

ANALYSIS OF THE CANTEEN INFORMATION SYSTEM AT AN-NAWAWI ISLAMIC BOARDING SCHOOL USING PIECES

Syarif Hidayatutullo¹; Nurajijah^{2*}

Information System^{1,2}

Universitas Nusa Mandiri, Jakarta, Indonesia^{1,2}

<https://www.nusamandiri.ac.id>^{1,2}

syarifkeren204@gmail.com¹, nurajijah.nja@nusamandiri.ac.id^{2*}

(*) Corresponding Author



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Abstract— The canteen at An-Nawawi Modern Islamic Boarding School Bogor plays a crucial role in supporting students' daily activities; however, its current information system is not optimally integrated to handle the growing student population and operational complexity. This study aims to analyze the problems within the canteen's information system to identify priority areas for improvement. The methodology employs a quantitative analysis using the PIECES framework, which evaluates six variables: Performance, Information, Economy, Control, Efficiency, and Service. Data was collected by distributing a questionnaire to respondents via Google Forms. The research findings show that among the six variables, the Control variable obtained the lowest average score (563.4), indicating a significant weakness in the supervision and data security aspects of the current system. Therefore, it is concluded that the main priority for future development should be focused on strengthening the control aspects to create a more secure, reliable, and well-managed canteen information system.

Keywords: Canteen Information System, Information System Analysis, Islamic Boarding School, PIECES Framework, System Evaluation.

Intisari— Pesantren Modern An-Nawawi Bogor memiliki kantin dengan peran krusial untuk menunjang aktivitas harian siswa, namun sistem informasinya belum terintegrasi secara optimal seiring dengan meningkatnya jumlah siswa dan kompleksitas operasional. Penelitian ini bertujuan untuk menganalisis permasalahan pada sistem informasi kantin tersebut guna mengidentifikasi area prioritas untuk perbaikan. Metode yang digunakan adalah analisis kuantitatif dengan kerangka kerja PIECES yang mengevaluasi enam variabel: Kinerja (Performance), Informasi (Information), Ekonomi (Economy), Kontrol

(Control), Efisiensi (Efficiency), dan Pelayanan (Service). Pengumpulan data dilakukan melalui penyebaran kuesioner kepada responden menggunakan Google Form. Hasil penelitian menunjukkan bahwa di antara keenam variabel, variabel Kontrol (Control) memperoleh skor rata-rata terendah (563,4), yang mengindikasikan adanya kelemahan signifikan dalam aspek pengawasan dan keamanan data pada sistem yang berjalan saat ini. Berdasarkan temuan tersebut, disimpulkan bahwa fokus utama untuk pengembangan sistem ke depan harus diprioritaskan pada penguatan aspek kontrol untuk menciptakan sistem informasi kantin yang lebih aman, andal, dan terkelola dengan baik.

Kata Kunci: Sistem Informasi Kantin, Analisis Sistem Informasi, Pesantren, Kerangka PIECES, Evaluasi Sistem.

INTRODUCTION

Modern Islamic boarding schools (*pesantren*) are unique educational institutions that integrate religious curricula with general sciences to foster students who excel both spiritually and intellectually. Within this ecosystem, the canteen plays a crucial role not only as a food provider but also as a center for social interaction that supports the daily lives of students (Nursaida Yusuf, 2022). However, in line with the growing student population and increasing operational complexity at the An-Nawawi Modern Islamic Boarding School Bogor, the current canteen information system has shown an inability to adapt effectively.

The digitalization of food service operations, particularly in canteens, has been a growing area of research. The core technology is often a Point-of-Sale system, which evolves from a simple cash register into an integrated management hub. Modern POS systems handle transactions, inventory

management, sales reporting, and customer relationship management (Amal et al., 2025)(Riana et al., 2022). Studies have shown that the successful adoption of such systems significantly improves operational efficiency, reduces financial leakage, and provides valuable data for business intelligence (Balisa et al., 2024).

However, a recurring theme in the literature is the challenge related to the Control aspect. Efforts to digitize customer-facing processes, often overlook the need for robust back-end controls(Raharjo, 2021). This can lead to issues like internal fraud, inaccurate inventory data due to untracked waste or spoilage, and weak data security protocols, which pose long-term risks to the business. This highlights a critical gap between front-end convenience and back-end accountability, a gap this study aims to investigate within the unique context of a pesantren canteen(Assyifa et al., 2025).

Most of the previous studies have focused on the implementation of canteen information systems in universities or SMEs, emphasizing transaction efficiency and inventory management. However, modern Islamic boarding schools present distinctive managerial characteristics, such as the need for daily monitoring of students' transactions, parental involvement in financial control, and integration with educational activities. These unique needs require a more secure and integrated solution, for example, through the adoption of a web-based digital payment system with RFID technology that facilitates cashless transactions, automates record-keeping, and provides direct access control for parents(Assyifa et al., 2025).

This condition gives rise to a series of significant operational problems. These include the management of student data and balances that are neither integrated nor updated in real-time, inaccurate inventory management, and slow service processes. The absence of sales trend analysis also creates difficulties for management in making strategic, data-driven decisions. Issues such as long queues and inefficiencies resulting from manual processes are common challenges in educational institution canteens, where the application of information technology has proven to be an effective solution for enhancing performance and effectiveness (Vita et al., 2023 ; Dari, 2022)

To systematically address this gap, an in-depth analysis of the existing system is required. This research adopts the PIECES (*Performance, Information, Economy, Control, Efficiency, Service*) framework as its primary analytical tool. PIECES was chosen for its comprehensive ability to evaluate an information system from multiple aspects, making it effective for identifying the root causes of problems in a specific and structured manner

(Hanifi et al., 2023). By employing this framework, a thorough evaluation of the canteen information system can be conducted to uncover its weaknesses and potential for improvement.

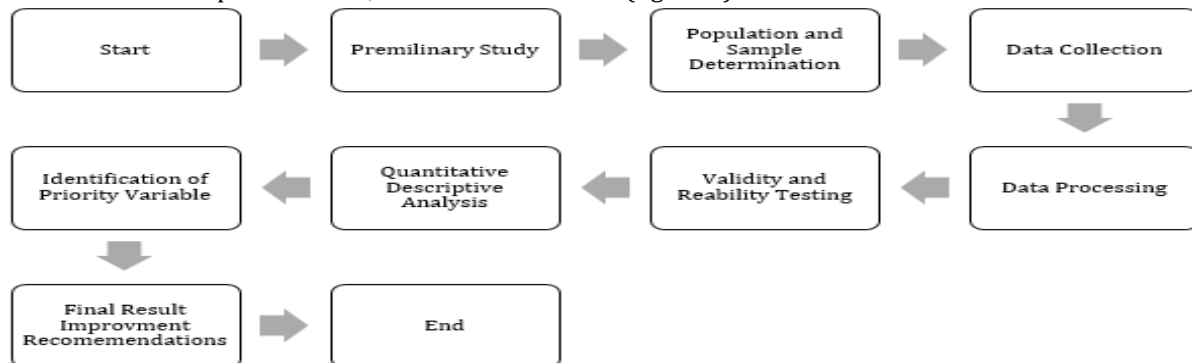
Therefore, this study aims to conduct an in-depth analysis of the canteen information system at An-Nawawi Modern Islamic Boarding School Bogor using the PIECES framework. This is where problem-centered frameworks like PIECES become invaluable. The PIECES framework is not a model for measuring overall success but rather a diagnostic tool for identifying problems and opportunities across six critical dimensions (Pratanto & Hidayah, 2025). It serves as a practical checklist for systems analysts to ensure a comprehensive evaluation, covering both technical and business-oriented aspects of a system. Its structured approach makes it particularly suitable for case studies aimed at system improvement or re-engineering (Satzinger et al., 2016). The results of this analysis will form the basis for formulating relevant and strategic recommendations for improvement, with the ultimate goal of developing an integrated, efficient canteen information system capable of better supporting the pesantren's managerial decision-making process(Raifan et al., 2024).

MATERIALS AND METHODS

This research was conducted through a systematic methodological flow, beginning with a preliminary study that included problem identification through initial observations and an in-depth literature review to build a theoretical foundation and validate the use of the PIECES framework as the analytical tool. Based on this foundation, the research population was defined, consisting of 252 students as end-users and 5 canteen managers as operators, from which a representative sample of 157 students was drawn using Slovin's formula to ensure the generalizability of the results, while all five managers were included via census due to their crucial roles. To ensure the depth and validity of the data, primary data collection was conducted using a triangulation strategy: a quantitative Likert-scale questionnaire was distributed to measure user perceptions across the six PIECES variables; semi-structured, in-depth interviews were conducted to explore the qualitative context and the reasons behind the given scores; and direct observation was used to objectively verify operational processes in the field. The collected quantitative data then entered the analysis phase, which began with instrument validity and reliability testing to ensure data quality and consistency. Once proven to be of high quality, the data was processed using descriptive analysis to

calculate the mean score for each PIECES variable (Darwi et al., 2023). This culminated in the objective identification of the variable with the lowest score as the most critical problem area, which then served

as a solid basis for formulating specific, relevant, and evidence-based recommendations for improvement, thus closing the entire research cycle. (figure 1).



Source : (Research result, 2024)

Figure 1. Stages of research

Table 2. List of Questions

No	Question
PERFORMANCE	
1	Sistem informasi kantin mudah diakses oleh pengguna.
2	Performa sistem tetap stabil saat digunakan oleh banyak pengguna secara bersamaan.
3	Sistem informasi kantin cepat dalam menyajikan informasi yang dibutuhkan.
4	Menu, fitur, dan navigasi yang tersedia pada sistem mudah dioperasikan.
5	Fitur-fitur yang tersedia pada sistem dapat menampilkan informasi yang relevan secara instan.
INFORMATION	
6	Informasi yang ditampilkan sistem memiliki ketepatan yang baik dan akurat.
7	Informasi yang disajikan oleh sistem mudah untuk dipahami.
8	Data dalam sistem informasi kantin mudah diakses sesuai dengan kebutuhan pengguna.
ECONOMY	
9	Sistem membantu mengurangi biaya operasional kantin (misalnya, penggunaan kertas).
10	Sistem membantu manajemen dalam mengontrol keuangan dan mengurangi potensi kerugian.
11	Manfaat yang diberikan oleh sistem sepadan dengan biaya pengembangan dan pemeliharannya.
12	Sistem memberikan kemudahan dalam pengelolaan harga dan promosi secara ekonomis.
CONTROL	
13	Data pribadi dan transaksi pengguna di dalam sistem terjamin keamanannya.
14	Sistem memiliki mekanisme kontrol yang baik, seperti validasi password oleh Tim IT.
15	Struktur menu dan navigasi pada sistem dirancang secara jelas dan tidak membingungkan.
16	Sistem memiliki kontrol akses untuk melindungi data dari perubahan yang tidak sah oleh pengguna lain.

No	Question
17	Sistem informasi kantin terlindungi dengan baik dari ancaman virus atau malware.
EFFICIENCY	
18	Sistem informasi kantin membuat pekerjaan terkait operasional kantin lebih mudah diselesaikan.
19	Sistem dapat diakses dengan baik dari berbagai jenis perangkat (misalnya, komputer atau smartphone).
20	Sistem menjadi sarana komunikasi yang relevan antara pengelola dan pengguna.
21	Penggunaan sistem mampu menghemat waktu, biaya, dan tenaga bagi pengguna dan pengelola.
22	Pelayanan yang diberikan oleh sistem sudah sesuai dengan harapan pengguna.
SERVICE	
23	Informasi yang dihasilkan oleh sistem dapat diandalkan untuk pengambilan keputusan.
24	Tata letak dan desain antarmuka sistem mudah dipahami dan digunakan.
25	Kecepatan akses sistem memberikan kepuasan kepada para pengguna.
26	Kualitas data dan informasi yang tersedia di dalam sistem memberikan kepuasan.
27	Secara keseluruhan, sistem ini sangat efektif dan efisien dalam memberikan pelayanan.

Source : (Research result, 2024)

This study employed a descriptive-evaluative case study approach to conduct an in-depth diagnosis of the canteen's information system within its natural context. The research population was comprehensively defined to include all 257 users, comprising 252 students and 5 canteen managers, from which a representative sample of 157 students was drawn using Slovin's formula, while all five managers were included via census. To ensure a robust and valid dataset, a data triangulation strategy was utilized for primary data collection (Antoro, 2024). The main instrument was

a quantitative questionnaire with 27 items (table 1) based on the PIECES framework, using a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree)(Simamora, 2022). This was supplemented by semi-structured interviews to gain qualitative depth and direct observation to objectively verify operational processes. The data analysis process was conducted in two stages: first, the instrument underwent rigorous validity and reliability testing to ensure data quality; second, the validated data was analyzed using descriptive statistics to calculate the mean score for each PIECES variable. This process culminated in the objective identification of the variable with the lowest score, which formed the basis for formulating specific, evidence-based recommendations.

RESULTS AND DISCUSSION

This section presents the results of the quantitative data analysis obtained from 157 respondents, followed by an in-depth discussion of the findings to evaluate the canteen information system at An-Nawawi Modern Islamic Boarding School using the PIECES framework.

1. Instrument Quality and Data Analysis Summary

Before the main analysis, the quality of the research instrument was tested to ensure the collected data was accurate and reliable (Wahyuning Sri, 2021).

- Validity test, The test was conducted by comparing the calculated r-value of each statement item against the r-table value (0.159 for N=157 at a 5% significance level). The results showed that 26 out of the total 27 items (Table 3) were valid, as their calculated r-values were greater than the r-table value. One item from the Control variable was found to be invalid (r-calculated = -0.18) and was therefore eliminated from the subsequent scoring analysis to maintain data integrity(Darma, 2021).

Table 3. Validity Test Result

Validity	Count R	Table R
<i>PERFORMANCE</i>	0,51	0,16
	0,55	0,16
	0,56	0,16
	0,59	0,16
	0,51	0,16
<i>INFORMATION</i>	0,63	0,16
	0,51	0,16
	0,62	0,16
<i>ECONOMY</i>	0,63	0,16
	0,63	0,16
	0,71	0,16
<i>CONTROL</i>	0,61	0,16
	0,66	0,16

Validity	Count R	Table R
<i>EFFICIENCY</i>	0,48	0,16
	-0,18	0,16
	0,34	0,16
	0,51	0,16
	0,66	0,16
	0,58	0,16
	0,55	0,16
	0,66	0,16
<i>SERVICE</i>	0,64	0,16
	0,68	0,16
	0,56	0,16
	0,6	0,16
	0,55	0,16
	0,58	0,16

Source : (Research result, 2024)

- Reliability Test, after eliminating the invalid item, a reliability test on the remaining 26 items yielded a Cronbach's Alpha of 0.903. This value is well above the common threshold of 0.60, indicating that the research instrument has very high internal consistency and reliability(table 2) (George & Mallery, 2016).

Table 2. Reability Test Result

Reliability Statistics	
Cronbach's Alpha	Number of Items
0,903	27

Source : (Research result, 2024)

- A normality test (e.g., using the Kolmogorov-Smirnov method) showed that the data for all variables was normally distributed ($p > 0.05$). This fulfills the necessary assumptions for further descriptive statistical analysis.

The quality-tested data was then processed to obtain the average score for each PIECES variable, which forms the basis of the system evaluation.

2. Evaluation of Information System Performance Based on the PIECES Framework

A descriptive analysis was conducted to understand user perceptions of the current canteen information system's performance. The average score for each PIECES variable is presented in Table 1 and visualized in Figure 1 for easier comparison.

Table 4. Summary of Average Scores for PIECES Variables

No.	Variable	Average Score	Rank
1	Service	630.06.00	1 (Highest)
2	Information	626.00.00	2
3	Economy	615.08.00	3
4	Efficiency	615.00.00	4
5	Performance	613.00.00	5
6	Control	563.04.00	6 (Lowest)

Source : (Research result, 2024)

The analysis results indicate that the canteen's information system is generally perceived positively by users across most aspects. The Service variable ranked highest with an average score of 630.6, suggesting user satisfaction with the quality of service delivered by the system. Conversely, the Control variable received a significantly lower average score of 563.4. This low score signifies a fundamental weakness in the system's supervision and security aspects, which should be the primary focus for improvement.

3. Discussion of Research Findings

The highest score in the Service variable indicates that, from the users' perspective, the existing information system has successfully delivered a satisfying transaction experience. This is likely driven by the ease and speed of the payment process, balance checking, or ordering, which directly reduces wait times and enhances student convenience. Supported by the high score in the Information variable, the system is also deemed capable of presenting necessary information (such as remaining balance or transaction history) clearly and accurately, which is a crucial pillar of good service.

The low score on the Control variable is the most significant finding of this research. It points to serious deficiencies in the system's supervision, security, and accountability mechanisms. In practice, this weakness can manifest in several ways:

- 1) Lack of an Audit Trail: The system may not be adequately recording who makes changes to data or performs transactions, making it difficult to trace anomalies or errors.
- 2) Weak Access Management: There may be no clear restriction of access rights among managers, cashiers, and other staff, opening loopholes for abuse of authority or unintentional data entry errors.
- 3) Difficult Reconciliation: The system might lack features for automatic reconciliation between recorded inventory, sales data, and actual revenue, posing a risk of inaccurate financial reports and potential revenue loss.

This weakness in the *Control* aspect poses a significant risk to the canteen's operational sustainability. Without adequate control, management cannot fully trust the data generated by the system to make strategic decisions regarding stock procurement, profit analysis, or budget planning.

These findings are consistent with several previous studies that also applied the PIECES framework in evaluating information systems. For instance, (Darwi et al., 2023) analyzed student satisfaction with the academic information system

and similarly identified weaknesses in the Control aspect, particularly related to data security and access management. This similarity suggests that the Control dimension is often a critical challenge not only in educational canteens but also in broader academic systems. Thus, the present study reinforces and extends prior research by highlighting that in the unique context of modern Islamic boarding schools, strengthening the Control variable is even more crucial due to parental involvement and the need for financial accountability.

4. Implications and Recommendations for Improvement

Based on these findings, the top priority for future system development must be to strengthen the Control variable. The proposed recommendations are not only technical but also procedural:

- a. Implementation of User Roles: Develop a user management feature with different access levels (e.g., Administrator, Manager, Cashier), where each role can only access menus and features relevant to their duties.
- b. Strengthening of Log-Recording Features: Ensure all critical activities, such as price changes, transaction cancellations, or stock additions, are automatically recorded in an immutable system log.
- c. Development of a Reporting and Reconciliation Module: Create a dedicated dashboard for managers that presents daily reconciliation reports between sales, balance usage, and remaining stock automatically to facilitate oversight.
- d. Training and Socialization of SOPs: Conduct training for staff on the importance of data security and adherence to new Standard Operating Procedures (SOPs) to minimize human error.

By strengthening the control aspect, the canteen's information system will not only enhance user satisfaction but also transform into a reliable, accountable, and strategic management tool for the An-Nawawi Modern Islamic Boarding School.

CONCLUSION

Based on the analysis of the canteen information system at An-Nawawi Modern Islamic Boarding School using the PIECES framework, it can be concluded that the system exhibits a dual performance: on one hand, it is highly satisfactory from a user perspective, reflected in the high scores for the Service and Information aspects, yet on the other hand, it possesses a fundamental weakness in the Control aspect, which was identified as the most critical area. This situation indicates significant

operational and security risks behind its user-friendly interface. Therefore, this study recommends that the management prioritize improvements to the Control aspect through the implementation of tiered access rights, the strengthening of audit trails, and the development of an automatic reconciliation module. For future researchers, it is suggested to conduct a post-implementation study to measure the effectiveness of these improvements, expand the research to other institutions for a comparative study, and examine the potential for integrating the canteen system with other academic or financial systems to create a more secure and integrated digital ecosystem.

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