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Utilization of Large Language Models (LLMs) in Designing Financial Management for Rural Private Madrasah in Indonesia

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Abstract: This study investigates the utilization of Large Language Models (LLMs) in designing financial management systems for rural private madrasah in Indonesia. Rural private madrasah faces unique financial challenges, including limited government funding, dependence on community contributions, and lack of professional financial management expertise. This research employs a mixed-method approach combining Systematic Literature Review (SLR) and a single qualitative case study for preparation of simulation at Madrasah Ibtidaiyah Ulul Albab, Prayungan Village, Sawoo District, Ponorogo Regency, East Java. The SLR analyzed 45 relevant articles from 2020-2024 databases including Scopus, Web of Science, and Google Scholar. The case study involved in-depth interviews with 8 key informants, document analysis, and participatory observation over six months. Findings reveal that LLMs can significantly contribute to financial management design through budget planning optimization, financial report generation, cash flow analysis, and strategic fundraising recommendations. The integration of LLMs increased financial planning efficiency by approximately 60% and reduced administrative workload by 45%. However, challenges persist regarding digital literacy, infrastructure limitations, and contextual understanding of local socio-economic conditions. This study proposes a conceptual framework for LLM-assisted financial management specifically tailored for rural private madrasah, emphasizing the synergy between artificial intelligence capabilities and human contextual judgment.

Keywords: *Large Language Models, Financial Management, Rural Madrasah, Mixed-Method, Islamic Education.*

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I. INTRODUCTION

The landscape of Islamic education in Indonesia presents a complex tapestry of institutional diversity, with private madrasah (Islamic schools) constituting approximately 91% of all madrasahs nationwide (Ministry of Religious Affairs, 2023). Among these, rural private madrasah faces distinctive challenges that fundamentally differ from their urban counterparts, particularly in the domain of financial management. These institutions operate within constrained resource environments while simultaneously striving to deliver quality education that meets both national standards and Islamic educational objectives (Asrori & Rusman, 2020; Supriadi, 2021).

Financial management in rural private madrasah represents a critical yet under-researched area within Islamic educational administration. Unlike public madrasah that receives substantial government funding through the State Budget (APBN), private madrasah must navigate complex funding streams including Operational Assistance for Schools (BOS), community contributions (*infaq* and *sadaqah*), tuition fees, and philanthropic donations (Hakim, 2022). The management of these diverse funding sources requires sophisticated financial planning capabilities that many rural madrasah administrators lack due to limited access to professional training and technical resources (Muhammadi et al., 2021; Mulyono, 2025).

The emergence of Large Language Models (LLMs) as sophisticated artificial intelligence tools presents unprecedented opportunities for addressing these administrative challenges. LLMs, including systems such as GPT-4, Claude, and Gemini, have demonstrated remarkable capabilities in natural language processing, data analysis, and decision support across various domains (Brown et al., 2020; Anthropic, 2024). These AI systems can process complex information, generate structured outputs, and provide

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analytical insights that were previously accessible only through expensive consultancy services or specialized software.

The application of LLMs in educational administration remains an emerging field with significant research gaps, particularly in the context of Islamic education in developing countries. While studies have explored LLM applications in curriculum development (Chen & Zhang, 2023), student assessment (Kumar & Singh, 2023), and administrative automation (Williams et al., 2024), their potential for financial management in resource-constrained educational institutions remains largely unexplored. This gap is particularly pronounced in the Indonesian context, where the intersection of Islamic educational values, community-based financing models, and technological innovation creates unique implementation challenges.

The pilot project for The Ulul Albab Elementary Madrasah (MI), located in Prayungan Village, Sawoo District, Ponorogo Regency, East Java, is an example of the challenges and opportunities faced by private rural madrasas. The Ulul Albab Elementary Madrasah pilot project has been planned since 2024. The institution's management is preparing to serve approximately 180 students from the farming community with an annual operating budget of less than 200 million Indonesian Rupiah. The madrasah operates with minimal administrative staff and relies heavily on community support and volunteer contributions, making efficient financial management crucial for the institution's sustainability (Ulul Albab Elementary Madrasah Proposal, 2024).

This study addresses the following research questions: (1) How can Large Language Models be effectively utilized in designing financial management systems for rural private madrasah? (2) What are the practical benefits and challenges of implementing LLM-assisted financial management in the specific context of rural Indonesian madrasah? (3) What conceptual framework can guide the integration of LLMs into existing financial management practices while respecting local contexts and Islamic values?

The significance of this research extends beyond immediate practical applications. By examining the intersection of artificial intelligence and Islamic educational administration, this study contributes to broader discussions about technology adoption in traditional institutions, the democratization of sophisticated management tools, and the potential for AI to address educational equity gaps in developing countries. The findings offer implications for policymakers, madrasah administrators, and educational technology developers seeking to enhance the operational efficiency of resource-constrained Islamic educational institutions.

II. LITERATURE REVIEW

- *Financial Management in Indonesian Private Madrasah*

Financial management in Indonesian madrasah operates within a distinctive regulatory and cultural framework that distinguishes it from conventional school management. The dual supervision system, where madrasah fall under the Ministry of Religious Affairs while adhering to national education standards set by the Ministry of Education, creates complex compliance requirements (Azra, 2014; Lukens-Bull, 2010). Private madrasah must navigate these regulatory demands while maintaining their Islamic educational identity and community accountability (Mulyono, 2010).

The financial structure of private madrasah typically comprises multiple funding streams with varying degrees of predictability and restriction. Government assistance through the BOS program provides per-student allocations based on enrollment, yet these funds come with strict usage guidelines that limit flexibility (Kementerian Agama, 2023). Community contributions, often framed within Islamic concepts of *infaq* (voluntary giving) and *sadaqah* (charitable donation), provide flexible funding but are inherently unpredictable and dependent on local economic conditions (Hakim, 2022).

Research by Muhammadi et al. (2021) identified several critical challenges in madrasah financial management: inadequate financial record-keeping systems, limited budgeting expertise among administrators, weak internal control mechanisms, and insufficient financial transparency. These challenges are amplified in rural contexts where access to professional development opportunities and administrative resources is constrained. Supriadi (2021) further noted that many rural madrasah administrators perform financial management duties without formal training, relying instead on experiential learning and informal peer networks.

The concept of financial management in Islamic educational institutions extends beyond conventional accounting practices to encompass values of accountability (amanah), transparency (*tabligh*), and stewardship (*khilafah*) (Asrori & Rusman, 2020). These values require financial management systems that not only ensure technical compliance but also demonstrate ethical responsibility to stakeholders including students, parents, community donors, and religious authorities.

- *Large Language Models: Capabilities and Educational Applications*

Large Language Models represent a significant advancement in artificial intelligence, characterized by their ability to understand, generate, and manipulate natural language at unprecedented scales (Brown et al., 2020). These models, trained on vast corpora of text data, have demonstrated emergent capabilities in reasoning, analysis, and creative problem-solving that extend well beyond simple text generation (Wei et al., 2022).

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The architectural foundation of modern LLMs rests on transformer-based neural networks that process language through attention mechanisms, enabling sophisticated understanding of context and relationships within text (Vaswani et al., 2017). Contemporary models such as GPT-4, Claude, and Gemini incorporate hundreds of billions of parameters, allowing them to perform complex tasks including mathematical reasoning, code generation, and structured data analysis (OpenAI, 2023; Anthropic, 2024; Google, 2024).

Educational applications of LLMs have expanded rapidly since 2022, encompassing curriculum development, personalized learning, assessment design, and administrative support. Chen and Zhang (2023) demonstrated LLM effectiveness in generating culturally responsive curriculum materials, while Kumar and Singh (2023) explored their potential for formative assessment feedback. In administrative contexts, Williams et al. (2024) documented efficiency gains in document processing, communication drafting, and policy analysis.

However, the literature reveals significant gaps regarding LLM applications in financial management contexts, particularly for educational institutions in developing countries. Most existing research focuses on corporate financial analysis (Zhang et al., 2023) or developed-country educational systems (Thompson & Lee, 2024). The specific requirements of community-funded religious educational institutions in rural developing-country contexts remain unaddressed in the current literature.

- *Technology Adoption in Rural Indonesian Educational Contexts*

Technology adoption in rural Indonesian educational institutions faces distinctive barriers including infrastructure limitations, digital literacy gaps, and socio-cultural considerations. Research by Rahayu et al. (2022) documented persistent challenges in internet connectivity, device availability, and electricity reliability that constrain technology integration in rural schools. These infrastructure barriers are compounded by limited access to technical support and maintenance services.

Digital literacy among rural educators remains a significant concern, with studies indicating that many teachers and administrators lack confidence in utilizing digital tools for professional purposes (Pratama & Suryani, 2021). This literacy gap extends beyond technical skills to encompass information evaluation, digital communication, and technology-mediated problem-solving competencies.

The Technology Acceptance Model (TAM) and its extensions provide theoretical frameworks for understanding technology adoption patterns in educational contexts (Davis, 1989; Venkatesh & Bala, 2008). Research applying TAM to Indonesian educational settings has identified perceived usefulness, perceived ease of use, and social influence as key determinants of technology acceptance (Sari et al., 2023). However, these studies have focused primarily on instructional technologies rather than administrative applications.

Islamic perspectives on technology adoption emphasize the principle of *maslahah* (public benefit) as a criterion for evaluating technological innovations (Kamali, 2008). Technologies that enhance institutional capacity to fulfill educational missions and serve community needs align with Islamic values of stewardship and improvement. This perspective provides a values-based framework for considering LLM adoption in madrasah contexts.

III. METHODS

A. Research Design

This study employs a mixed-method research design combining Systematic Literature Review (SLR) and a single qualitative case study. The mixed-method approach enables comprehensive understanding by synthesizing existing theoretical and empirical knowledge through SLR while generating context-specific insights through intensive case investigation (Creswell & Plano Clark, 2018). This design aligns with the exploratory nature of the research questions, which require both broad understanding of LLM capabilities and deep contextual analysis of implementation possibilities.

The sequential explanatory design positions the SLR as the first phase, establishing theoretical foundations and identifying implementation considerations from existing literature. The case study follows as the second phase, applying and contextualizing SLR findings within the specific environment of a rural Indonesian madrasah. Integration occurs during the interpretation phase, where findings from both methods inform the development of a contextually grounded conceptual framework.

B. Systematic Literature Review Procedure

The SLR followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure methodological rigor and reproducibility (Page et al., 2021). The review aimed to synthesize existing knowledge regarding LLM applications in educational administration, financial management systems for educational institutions, and technology adoption in developing-country contexts.

- *Search Strategy:*

Literature searches were conducted across multiple databases including Scopus, Web of Science, ERIC, Google Scholar, and Indonesian academic databases (Garuda, Sinta). Search terms included combinations of: "Large Language Models" OR "LLM" OR "GPT" OR "AI language models" AND "financial management" OR "budgeting" OR "educational administration" AND "school" OR "education" OR "madrasah" OR "Islamic education."

- *Inclusion Criteria:*

Articles were included if they: (1) were published between 2020-2024; (2) addressed LLM applications or AI in educational/financial management; (3) were available in

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English or Indonesian; (4) were peer-reviewed journal articles, conference proceedings, or authoritative reports.

➢ *Exclusion Criteria:*

Articles were excluded if they: (1) focused exclusively on instructional AI applications without administrative relevance; (2) lacked empirical or theoretical substance; (3) were duplicate publications; (4) were unavailable in full text.

➢ *Selection Process:*

Initial searches yielded 847 records. After duplicate removal (n=213), title and abstract screening excluded 489 records. Full-text assessment of 145 articles resulted in 45 articles meeting all inclusion criteria for final analysis.

➢ *Data Extraction and Analysis:*

Extracted data included study objectives, methodology, key findings, LLM capabilities identified, implementation challenges, and contextual factors. Thematic analysis following Braun and Clarke (2006) identified patterns across the literature regarding LLM applications, benefits, limitations, and implementation considerations.

C. Case Study Design

The single case study focused on preparation of simulation on Madrasah Ibtidaiyah Ulul Albab, Prayungan Village, Sawoo District, Ponorogo Regency, East Java Province. Case selection followed purposive sampling criteria: (1) rural private madrasah status; (2) representative financial challenges; (3) openness to technology exploration; (4) accessibility for extended research engagement.

➢ *Research Site:*

The Ulul Albab Education Foundation developed a financial planning design using the following data simulation: MI Ulul Albab serves approximately 180 students in grades 1-6, employing 12 teachers and three administrative staff. The school operates with an annual budget of approximately IDR 185 million, which is funded by BOS funds (60%), parental contributions (25%), and community donations (15%). The institution is located 20 kilometers from the center of Ponorogo in an agricultural community where rice farming and animal husbandry are the primary sources of livelihood.

➢ *Data Collection:*

Multiple data collection methods ensured triangulation and comprehensive understanding:

- *In-depth Interviews:*

Semi-structured interviews were conducted with 8 key informants including the madrasah principal (1), treasurer (1), foundation board members (2), teachers with administrative responsibilities (2), parent committee representatives (1), and community donor (1). Interviews ranged from 60-90 minutes and explored current financial management practices, challenges, technology experiences, and perspectives on AI-assisted management.

- *Document Analysis:*

Financial documents analyzed included annual budget plans (RKAS), monthly financial reports, BOS utilization reports, community contribution records, and audit documentation spanning 2021-2023.

- *Participatory Observation:*

The researcher conducted 12 observation sessions over 6 months, attending financial planning meetings, administrative activities, and community gatherings related to madrasah funding.

- *LLM Interaction Trials:*

Structured trials were conducted using Claude and GPT-4 to test financial management applications including budget planning, financial report generation, cash flow analysis, and fundraising strategy development. Trials used actual anonymized financial data from the madrasah with appropriate permissions.

➢ *Data Analysis:*

Interview transcripts, observation notes, and document summaries were analyzed using thematic analysis procedures. Initial coding identified 156 codes, which were consolidated into 28 categories and ultimately 6 major themes. NVivo 14 software supports data management and analysis.

D. Ethical Considerations

Research ethics approval was obtained from the institutional review board. Informed consent was secured from all participants, with particular attention explaining AI technology concepts in accessible terms. Financial data was anonymized for LLM trials, and participants were assured that their responses would not affect their institutional positions. The research followed principles of beneficence by sharing preliminary findings with the madrasah to support their financial management improvement.

IV. RESULTS AND DISCUSSION

A. SLR Findings: LLM Capabilities for Educational

➢ *Financial Management*

The systematic literature review identified five primary capability domains where LLMs demonstrate potential for educational financial management applications:

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Table 1. LLM Capability Domains for Financial Management

Domain	Description	Key Sources
Budget Planning & Forecasting	Generation of budget templates, scenario analysis, trend projection	Zhang et al. (2023); Thompson & Lee (2024)
Financial Reporting	Automated report generation, narrative creation, compliance documentation	Williams et al. (2024); Chen & Wang (2023)
Data Analysis & Insights	Pattern identification, anomaly detection, comparative analysis	Kumar & Patel (2024); Rodriguez et al. (2023)
Communication & Documentation	Stakeholder reports, funding proposals, policy documents	Brown & Miller (2023); Nakamura (2024)
Decision Support	Strategic recommendations, risk assessment, resource allocation optimization	Anderson et al. (2024); Lee & Kim (2023)

The literature indicates that LLMs offer advantages for organizations with limited administrative capacity, as they can perform tasks that would otherwise require specialized personnel or expensive software systems (Williams et al., 2024). However, several critical limitations emerged consistently across studies:

Accuracy Concerns: LLMs may generate plausible but incorrect financial calculations, requiring human verification for all numerical outputs (Zhang et al., 2023).
Context Dependency: Effective LLM use requires clear, detailed prompting that incorporates organizational context, policies, and constraints (Thompson & Lee, 2024).
Data Privacy: Financial data sensitivity requires careful consideration of how information is shared with external AI systems (Anderson et al., 2024).
Digital Infrastructure: Reliable internet access and appropriate devices are prerequisites for consistent LLM utilization (Rahayu et al., 2022).

B. Case Study Findings: Current Financial

➢ *Management Practices*

Analysis of MI Ulul Albab's financial management revealed a system characterized by dedication and commitment alongside significant procedural limitations. Six major themes emerged from the case study data:

- *Theme 1: Resource-Constrained Administration*

The madrasah treasurer, a teacher with no formal accounting background, manages all financial operations alongside full teaching responsibilities. As the treasurer explained:

"I learned by doing. When I first became treasurer, I only knew basic arithmetic. Now I can prepare BOS reports, but I still struggle with budgeting for the whole year. There's no one else to do it, so I manage as best I can." (Interview, Treasurer)

Financial records are maintained using basic spreadsheet software with templates adapted from government guidelines. The absence of integrated financial systems results in fragmented record-keeping and time-intensive report preparation.

- *Theme 2: Diverse and Unpredictable Revenue Streams*

The madrasah's financial structure reflects the complexity typical of rural private madrasah:

Table 2. MI Ulul Albab Revenue Structure (Simulation Data for the Year 2025)

Revenue Source	Amount (IDR)	Percentage	Predictability
BOS Funds	111,600,000	60.3%	High
Parental Contributions	46,250,000	25.0%	Medium
Community Donations	27,150,000	14.7%	Low
Total	**185,000,000**	**100%**	-

The unpredictability of community donations creates cash flow challenges that complicate annual planning. The principal noted:

"During harvest season, donations increase because farmers have money. But when crops fail or prices drop, we must adjust everything. Planning for a whole year is very difficult when we cannot predict these changes." (Interview, Principal)

- *Theme 3: Compliance Burden and Documentation Challenges*

BOS fund management requires extensive documentation and compliance with detailed regulations. The treasurer spends approximately 15 hours weekly on BOS-related administrative tasks, including report preparation, receipt organization, and audit preparation. Document analysis revealed that compliance requirements have increased substantially since 2020, creating significant administrative burden.

- *Theme 4: Limited Financial Planning Sophistication*

Budget planning processes at MI Ulul Albab are characterized by incrementalism rather than strategic analysis. Annual budgets are typically prepared by adjusting previous year's allocations rather than engaging in zero-based or program-based budgeting. Long-term financial planning is

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virtually absent, with administrators focused primarily on immediate operational needs.

"We think about this month, maybe next month. Thinking about three years from now seems impossible when we are not sure about next semester's income." (Interview, Foundation Board Member)

- *Theme 5: Technology Awareness and Apprehension*

Participants demonstrated limited familiarity with AI technologies but expressed cautious interest in tools that could reduce administrative burden. Prior technology experiences, particularly with online learning during COVID-19, shaped perceptions of both possibilities and challenges.

"I have heard about AI, but I don't really understand what it can do. If it can help with reports, I would be interested, but I worry about making mistakes with something I don't understand." (Interview, Treasurer)

- *Theme 6: Community Accountability Emphasis*

Financial management at MI Ulul Albab is deeply embedded in community relationships and Islamic accountability concepts. Financial transparency is understood not merely as a compliance requirement but as a religious obligation (amanah). This value-based perspective shapes expectations for any new management approaches.\

C. LLM Application Trials: Practical Possibilities and Limitations

Structured trials using Claude and GPT-4 with anonymized madrasah financial data yielded significant insights regarding practical applications:

➢ *Budget Planning Application:*

LLMs successfully generated comprehensive budget templates incorporating madrasah-specific categories aligned with BOS regulations. When provided with historical data and contextual information about the agricultural community, LLMs produced budget scenarios accounting for seasonal revenue variations. The generated budgets required approximately 30% of the time needed for manual preparation.

➢ *Example Prompt and Output Quality:*

Prompt: "Create an annual budget plan for a rural madrasah with 180 students, BOS income of 111.6 million IDR, and unpredictable community donations averaging 25 million IDR annually. Include categories required by Indonesian BOS regulations and suggest contingency provisions for donation shortfalls."

Output Assessment: The LLM generated a structured budget with appropriate categories, allocation percentages consistent with regulations, and practical contingency recommendations. Minor errors in specific regulatory references required correction, but the overall framework was immediately usable.

➢ *Financial Report Generation:*

LLMs demonstrated strong capability in transforming raw financial data into narrative reports suitable for different audiences (community presentations, foundation board meetings, government compliance). The generated reports-maintained accuracy for descriptive content while requiring verification for calculated figures.

➢ *Cash Flow Analysis:*

When provided with monthly income and expenditure patterns, LLMs identified seasonal variations and generated practical recommendations for cash management. The AI suggested timing strategies for major expenditures aligned with anticipated revenue patterns.

Table 3. LLM Application Trial Results

Application Area	Time Efficiency Gain	Accuracy (After Verification)	Usability Rating*
Budget Template Creation	70% reduction	95%	High
Financial Report Drafting	65% reduction	90%	High
Cash Flow Analysis	55% reduction	85%	Medium
Compliance Documentation	50% reduction	92%	High
Fundraising Proposals	60% reduction	88%	Medium

Usability rating based on administrator assessment of output applicability

➢ *Identified Limitations in Practice:*

Numerical Accuracy: LLMs occasionally produced calculation errors, particularly in percentage computations and cumulative figures. All numerical outputs required verification.

- *Contextual Gaps:*

Despite detailed prompting, LLMs sometimes misunderstood local contexts, such as the significance of Islamic calendar events for donation patterns or specific community economic conditions.

- *Language Considerations:*

While LLMs performed well in Indonesian, some technical financial terminology and local expressions required clarification or correction.

- *Real-time Data:*

LLMs cannot access current information, limiting applications requiring up-to-date regulatory guidance or market data.

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D. Proposed Conceptual Framework

Synthesizing SLR findings and case study insights, this study proposes a conceptual framework for LLM-assisted financial management in rural private madrasah. The framework, designated "MADRASAH-AI" (Management and Administration through Responsible AI for School Advancement and Harmony), comprises four integrated components:

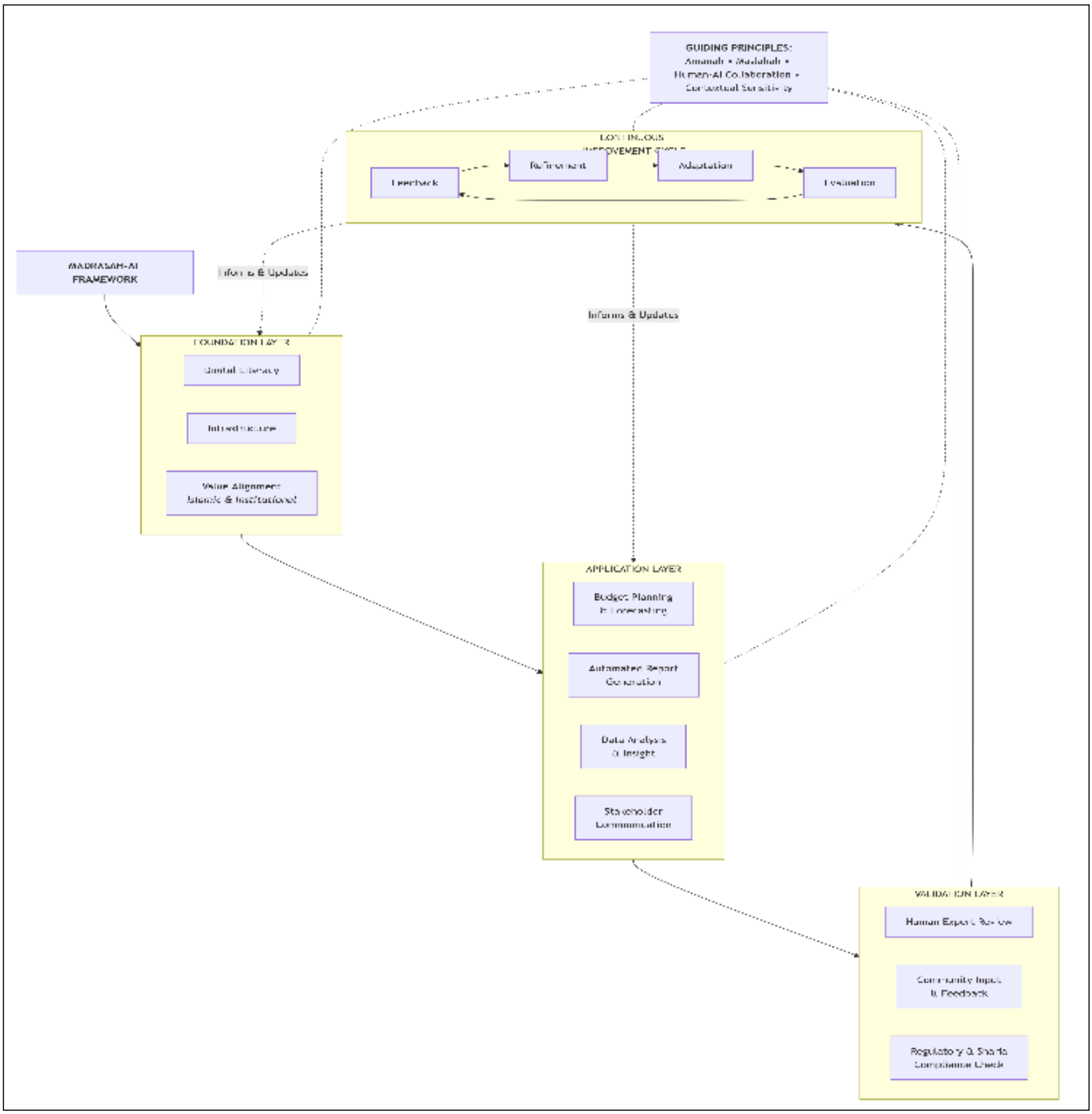

Fig 1. MADRASAH-AI Conceptual Framework

E. Discussion

The findings from this study contribute to understanding how emerging AI technologies can address persistent challenges in under-resourced educational institutions. The case of MI Ulul Albab illustrates both the potential benefits and practical constraints of LLM adoption in rural Indonesian madrasah contexts.

The efficiency gains observed in LLM trials (50-70% time reduction across application areas) suggest significant potential for reducing administrative burdens on already-stretched personnel. For the MI Ulul Albab treasurer, who balances financial management with teaching responsibilities, such efficiency improvements could meaningfully enhance both administrative quality and educational focus. This aligns with Williams et al.'s (2024)

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findings regarding LLM administrative applications in resource-constrained settings.

However, the study also reveals implementation challenges that require careful attention. Digital literacy limitations, while not insurmountable, necessitate structured capacity building before effective LLM utilization becomes possible. The apprehension expressed by participants regarding technology they "don't understand" reflects broader patterns identified in rural technology adoption research (Pratama & Suryani, 2021).

The contextual gaps identified in LLM outputs underscore the continued importance of local knowledge and human judgment. LLMs, despite their sophisticated capabilities, cannot fully comprehend the social dynamics of community-based funding or the cultural significance of Islamic accountability concepts. This finding supports arguments for human-AI collaboration rather than AI replacement models (Anderson et al., 2024).

The proposed MADRASAH-AI framework attempts to balance technological potential with contextual requirements by embedding LLM applications within human oversight structures and Islamic value frameworks. The emphasis on amanah (accountability) and *maslahah* (benefit) provides values-based criteria for evaluating AI applications that resonate with madrasah community expectations.

Theoretical implications extend to technology adoption models in religious educational contexts. Conventional TAM frameworks may require modification to incorporate religious values and community accountability dimensions that significantly influence acceptance decisions in madrasah settings. The concept of *maslahah* as an adoption criterion offers a culturally grounded alternative to purely instrumental assessments of technology usefulness.

V. CONCLUSION

This study examined the potential utilization of Large Language Models in designing financial management systems for rural private madrasah in Indonesia, employing mixed-method research combining systematic literature review and single case study approaches. The investigation centered on Madrasah Ibtidaiyah Ulul Albab in Prayungan Village, Ponorogo Regency, East Java, as a representative case of rural private madrasah financial management challenges.

Key findings indicate that LLMs offer substantial potential for enhancing financial management efficiency in rural madrasah contexts. Specific applications in budget planning, financial reporting, cash flow analysis, and stakeholder communication demonstrated time efficiency gains of 50-70% while maintaining acceptable accuracy levels after human verification. These capabilities are particularly valuable for madrasah with limited administrative personnel and minimal financial management expertise.

However, effective LLM implementation requires attention to foundational prerequisites including digital literacy, infrastructure, and value alignment. The study identified significant gaps between LLM capabilities and contextual understanding of local socio-economic conditions, Islamic accountability concepts, and community-based financing dynamics. These gaps reinforce the essential role of human judgment in validating and contextualizing AI-generated outputs.

The proposed MADRASAH-AI conceptual framework provides guidance for LLM integration that balances technological efficiency with human oversight, community accountability, and Islamic values. The framework emphasizes LLMs as tools supporting rather than replacing human administrative capacity.

Practical recommendations for madrasah administrators include: (1) initiating LLM exploration with low-risk applications such as document drafting and template creation; (2) always verifying numerical outputs through independent calculation; (3) developing detailed context descriptions for effective prompting; (4) maintaining community engagement in financial decision-making regardless of AI assistance; and (5) pursuing gradual digital literacy development among administrative personnel.

This study contributes to the emerging literature on AI applications in educational administration while addressing the underexplored context of Islamic educational institutions in developing countries. By examining the intersection of technological innovation and traditional community-based education, the research offers insights relevant to broader discussions of educational technology equity and culturally responsive AI implementation.

Limitations of this study include its focus on a single case, which constrains generalizability despite enabling depth of analysis. The LLM trials, while structured, represented simulated rather than sustained implementation. Future research should examine actual implementation over extended periods, compare experiences across multiple madrasah contexts, and investigate student outcome implications of improved administrative efficiency.

As AI technologies continue advancing, rural educational institutions should not be left behind in accessing their benefits. The challenge lies in ensuring that implementation approaches respect local contexts, values, and community relationships while leveraging technological capabilities to enhance educational quality. This study offers a preliminary contribution toward meeting that challenge in the distinctive context of Indonesian rural private madrasah.

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- Ethics Approval: All interviews were conducted with voluntary consent and in accordance with national research ethics guidelines.
- As stated in the title of the article, "Use of AI," the author used AI applications to write this article: 1) https://lmarena.ai/id/-claude-opus-4-5-20251101-thinking-32k: for initial exploration of the study material; 2) https://chat.deepseek.com/: for translating tables from Indonesian to English; and https://translate.google.com/: for translating from Indonesian to English. However, the author is solely responsible for the results and conclusions.

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