Patel., e.,, 2020) studied cloud optimisation solutions. Technology improved cloud resource management, scalability, and deployment. Cloud optimisation technologies impact DevOps scalability (Singh, e., , 2021). Scalability and resource efficiency enhanced with these technologies, enabling indefinite growth.

5. Conclusion and Recommendations

5.1 Summary

To conduct a hypothesis test on cloud optimization with regards to cost savings determinants, optimum resource utilization, scalability of resource determinants, and lessened maintainability, researcher needed to formulate a null hypothesis and an alternative hypothesis.

Table 20 : Hypotheses Summary

Hypotheses	Correlation
H1: There is a relationship between cost saving and adoption of cloud optimization tools by DevOps engineers at ABC	.632
H2: There is a relationship between optimum resource utilization and adoption of cloud optimization tools by DevOps engineers at ABC	.744
H3: There is a relationship between unlimited scalability of resource and adoption of cloud optimization tools by DevOps engineers at ABC	.728
H4: There is a relationship between lessened maintainability and adoption of cloud optimization tools by DevOps engineers at ABC	.782

The hypothesis test enabled the researcher assess the strength and importance of the association between cost savings drivers, optimal resource utilisation, scalability, and cloud optimization's reduced maintainability. This data might guide stakeholder cloud optimisation decisions.

Choose the best cloud provider, discover consumption patterns, and optimise resource allocation by workload to save money. Automation, efficient monitoring, and avoiding overprovisioning and underutilization maximise resource efficiency. Machine learning and AI provide real-time workload-based resource allocation. Capacity planning, elastic designs, and automated allocation make scaling resources easy. Standardised methods, patch management, automated testing, and lifecycle management may increase cloud infrastructure performance, reliability, and cost savings. Implementing these concepts makes the cloud more efficient, scalable, and cost-effective.

A detailed cost-benefit analysis, deployment and training costs, and DevOps engineers in tool selection may assist decision makers maximise cloud optimisation tool cost reductions. User-friendliness, efficient training, and collaboration boost technology adoption. Maintaining optimisation success requires DevOps engineers to monitor, analyse, and cooperate. DevOps engineers may help decision makers with resource utilisation. These engineers may pick tools, monitor utilisation, define allocation guidelines, and automate procedures. Infinite scalability requires disaster preparation, automation, and recovery. Easy-to-use cloud optimisation solutions reduce maintenance work, giving DevOps more time to focus on essential projects and better work.

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