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Understanding and Reducing Cloud Resource Waste in Beginner Software Projects: A Practical Study Using AWS

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Abstract - *Cloud computing allows students and developers to access computing resources without purchasing physical infrastructure. However, resources that remain active without being used, oversized virtual machines, unused storage volumes, and forgotten services can lead to unnecessary expenditure. This study examines the causes of cloud resource waste in beginner software projects and identifies practical methods for reducing it using Amazon Web Services (AWS). The research follows a descriptive and analytical approach based on secondary data from published cloud-industry reports, AWS documentation, and academic literature. Flexera's 2026 State of the Cloud Report estimates that 29% of cloud spend is wasted and reports that 85% of respondents consider cloud-cost management a major challenge [1]. A hypothetical 30-day EC2 usage example demonstrates how scheduling a development instance for four hours per day instead of leaving it running continuously can reduce its running time by 83.33%. The study proposes a beginner-friendly framework based on planning, monitoring, scheduling, reviewing, and deleting unnecessary resources. The findings are based on secondary sources and illustrative calculations, not a live AWS experiment.*

Keywords: Cloud Computing, AWS, Resource Waste, Cost Optimization, Amazon EC2, Secondary Data, Cloud Resource Management.

1. INTRODUCTION

Cloud computing provides on-demand access to computing power, storage, databases, and other IT services through the internet. It enables students and developers to build and test applications without investing in physical servers. Amazon Web Services (AWS) offers services such as Amazon EC2 for virtual computing, Amazon EBS for block storage, and Amazon S3 for object storage.

Although cloud computing offers flexibility, it does not automatically guarantee efficient resource usage. A virtual machine may continue running after a practical session has ended, storage volumes may remain after a project is completed, and resources may be larger than the application requires. These situations can increase expenditure without providing additional value.

Flexera's 2026 report identifies cloud-cost management as a major challenge for 85% of surveyed respondents and estimates wasted cloud spend at 29% [1]. These are industry-wide findings, not measurements of student projects, but they demonstrate why resource efficiency is an important cloud-computing topic.

2. PROBLEM STATEMENT

Beginner developers may create cloud resources for learning, testing, or demonstration and forget to stop or remove them when they are no longer required. Unused storage, continuously running instances, oversized resources, and unreviewed services can create avoidable costs. This study examines common sources of waste and proposes practical steps for beginner AWS projects.

3. OBJECTIVES OF THE STUDY

1. To identify common causes of cloud resource waste in beginner software projects.
2. To review secondary data on cloud-cost management and resource optimization.
3. To explain how AWS services such as EC2, EBS, and S3 can contribute to resource waste.
4. To demonstrate the effect of scheduled instance usage through a hypothetical calculation.

5. To propose a simple framework for improving resource utilization and cost awareness.

4. RESEARCH METHODOLOGY

The study uses a descriptive and analytical research design. Secondary data are drawn from Flexera's 2026 State of the Cloud Report, the FinOps Foundation's State of FinOps Report 2025, AWS documentation, and academic literature on cloud resource management. The information is reviewed thematically, focusing on compute scheduling, storage management, resource sizing, and cost monitoring. The EC2 example is hypothetical; no questionnaire, live AWS deployment, or primary billing data were used. The findings should therefore be interpreted as secondary-data analysis and illustration, not as experimental results.

5. REVIEW OF LITERATURE

Flexera's 2026 State of the Cloud Report estimates that 29% of cloud spend is wasted and reports that 85% of respondents identify cloud-cost management as a major challenge [1]. The statistics describe organizations broadly and should not be treated as the waste rate for student projects.

The FinOps Foundation's 2025 report identifies workload optimization and waste reduction as important priorities among FinOps practitioners [2]. AWS cost-optimization guidance discusses opportunities such as reviewing low-utilization compute resources and underutilized storage [3]. Manvi and Shyam surveyed resource-management approaches for Infrastructure as a Service (IaaS), while Vakili Fard and colleagues reviewed resource-allocation mechanisms in cloud computing [4], [5]. Together, these sources highlight the importance of matching resources to workload needs and monitoring usage.

6. COMMON SOURCES OF CLOUD RESOURCE WASTE

Source	Beginner-project example	Suggested control
Continuously running EC2	Development server remains on overnight	Stop it when not needed
Oversized instance	Small app uses more capacity than required	Review utilization and instance size
Unused EBS volume	Storage remains after project cleanup	Confirm data needs, then remove if safe
Unnecessary S3 files	Old test files are retained	Review files and lifecycle policies
Forgotten services	Resources remain after demonstration	Use a cleanup checklist
No cost monitoring	Spending goes unnoticed	Review billing and configure alerts

Source: Synthesized from AWS cost-optimization guidance [3]. Examples are illustrative, not measured frequencies.

Stopping an EC2 instance does not necessarily remove all charges: associated storage and other billable resources may continue to incur costs. Compute and storage therefore need separate review.

7. SECONDARY DATA ANALYSIS

7.1 Industry evidence on cloud waste

Flexera's 2026 report estimates that 29% of cloud spend is wasted [1]. Figure 1 presents this estimate as a proportion of total spend. The 71% remainder is calculated as the complement of the estimate and is not an independently measured category of fully optimized spending.

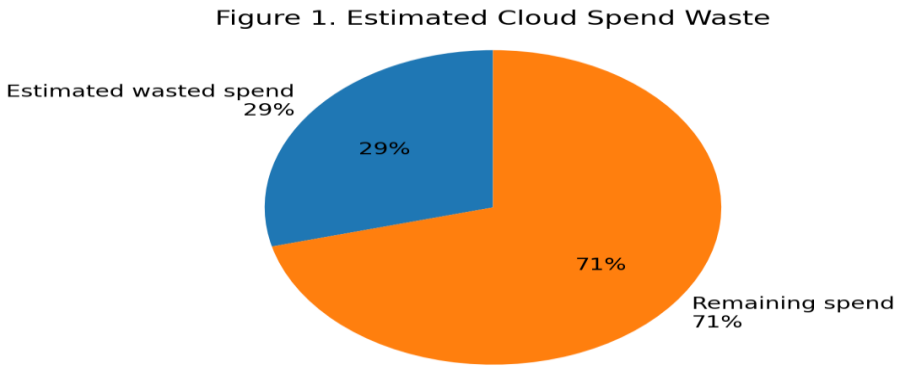

Figure 1. Estimated cloud spend waste. Source: Flexera [1]; the 71% remainder is calculated as 100% − 29%.

The same report finds that 85% of respondents identify managing cloud spend as a major challenge [1]. These industry findings reinforce the need for visibility, monitoring, and regular resource review, but they do not measure student projects specifically.

7.2 Importance of optimization

The FinOps Foundation's 2025 survey identifies workload optimization and waste reduction as leading priorities among FinOps practitioners [2]. These findings suggest that cost awareness should be built into cloud development workflows. Beginners can start with simple practices such as checking active instances, reviewing storage, monitoring billing, and removing unnecessary resources.

8. PRACTICAL AWS CASE STUDY: EC2 RUNNING-TIME REDUCTION

8.1 Scenario and calculation

Consider a hypothetical student developing a small web application on one EC2 instance for four hours per day across 30 days. Scenario A leaves the instance running continuously; Scenario B stops it after four hours of use.

Scenario A: 30 × 24 = 720 running hours per month.

Scenario B: 30 × 4 = 120 running hours per month.

Running hours avoided: 720 − 120 = 600 hours.

Percentage reduction: (600 ÷ 720) × 100 = 83.33%.

Measure	Scenario A	Scenario B
Hours per day	24	4
Days per month	30	30
Monthly running hours	720	120
Running hours avoided	—	600
Reduction in running hours	—	83.33%

Figure 2 presents the scheduled-use scenario as 120 hours of planned running time and 600 hours stopped. These values are hypothetical, not published survey data or records from an actual AWS account.

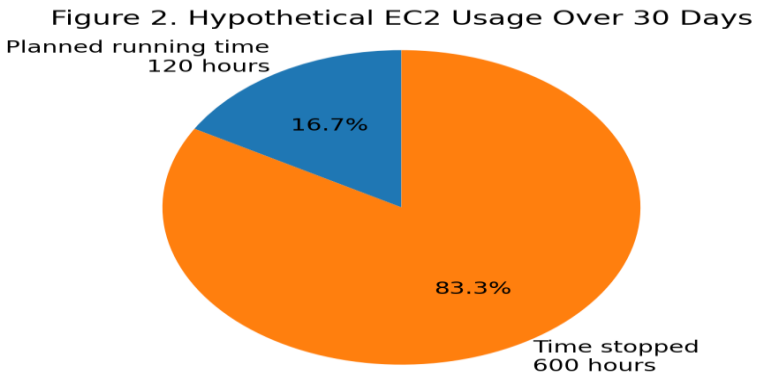

Figure 2. Hypothetical EC2 usage over 30 days. Source: Author's calculation based on the scenario described in Section 8.

This example shows that scheduling can reduce running time when a server is needed only for a limited period. Actual savings depend on instance type, AWS Region, pricing model, attached storage, data transfer, and other services. No specific monetary saving is claimed; the AWS Pricing Calculator can be used to estimate costs [6].

9. PROPOSED RESOURCE-MANAGEMENT FRAMEWORK

6. **Plan.** Identify the resources required before creating them and begin with the minimum configuration that meets the application's needs.
7. **Monitor.** Review running instances, storage volumes, and other active resources regularly; check billing and monitoring tools.
8. **Schedule.** Stop development resources when they are not needed, after checking that no background tasks require continuous availability.
9. **Review and optimize.** Check whether compute capacity matches the workload and review storage for obsolete resources.
10. **Clean up.** At the end of a session or project, remove unnecessary resources while preserving required data and backups.

10. RESULTS AND DISCUSSION

The secondary evidence shows that cloud-cost management remains a significant industry concern. Flexera's estimate of 29% wasted cloud spend and its finding that 85% of respondents identify cloud-cost management as a challenge provide context for the issue [1]. The hypothetical EC2 calculation shows that reducing planned running time from 24 hours to four hours per day decreases monthly running time by 83.33%, under the stated assumptions. This is a reduction in running hours, not a guaranteed reduction in the same proportion of the total bill.

The analysis suggests three lessons: beginners should understand billing implications before creating resources; monitoring and scheduling should be part of development; and compute optimization should be accompanied by storage and service cleanup. The charts communicate published industry estimates and a separate illustrative calculation. They do not prove that beginner projects waste 29% of their budgets or that every student will achieve the same reduction.

11. RECOMMENDATIONS

11. Estimate resource requirements before launching an AWS service.
12. Stop development and testing instances when they are not required.
13. Review storage resources separately from compute resources.
14. Check billing information and configure suitable budget alerts where available.
15. Maintain a checklist of resources created during development.
16. Use the AWS Pricing Calculator to estimate costs before deployment.
17. Test the proposed framework in future research using actual student-project usage records.

12. LIMITATIONS AND FUTURE SCOPE

This study relies on secondary sources and a hypothetical EC2 example. It does not include primary survey responses, live AWS billing data, or experimental measurements. Industry-wide statistics may not represent students or the costs of beginner projects. Future research could deploy a small AWS application, collect usage and billing data over a defined period, and compare costs before and after scheduling and cleanup practices.

13. CONCLUSION

Cloud resource waste is important because resources can remain active or stored when they provide little project value. This study reviewed published industry reports, AWS guidance, and academic literature to identify common causes of waste and practical prevention methods. The secondary data show that cloud-cost management and optimization remain significant concerns. The hypothetical EC2 example illustrates that scheduling an instance for four hours per day rather than leaving it running continuously can reduce monthly running time by 83.33% under the stated assumptions. A framework based on planning, monitoring, scheduling, reviewing, and cleanup can help beginners develop responsible cloud practices. Further research should validate these recommendations using actual AWS usage and billing records.

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