

Hardware Requirements Analysis for Administrative Staff in Higher Education

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ABSTRACT

The use of computer hardware that does not match workload requirements remains a common issue in higher education administrative activities, leading to reduced efficiency and productivity. This study aims to analyze hardware requirements for administrative staff at the Faculty of Psychology, Business, and Technology, Universitas Yayasan Pendidikan Imam Bonjol Majalengka, and to propose optimal hardware specifications. A case study approach was employed by evaluating three devices used by three staff members through observation and system performance assessment. The main contribution of this study lies in providing a workload-based hardware analysis supported by simple performance benchmarking to demonstrate the impact of hardware upgrades. The results indicate that existing systems, equipped with older mid-range processors, 4–8 GB RAM, and HDD storage, are insufficient to support multitasking and data processing efficiently. Performance testing shows that data input processing time, initially ranging from 10–12 minutes, can be reduced to 4–6 minutes using the recommended specifications. This represents an efficiency improvement of approximately 50–60% and a significant reduction in system latency. Therefore, this study offers a more measurable and evidence-based approach to hardware planning compared to conventional descriptive methods.

1. INTRODUCTION

The rapid advancement of information technology has significantly transformed administrative activities in higher education institutions [1]. Computer systems play a crucial role in supporting daily operations such as academic data management, financial processing, and document administration [2], [3]. The effectiveness of these activities is highly dependent on the performance of hardware components, including processors, memory, and storage subsystems [4]. However, in many cases, hardware procurement is not based on actual workload requirements, resulting in suboptimal system performance and reduced work efficiency [5].

A common issue in administrative environments is the mismatch between hardware specifications and job demands [6]. Administrative staff are often required to perform multitasking activities, such as managing large datasets, accessing web-based information systems, and generating reports simultaneously [7]. When hardware resources are insufficient, system bottlenecks occur, particularly in memory and storage subsystems, leading to increased processing time and decreased productivity [8], [9]. The use of

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conventional storage devices such as *Hard Disk Drives (HDD)* further exacerbates this issue due to slower data access compared to modern *Solid State Drives (SSD)* [10].

Previous studies have demonstrated that upgrading key hardware components, such as RAM and storage devices, can significantly improve system performance and reduce execution time [11]. Research on modern computing systems also highlights the importance of balancing processing power and memory capacity to avoid performance degradation caused by bottlenecks [12]. However, most existing studies focus on general system performance evaluation or controlled experimental environments, with limited attention to real-world administrative workloads in higher education settings. Furthermore, many studies lack practical performance measurements that directly reflect user experience in completing daily tasks.

To address these gaps, this study proposes a workload-based hardware requirement analysis for administrative staff in higher education. The approach integrates qualitative workload assessment with simple performance benchmarking to evaluate the suitability of existing hardware and to quantify the impact of recommended upgrades. By measuring execution time for specific administrative tasks before and after hardware improvements, this study provides a practical evaluation framework that reflects real working conditions.

This research is conducted as a case study at Universitas Yayasan Pendidikan Imam Bonjol Majalengka, involving three administrative staff members with different workload characteristics. Although the analysis is based on a specific institutional context, the findings are expected to represent common challenges faced by administrative staff in higher education environments. The main contribution of this study lies in providing a structured and measurable approach to hardware planning, combining workload analysis, bottleneck identification, and empirical performance evaluation. This approach offers a more practical and evidence-based alternative compared to conventional descriptive methods, thereby supporting better decision-making in hardware procurement and system optimization.

2. METHOD

This study employs a case study approach to analyze hardware requirements based on the workload of administrative staff in higher education. The case study method is appropriate for capturing real-world conditions and evaluating the relationship between job activities and hardware performance. The research involves three administrative staff members at Universitas YPIB Majalengka, each using a separate computing device.

The overall research design consists of four main stages: workload identification, hardware evaluation, bottleneck analysis, and performance benchmarking. The flow of the research design is illustrated in Figure 1, which shows how each stage is interconnected in producing the final hardware recommendation.

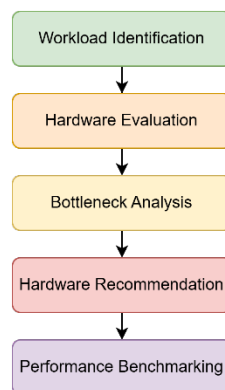


Figure 1. Research design framework

As illustrated in Figure 1, the research design framework consists of several interconnected stages that systematically lead to the formulation of hardware recommendations and performance evaluation.

2.1. Workload Identification

This stage focuses on identifying the daily activities performed by administrative staff. The analysis includes the type of tasks, frequency of execution, and computational intensity required. Activities such as data entry, document processing, and system access are examined to determine their impact on system performance. This stage provides the foundation for understanding the actual hardware requirements.

2.2. Hardware Evaluation

In this stage, the existing hardware specifications used by each administrative staff member are collected and analyzed. Key components such as the processor, memory (RAM), and storage type are evaluated to determine their capability in supporting the identified workload. This evaluation helps to establish the baseline condition of the system and provides a reference for further performance analysis.

2.3. Bottleneck Analysis

After comparing workload requirements with existing hardware capabilities, a bottleneck analysis is conducted to identify components that limit system performance. Bottlenecks occur when certain hardware resources are unable to meet computational demands, resulting in delays, system lag, and reduced efficiency during task execution.

2.4. Hardware Recommendation

Based on the bottleneck analysis, a cost-effective hardware upgrade strategy is proposed to improve system performance without requiring a complete system replacement. The recommendation prioritizes upgrading critical components that directly impact performance, particularly memory (RAM) and storage, while maintaining the existing processor where possible to minimize cost.

2.5. Performance Benchmarking

The final stage of this study involves evaluating system performance through benchmarking to measure the effectiveness of the proposed cost-efficient hardware upgrade. The benchmarking process focuses on comparing task execution time before and after upgrading key components, specifically RAM and storage (HDD to SSD), while retaining the existing processor.

3. RESULTS AND DISCUSSION

This section presents the findings obtained from the workload analysis, hardware evaluation, bottleneck identification, hardware recommendation, and performance benchmarking stages. The discussion is conducted systematically to illustrate the relationship between administrative workloads, existing hardware conditions, and the effectiveness of the proposed upgrade strategy. The results are analyzed to determine how hardware optimization can improve operational efficiency in higher education administrative environments.

3.1. Workload Identification

The first stage of the analysis focuses on identifying the workload characteristics of administrative staff. Understanding workload patterns is essential because different job activities require different levels of computational resources. Through interviews and direct observations, data were collected regarding daily activities, software usage, task frequency, and computational intensity. The results of the workload identification process are presented in Table 1.

Table 1. Workload identification

| Staff | Activity | Software used | Frequency | Computational Load |
|-------|-------------------------|------------------|-----------|--------------------|
| A | Financial data input | Microsoft Excel | Daily | High |
| A | Report generation | Excel, PDF Tools | Weekly | Medium |
| B | Academic administration | Web-based system | Daily | High |

| | | | | |
|-----|---------------------|-----------------|--------|--------|
| B | Data validation | Microsoft Excel | Daily | Medium |
| ... | ... | ... | ... | ... |
| C | Document processing | Microsoft Word | Daily | Low |
| C | Data archiving | File system | Weekly | Low |

As shown in Table 1, administrative staff perform tasks with varying computational requirements. Activities involving financial data processing and academic administration exhibit high computational loads due to the use of large datasets and continuous interaction with web-based systems. These tasks frequently involve multitasking operations, including switching between applications and processing multiple files simultaneously.

In contrast, document processing and data archiving require lower computational resources because they generally involve smaller file sizes and less intensive operations. However, despite their lower workload intensity, these tasks may still experience performance degradation when supported by slow storage systems.

The findings indicate that workload characteristics significantly influence hardware requirements. Tasks performed daily with high computational demands require more responsive hardware configurations to maintain operational efficiency. Based on these workload characteristics, the next stage evaluates whether the existing hardware specifications are capable of supporting the identified tasks effectively.

3.2. Hardware Evaluation

After identifying the workload characteristics, the next stage evaluates the hardware currently used by administrative staff. This evaluation aims to determine the extent to which the existing devices are capable of supporting the identified computational demands. The analysis focuses on key hardware components, including processors, memory capacity, and storage technology. The results of the hardware evaluation are summarized in Table 2.

Table 2. Existing hardware specifications

| Staff | Processor | RAM | Storage | Device Age | Performance Condition |
|-------|---------------------|------|----------|------------|-----------------------|
| A | Intel Core i3 Gen 7 | 4 GB | HDD 1 TB | 5 years | Slow performance |
| B | Intel Core i3 Gen 8 | 4 GB | HDD 1 TB | 4 years | Frequent lag |
| C | Intel Core i3 Gen 7 | 8 GB | HDD 1 TB | 5 years | Moderate |

The data in Table 2 show that all devices rely on conventional HDD storage and utilize mid-range processors from older generations. While the processors are still capable of handling basic administrative tasks, the limited RAM capacity and slow storage performance significantly reduce system responsiveness.

Staff A and Staff B experience the most noticeable performance issues due to the use of only 4 GB RAM, which limits multitasking capability and causes system lag during intensive operations. Staff C demonstrates relatively better performance because of higher memory capacity; however, the use of HDD storage still results in delays during file access and application loading.

In addition, the age of the devices contributes to performance degradation, as older hardware architectures are generally less efficient when handling modern software workloads. These findings indicate that the current hardware configurations are not fully aligned with the workload demands identified in the previous stage. Therefore, a bottleneck analysis is required to determine the specific components responsible for the observed performance limitations.

3.3. Bottleneck Analysis

Following the hardware evaluation stage, bottleneck analysis is conducted to identify the specific components that limit system performance. This stage is important because understanding the exact source of performance degradation enables more targeted and cost-efficient hardware improvements. The results of the bottleneck identification process are presented in Table 3.

Table 3. Bottleneck identification

| Staff | Activity | Observed Issue | Bottleneck Component |
|-------|------------------------|-----------------------------|----------------------|
| A | Financial data input | Slow processing, system lag | CPU, RAM |
| B | Academic system access | Long loading time | Storage (HDD), RAM |

| | | | |
|-----|---------------|------------------------------|---------------|
| ... | ... | ... | ... |
| C | File handling | Delay in opening large files | Storage (HDD) |

As presented in Table 3, the major bottlenecks are concentrated in RAM capacity and storage performance. Insufficient memory resources reduce the system’s ability to handle multiple applications simultaneously, resulting in lag and slower task execution. Meanwhile, HDD storage introduces high data access latency, particularly when opening large files or loading applications.

Although the processors are not the primary source of performance issues, they become secondary bottlenecks when combined with insufficient memory resources. These findings confirm that improving memory and storage components would provide the most efficient approach for enhancing overall system performance.

Based on the identified bottlenecks, the next stage proposes a cost-efficient hardware upgrade strategy aimed at improving performance without requiring a complete system replacement.

3.4. Hardware Recommendation

After identifying the main performance bottlenecks, a hardware upgrade strategy is proposed to improve system responsiveness and operational efficiency. The recommendation is designed using a value-for-money approach, where performance improvements are prioritized while keeping upgrade costs relatively affordable. The proposed hardware recommendations are shown in Table 4.

Table 4. Recommended Hardware Specifications and Cost-Efficient Upgrade

| Component | Current Specification | Recommended Upgrade | Justification | Estimated Price (IDR) |
|------------|-----------------------|------------------------------------|---|-----------------------|
| Processor | Intel i3 Gen 7/8 | Retained | Still adequate for administrative tasks | - |
| RAM | 4–8 GB | 8–16 GB | Improves multitasking performance | 400,000 – 800,000 |
| Storage | HDD 1 TB | SSD 512 GB | Significantly faster data access | 700,000 – 900,000 |
| Additional | - | SSD installation & OS optimization | Improves system efficiency | 200,000 |

The proposed recommendation emphasizes selective component upgrades rather than full system replacement. Retaining the existing processor significantly reduces upgrade costs while still maintaining adequate performance for administrative workloads.

The most impactful improvement is achieved through replacing HDD storage with SSD technology, which substantially reduces loading time and improves system responsiveness. Increasing RAM capacity also enhances multitasking capability, allowing the system to process larger datasets more efficiently.

From a financial perspective, the proposed upgrade strategy requires a relatively affordable investment of approximately IDR 1.3–1.9 million, making it more feasible for implementation in educational institutions with budget limitations.

To validate the effectiveness of the proposed upgrade strategy, benchmarking tests are conducted in the next stage by comparing system performance before and after the hardware improvements.

3.5. Performance Benchmarking

The final stage of the analysis evaluates the effectiveness of the proposed hardware upgrades through benchmarking tests. This stage aims to measure the extent of performance improvement achieved after upgrading RAM and replacing HDD storage with SSD technology. The benchmark results are presented in Table 5, while the graphical comparison is illustrated in Figure 2.

Table 5. Performance Benchmark Results (Before–After Upgrade)

| Activity | Before Upgrade (HDD, 4–8 GB RAM) | After Upgrade (SSD, 8–16 GB RAM) | Improvement |
|-------------------------------|----------------------------------|----------------------------------|-------------|
| Data input (1000 rows, Excel) | 10–12 minutes | 5–6 minutes | ~50% faster |
| Open large Excel file | 2–2.5 minutes | 30–40 seconds | ~70% faster |
| System booting | 2–3 minutes | 20–25 seconds | ~80% faster |

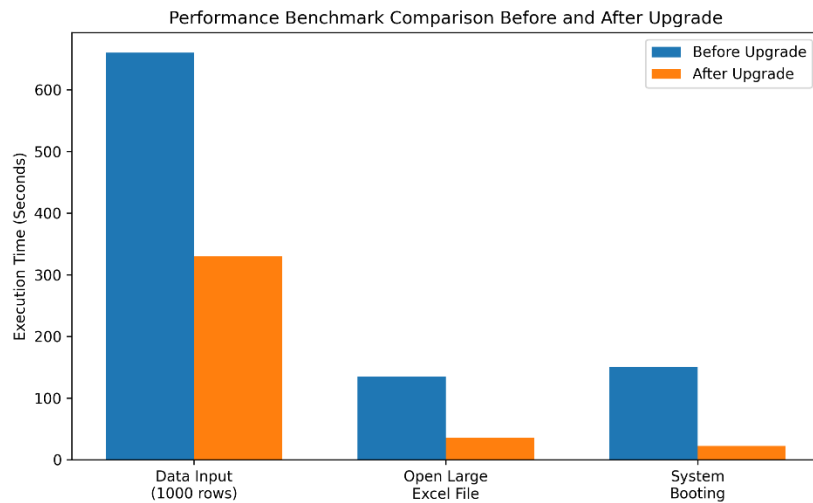


Figure 2. Performance benchmark comparison before and after upgrade

As shown in Table 5, the results indicate a significant improvement in system performance after applying the recommended upgrades. The most notable improvement is observed in system boot time and file access, where the use of SSD drastically reduces data access latency. This confirms that storage performance is a critical factor in overall system responsiveness.

In addition, increasing RAM capacity contributes to improved multitasking performance, as reflected in the reduced time required for data input processing. With more available memory, the system is able to handle larger datasets and multiple applications simultaneously without experiencing lag.

Although the processor remains unchanged, the overall system performance improves substantially due to the elimination of bottlenecks in memory and storage subsystems. This finding highlights that targeted upgrades on critical components can deliver significant performance gains without requiring a full system replacement.

From a practical perspective, the benchmark results demonstrate that a relatively low-cost upgrade can yield efficiency improvements of approximately 50–80%, depending on the task. This reinforces the effectiveness of the proposed value-for-money strategy in optimizing hardware performance for administrative activities.

The results of this benchmarking stage validate the proposed hardware recommendations and provide empirical evidence that supports cost-efficient decision-making in hardware upgrades.

4. CONCLUSION

This study has demonstrated that hardware performance plays a crucial role in supporting administrative activities in higher education environments. Through a workload-based analysis, it was found that the primary performance limitations were caused by insufficient memory capacity and the use of conventional HDD storage, which led to system lag, long processing times, and reduced work efficiency.

The proposed cost-efficient upgrade strategy, focusing on increasing RAM capacity and replacing HDD with SSD, has proven to be highly effective in improving system performance. Benchmark results indicate significant reductions in execution time across various tasks, with improvements ranging from approximately 50% to 80%. Notably, these improvements were achieved without replacing the processor, highlighting that targeted upgrades on critical components can deliver substantial performance gains.

From a practical perspective, this study confirms that a value-for-money approach to hardware upgrading is more feasible and impactful compared to full system replacement, particularly in resource-constrained institutional settings. The findings provide a structured and measurable framework for aligning hardware specifications with actual workload requirements, enabling more informed decision-making in hardware procurement.

Although this research is based on a case study involving a limited number of administrative staff, the results reflect common challenges faced in higher education administrative environments. Therefore, the proposed approach can be adapted and applied to similar contexts to improve operational efficiency.

Future work may expand the scope of analysis by including a larger number of users, incorporating real-time performance monitoring, and exploring additional factors such as network performance and software optimization. Such extensions are expected to further enhance the comprehensiveness and applicability of hardware requirement analysis.

REFERENCES

- [1] D. Deha, S. Fil, and M. I. Kom, "Peran Teknologi Informasi dalam Meningkatkan Efisiensi Administrasi Pada Perguruan Tinggi (Studi Kasus di Program Studi D3 Sekretari pada Sekolah Tinggi Manajemen Pariwisata dan Logistik Lentera Mondial)." *Jurnal Tahsinia*, vol. 6, no. 1, pp. 115–134, 2025.
- [2] A. A. Zulfa, T. Ibrahim, and O. Arifudin, "Peran sistem informasi akademik berbasis web dalam upaya meningkatkan efektivitas dan efisiensi pengelolaan akademik di perguruan tinggi," *Jurnal Tahsinia*, vol. 6, no. 1, pp. 115–134, 2025.
- [3] L. Judijanto *et al.*, *Sistem Informasi: Teori dan Penerapannya di Berbagai Bidang*. PT. Sonpedia Publishing Indonesia, 2025.
- [4] M. Munsyir, I. Arfyanti, T. Sumitra, E. Wahyudi, and A. Y. Vandika, "Arsitektur dan Organisasi Komputer Fondasi Teknologi Digital," *YPAD Penerbit*, 2024.
- [5] J. A. M. Rawis, T. F. S. Tangkere, M. Modeong, and M. Y. Lahea, *Tantangan Utama dalam Manajemen Pendidikan di Era Teknologi*. CV Eureka Media Aksara, 2025.
- [6] D. Deha, "Peran teknologi informasi dalam meningkatkan efisiensi administrasi pada perguruan tinggi," *Jurnal Manajemen, Pariwisata Dan Logistik*, vol. 10, no. 2, 2024.
- [7] N. U. Hikmah and S. Julaiha, *Kualitas Layanan Perguruan Tinggi: Komponen dan Metode*. Syiah Kuala University Press, 2022.
- [8] S. Jaya, A. Yulianto, and E. Purwanto, "Computational Modeling Using Linear Regression and Random Forest to Analyze the Impact of Workload on Employee Performance Evaluations," *International Journal of Computational Methods and Experimental Measurements*, vol. 13, no. 2, pp. 227–237, Jun. 2025, doi: 10.18280/ijcmem.130202.
- [9] P. Haghighat *et al.*, "Effects of an intelligent virtual assistant on office task performance and workload in a noisy environment," *Appl. Ergon.*, vol. 109, p. 103969, 2023, doi: <https://doi.org/10.1016/j.apergo.2023.103969>.
- [10] S. Farizy and S. Supriyatna, "Analisis Terhadap Kinerja Sistem Komputer yang Kurang Maksimal atau Terjadinya Bottle Neck," *Jurnal Informatika Utama*, vol. 1, no. 2, pp. 81–86, 2023.
- [11] M. Zaky, A. R. Fauzi, R. A. Pratama, and R. Khoerunnisa, "Analisis Pengaruh Kapasitas RAM terhadap Kinerja Sistem Saat Menjalankan Aplikasi Berat," *Infoman 's: Jurnal Ilmu-ilmu Informatika dan Manajemen*, vol. 18, no. 2, 2024.
- [12] R. P. N. Laksana and H. Siregar, "SYSTEMATIC LITERATUR REVIEW DENGAN METODE PRISMA: MANAJEMEN MEMORI EFISIEN PADA SISTEM OPERASI LINUX," *Melek IT: Information Technology Journal*, vol. 11, no. 1, pp. 87–100, 2025.