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A Web-Based School Budget Management Information System Using the Zero-Based Budgeting Method

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Abstract

Transparent and accountable school budget management is a critical aspect of supporting good educational governance. However, many schools still rely on historical-based budgeting approaches, which tend to be inefficient as they replicate previous year allocations without evaluating actual needs. This study aims to design and develop a web-based school budget management information system by implementing the Zero-Based Budgeting (ZBB) method, in which each unit builds its budget from scratch every period based on a clear justification of needs rather than historical data. This research adopts the Research and Development (R&D) method as its research framework, combined with the Rapid Application Development (RAD) method for system development, encompassing the stages of planning, analysis, design, implementation, testing, and maintenance. The system was built using PHP and MySQL web technologies, with an interface designed for school financial administrators. Key features include activity-based budget proposal input with priority justification, expenditure recording and tracking, and periodic financial reporting. Testing using the Black Box Testing method confirmed that the system's functions operate in accordance with the defined requirements. The implementation of the ZBB approach in this system is expected to support more efficient, transparent, and accountable budget management at SMK Negeri 1 Medan.

Keywords: information systems, budget management, *zero-based budgeting*, *web-based*, *school*

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1. Introduction

Digital transformation has revolutionized public sector governance, including education. Data from the Ministry of Education, Culture, Research, and Technology (2023) show that 78% of secondary schools in Indonesia have adopted management information systems, but only 35% are integrated with financial management [1]. In fact, the effectiveness of school budgeting particularly at Vocational High Schools (SMK) is a critical factor in supporting vocational education geared toward preparing students for the industrial workforce [2].

SMK Negeri 1 Medan, as a leading vocational institution in North Sumatra, faces complex budgeting needs that extend beyond conventional academic activities, including the maintenance of practical training equipment, teacher competency certification, and the operations of production units that collaborate with industry. Unfortunately, the current budgeting system still relies on a traditional incremental approach, in which annual allocations are based on the previous period's budget execution without an in-depth

evaluation of current strategic needs. As a result, systematic inefficiencies occur, such as program duplication, excessive allocations for non-essential activities, and a lack of funding for critical initiatives like the development of state-of-the-art laboratories.

This problem is exacerbated by a lack of transparency and accountability in the budgeting cycle. A study by Siregar (2023) of 15 vocational high schools in North Sumatra revealed that 67% of teachers are not involved in budget preparation, resulting in proposals that often fail to address the actual needs of hands-on learning. Manual, spreadsheet-based documentation is also prone to human error, data loss, and an inability to respond to sudden changes such as impromptu industry collaboration projects that require rapid budget adjustments. Flagship facilities include automotive workshops, multimedia studios, culinary arts units, computer networking labs, mechatronics workshops, and graphic design units that serve as hubs for project-based learning (PBL). Furthermore, a 2023 internal audit showed that 28% of the school's budget was allocated to

recurring programs that are no longer relevant to the Merdeka Belajar curriculum [3].

To address these issues, Zero-Based Budgeting (ZBB) is considered an appropriate financial planning method to implement. ZBB is not an algorithm, but rather a philosophical framework that requires each budget line item to be planned from "zero" (zero-base) based on the justification of needs and strategic impact for the current year, rather than historical data. To facilitate a rational program evaluation, this method relies on cost-benefit analysis mechanisms to eliminate the tendency toward rigidity in budgeting, such as: "Does this year's CNC machine training support the Merdeka Belajar curriculum?" or "What is the impact of procuring electric vehicle simulators on student competencies?" However, manual implementation of ZBB is resource-intensive because it involves analyzing hundreds of proposals. This is where web-based technology plays a crucial role as a solution: transforming the manual, paper-based Zero-Based Budgeting process into a structured digital workflow. Rather than relying on a computational algorithm to decide budget outcomes, the system provides a structured platform through which each unit submits its budget proposals together with a written justification of needs, after which priority levels are assigned based on the urgency and strategic impact of each activity. The ultimate goal is an information system that digitizes the ZBB documentation and justification process, thereby reducing administrative burden and supporting more consistent, evidence-based prioritization compared to manual, spreadsheet-based methods [4].

Based on empirical evidence from previous studies, the integration of the Zero-Based Budgeting (ZBB) method with digital systems has consistently shown a significant improvement in budget management efficiency. Rahman and Fauziah (2022), in their study at a private vocational high school in Yogyakarta, demonstrated that the implementation of a semi-digital, rule-based ZBB system successfully reduced ineffective budget spending by 22% through an automated proposal evaluation mechanism that prioritized high-impact activities such as the maintenance of practical training equipment and teacher training. Furthermore, in a study by Firmialy et al. (2025) titled "Development and Dissemination of a Zero-Based Budgeting-Based Application for the Tourism and Hospitality Sectors," the researchers successfully developed the Android-based HospiBudget application, which adopts the Zero-Based Budgeting (ZBB) and Zero-Based Modeling (ZBM) methods. This study demonstrated that integrating ZBB concepts into a digital application can address budget inertia, enhance financial transparency, and facilitate more rational budget planning based on the actual needs of SMEs [5]. Unlike Rahman and Fauziah's [10] semi-digital, rule-

based implementation and Firmialy et al.'s [5] mobile-based ZBB-ZBM application for the tourism and hospitality sector, this study focuses on a fully web-based ZBB implementation within a public vocational secondary school context, covering the complete budgeting cycle from proposal submission and needs justification to expenditure recording and periodic financial reporting [11].

Based on the needs analysis, the information system developed must ultimately achieve an automated Zero-Based Budgeting (ZBB) system. For SMK Negeri 1 Medan, this system not only serves as a tool to improve budget accuracy but must also become a model for vocational financial management capable of adapting responsively to the dynamic needs of the industry. This research is expected to fill a gap in academic studies specifically, the limited research on the implementation of automated ZBB at the secondary education level while also contributing to the achievement of the "Merdeka Belajar" Curriculum's goals through a precise budget allocation mechanism that involves the active participation of all stakeholders.

2. Research Methods

This study adopts the Research and Development (R&D) method as its research framework. According to [6], the R&D method is an approach used to develop new products, whether physical, non-physical, or services [7]. The R&D process includes the stages of design, development, testing, and evaluation of the resulting product [8]. According to research conducted by [9], the research and development method consists of several systematic steps, as described in Figure 1.

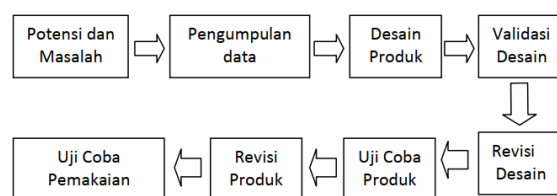


Figure 1. Research and Development Flow Method

2.1. System Development Method

Rapid Application Development (RAD) is a system development method that emphasizes speed and flexibility in the software development process. This method aims to shorten development time through the use of prototyping, rapid feedback, and interactive cycles that allow changes to be made dynamically according to user needs. RAD is particularly well-suited for projects that require a quick response to changes, especially in the development of complex information systems based directly on user needs [12]. The main stages and characteristics of the RAD method are described in Figure 2 [13].

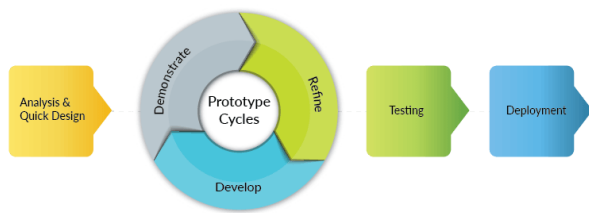


Figure 2. RAD System Development Method

3. Results and Discussion

3.1. Requirements Planning

During the planning phase, the requirements for the e-budgeting system to be developed were identified. This study aims to design an integrated financial management system to streamline the processes of record-keeping,

budget planning, and financial reporting at SMK Negeri 1 Medan. The school's requirements include features for creating budgets, tracking expenditures, and generating accurate financial reports [14]. Requirement identification was carried out in consultation with the research supervisor, focusing on the practical budgeting needs of SMK Negeri 1 Medan as described in the Introduction.

The concept of manual zero-based budgeting begins with the identification of specific needs, namely determining all activities that require a budget, covering all units that need funding allocations, such as teacher stipends, educational staff stipends, the administration of semester exams, and other needs. Next, a needs analysis is conducted, in which each unit must submit a budget based on actual needs, rather than on the budget from the previous period.

Table 1. Budget Calculation for Fiscal Year 2025

No.	Activity	Calculation Details	Total (Rp)
1	Teacher Salaries	$129 \text{ hours} \times 4 \text{ weeks} \times 6 \text{ months} \times 40,000$	123,840,000
2	Educational Staff Salaries	$(700,000 \times 6 \times 2) + (400,000 \times 6 \times 2) + (50,000 \times 6 \times 9)$	15,900,000
3	Semester Examination Administration	$(20,000 \times 15) + (300 \times 280 \times 15) + (400 \times 280 \times 15)$	3,240,000
4	Routine Operational Expenses	$(1,333,000 \times 6) + (500,000 \times 6) + (300,000 \times 6)$	12,800,000
5	Official Travel Expenses	$(200,000 \times 6) + (100,000 \times 6)$	1,800,000
6	Facilities and Infrastructure Maintenance	$1,000,000 + 10,000,000 + \dots$	17,750,000
7	Cleaning Supplies	$(30 \times 10,000) + (28 \times 12,500) + (14 \times 25,000)$	1,000,000
8	Extracurricular Activities	$(600,000 + 500,000 + 300,000 + 300,000 + 300,000) \times 6 + 13,650,000$	25,600,000
9	Books	—	12,500,000
10	ICT Equipment	$(4,000,000 \times 6) + 2,000,000 + 5,000,000$	31,000,000
11	BOS Incentives	$600,000 \times 6$	3,600,000
12	First Aid (P3K) Supplies	$1,000,000 \times 6$	6,000,000
13	BOS Fund Tax	—	3,120,000

Total Budget: 258,150,000

The Budget Justification for the budget presented in Table 1 emphasizes that every rupiah allocated must have a strong rationale for inclusion in the budget, whereby the salaries of teachers and educational staff are calculated based on the number of effective working hours, the administration of exams is calculated based on the need for printed materials per student, and routine expenditures are realistically adjusted to meet the needs for office supplies, electricity, and internet. In addition, priorities must be set based on the most urgent needs and their impact on the school's operational continuity, as presented in Table 2.

3.2. Design (Use Case Diagram)

Figure 3 shows the use case diagram of the web-based e-budgeting system using the Zero-Based Budgeting

(ZBB) approach at SMK Negeri 1 Medan, which involves two actors: Bendahara (Treasurer) and Kepala Sekolah (School Principal). Both actors can log in to the system (Login) and view financial reports. Beyond these shared functions, the Bendahara is responsible for managing budget data and recording expenditure data, while the Kepala Sekolah's role is focused on monitoring budget utilization and approving submitted budget activities.

3.3. Design Validation

Prior to implementation, the system design covering the user interface and the ZBB workflow was validated by the research supervisor. The validation confirmed that the proposed interface and workflow were appropriate for implementation at SMK Negeri 1 Medan.

Table 2. Budget Priority and Justification

No.	Activity	Priority	Priority Justification
1	Teacher Salaries	Very High	Essential to ensure the continuity of teaching and learning activities.
2	Educational Staff Salaries	High	Supports administrative operations and the smooth implementation of school activities.
3	Semester Examination Administration	High	Important for the periodic academic assessment of students.
4	Routine Operational Expenses	High	Supports daily operational needs such as electricity, water, and office supplies.
5	Official Travel Expenses	Medium	Supports external coordination activities but can be optimized to improve cost efficiency.
6	Facilities and Infrastructure Maintenance	High	Essential for maintaining school facilities in proper working condition.
7	Cleaning Supplies	Medium	Necessary for maintaining cleanliness, but procurement can be adjusted based on actual usage.
8	Extracurricular Activities	Medium	Important for student development, but funding can be adjusted according to priority programs.
9	Books	High	Supports the improvement of student literacy and the quality of learning.
10	ICT Equipment	High	Supports technology-based teaching and learning for both teachers and students.
11	BOS Incentives	Medium	Provides additional motivation for BOS fund administrators, although its effectiveness can be evaluated.
12	First Aid (P3K) Supplies	High	Mandatory to ensure health and safety within the school environment.
13	BOS Fund Tax	Mandatory	A legal obligation that cannot be avoided and must be accurately accounted for.

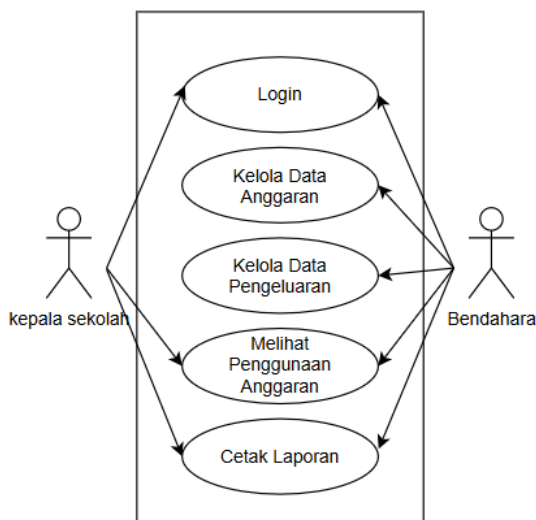


Figure 3. Use Case Diagram

3.4. System Development

1. Activity Budget Plan

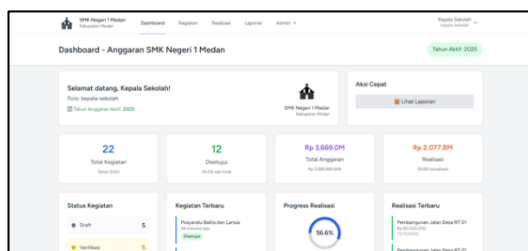


Figure 4. Activity Budget Plan

Based on Figure 4, users can create a new budget activity by filling in the activity name, budget field, funding source, budget ceiling, and the activity's start and end dates, along with optional notes. Each submitted activity is initially recorded with a "Draft" status.

2. Expenditure Recording

Figure 5. Expenses

Managing the recording of school financial expenses involves various aspects, such as the type of expense, the amount, and the transaction date, as shown in Figure 5. Each transaction must be recorded in detail to ensure that financial reports remain accurate and transparent. With proper record-keeping, school budget management can be carried out more efficiently.

3. Financial Reporting

Figure 6 provides a variety of reports related to financial activities, including activity reports, realization reports per budget field and per month,

and a financial summary. These reports facilitate more effective financial monitoring and analysis. With these reports, financial management can be conducted in a more transparent and structured manner.

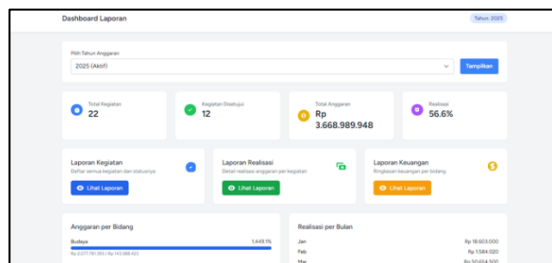


Figure 6. Report

3.5. Testing & Integration

The developed system was tested using the Black Box Testing method to ensure that each function operates according to the defined requirements, without examining the internal code structure. The test scenarios and results are presented in Table 3. [15].

3.6. Maintenance

After the system is launched, the maintenance phase begins with performance monitoring and updates or fixes as needed. The author maintains communication with the school to ensure the system runs smoothly and meets their needs, including providing additional training for staff when new features are introduced.

Table 3. Budget Priority and Justification

Yes	Features Tested	Skenario	Expected Results	Actual Results
1	Login	Log in with valid credentials	Successfully log in to the dashboard according to the role	<i>approved</i>
2	Login	Login with invalid credentials	System deny access and displays error messages	approved
3	Manage Data	Budget Add new activities with complete data	Saved data, initial status of "Draft"	approved
4	Manage Data	Budget Fill out the form with a blank required field	System displays validation, data is not stored	approved
5	Verification Approval	& The Principal approves the activity with the status of "Verification"	Status changes to "Approved", dashboard updated	approved
6	Manage Data	Expense Record the realization of expenses for approved activities	Realized data stored, percentage realized updated	approved
7	Reports	View Activity Reports by fiscal year	List of activities & status of performances according to the selected year	approved
8	Reports	Display Realization Reports by field/month	Breakdown of realizations is displayed accurately per field/month	approved
9	View Budget Usage	The principal opens the dashboard	Total budget, number approved, percentage realization displayed in real-time	approved

4. Conclusion

The research findings confirm that the implementation of a web-based School Budget Information System using the Zero-Based Budgeting (ZBB) approach at SMK Negeri 1 Medan was successfully developed and aligns with its primary objectives. First, the system supports improved budget efficiency by requiring the elimination of non-strategic fund allocations, facilitated by an in-depth analysis of each budget proposal based on a zero-base justification of needs. Second, financial management transparency was enhanced by real-time tracking features and a dashboard accessible to the principal and treasurer, enabling continuous monitoring and reducing unaccountable practices. Third, the accuracy of

financial planning and reporting is supported by the system's structured recording and approval workflow — covering budget proposal submission, verification, and approval — which minimized the risk of human error associated with manual, spreadsheet-based methods. Fourth, the system facilitates structured collaboration between the treasurer, who manages budget and expenditure data, and the principal, who reviews and approves budget proposals, ensuring alignment between fund allocations and the actual needs of vocational education. These findings demonstrate the feasibility of integrating ZBB principles and web technology in the context of vocational high schools and offer a reference model for the digital transformation of budgeting within Indonesia's vocational education sector.

References

- [1] M. S. Putra, W. Lasmawan, G. P. Suharta, and W. Widiana, "Transformasi Pendidikan di Era Digital Solusi Kreatif dalam Meningkatkan Kualitas Pembelajaran," *JPSL: Jurnal Pendidikan Sosial dan Lingkungan*, vol. 3, no. 2, pp. 2963–7686, 2025, [Online]. Available: <https://jurnal.stkip-al-amin-dompu.ac.id/index.php/jpsl>
- [2] A. Purnomo, H. Maulidah, Sudari, T. Setiorini, and Nurkolis, "Model Manpower Planning Sebagai Basis Perencanaan Pembiayaan Pendidikan Smk Untuk Meningkatkan Keterserapan Tenaga Kerja," *Modeling: Jurnal Program Studi PGMI*, vol. 12, no. 1, pp. 64–74, 2025.
- [3] R. Setiawan Munir and I. Yuliana, "Implementasi Learning Management System Berbasis Moodle dengan Project Based Learning pada Mata Pelajaran TIK Siswa Sekolah Menengah Kejuruan," *JiIP (Jurnal Ilmiah Ilmu Pendidikan)*, vol. 8, no. 3, pp. 2542–2551, 2025, [Online]. Available: <http://jiip.stkipyapisdompuppu.ac.id>
- [4] R. Saputra, E. Wijaya, and Nurjanah, "Automatisasi Penganggaran Pendidikan dengan Algoritma Zero-Based Budgeting Berbasis Web," *Jurnal Teknologi Informasi Pendidikan*, vol. 6, no. 2, pp. 77–92, 2023, doi: 10.1016/jtip.2023.006.
- [5] S. D. Firmialy, Cahyaningsih, and I. Adriyanti, "Pengembangan Dan Sosialisasi Penggunaan Aplikasi Berbasis Zero Based Budgeting Untuk Industri Sektor Pariwisata Dan Hospitality Sita Deliyana Firmialy," *Jurnal Akademik Pengabdian Masyarakat*, vol. 3, no. 5, pp. 60–71, 2025, doi: <https://doi.org/10.61722/japm.v3i5.6399>.
- [6] N. Aliya Tasya, R. A. Putri, and A. M. Harahap, "Sistem Informasi Manajemen Aset Dengan Metode Garis Lurus Berbasis Web Pada SMA Nur Ihsan," *Journal of Science and Social Research*, vol. 4307, no. 2, pp. 493–503, 2024.
- [7] P. Khairunnisa and R. Rasji, "Menilik Penjatuhan Sanksi Kumulatif Terhadap Tindak Pidana Yang Dilakukan oleh Anak Yang Berhadapan dengan Hukum Ditinjau dari Perspektif Kepastian Hukum," *Ranah Research: Journal of Multidisciplinary Research and Development*, vol. 6, no. 4, 2024, doi: 10.38035/rtrj.v6i4.
- [8] Okpatrioka, "Research And Development(R&D)PenelitianYang Inovatif Dalam Pendidikan," *DHARMA ACARIYA NUSANTARA: Jurnal Pendidikan, Bahasa dan Budaya*, vol. 1, no. 1, pp. 86–100, Mar. 2023.
- [9] Fathur Rohman, Hadiq, and Nur Ahmadi Indartono, "Sistem Pakar Diagnosa Permasalahan Sepeda Motor Dengan Metode Cosine Similarity," *Jikom: Jurnal Informatika dan Komputer*, vol. 12, no. 1, pp. 18–30, 2022, doi: 10.55794/jikom.v12i1.62.
- [10] R. A. Putri, A. B. Nasution, and N. Zuriandini, "Implementasi M-Commerce Pemesanan Jasa Kreatif Pada Cv. Buat Mama Bangsa," *Journal of Science and Social Research*, vol. 4307, no. 2, pp. 515–523, 2024.
- [11] M. Nasrani *et al.*, "Perancangan Aplikasi Penjualan Buku Rohani Berbasis Mobile Dengan Metode Rapid Application Development Di Yayasan Lembaga Alkitab Indonesia Perwakilan Medan," *Jurnal Ilmiah Sistem Informasi*, vol. 3, no. 2, pp. 22–32, 2023, [Online]. Available: <https://ejurnal.methodist.ac.id/index.php/methosisfo/>
- [12] R. L. Andharsaputri, E. Syahputra, and W. Prianto, "Implementasi Rapid Application Development Pada Sistem Informasi Pengadaan Barang Dan Jasa," *JOISIE Journal Of Information System And Informatics Engineering*, vol. 5, no. 1, pp. 9–12, 2021, doi: 10.35145/joisie.v5i1.1259.
- [13] H. R. Putra, "Rancang Bangun Sistem Informasi Pencocokan Antar Dokumen Tugas Outbond Bela Negara Menggunakan Metode Cosine Similarity," *Universitas Pembangunan Nasional "Veteran" Jawa Timur*, vol. 75, no. 17, pp. 399–405, 2021.
- [14] E. Fatmawati and N. Rahmawati, "Layout Planning of Finished Goods Warehouse Using Class-Based Storage Method Based on Turnover Ratio in PT XYZ," *Jati Emas (Jurnal Aplikasi Teknik dan Pengabdian Masyarakat)*, vol. 9, no. 1, pp. 199–208, 2025.
- [15] W. Welda, D. M. D. U. Putra, and A. M. Dirgayusari, "Usability Testing Website Dengan Menggunakan Metode System Usability Scale (Sus)s," *International Journal of Natural Science and Engineering*, vol. 4, no. 3, pp. 152–161, Nov. 2020, doi: 10.23887/ijnse.v4i2.28864.