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LITERATURE REVIEW OF THE APPLICATION FRAMEWORK IN THE ENTERPRISE ARCHITECTURE OF SECONDARY SCHOOLS

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Abstract: The widespread use of information and communication technology (ICT) has enhanced effectiveness and quality in management, research, and education at educational institutions. In this digital age, secondary schools are required to improve operational efficiency and educational strategies through the use of information technology. Therefore, the implementation of an enterprise architecture (EA) framework is crucial to ensure a strategic alignment between educational goals and technology. However, before implementing the framework, schools must evaluate various factors that influence the suitability and effectiveness of EA, including current technology needs, staff competencies, existing infrastructure conditions, and other factors. This study gathers and analyzes data from related studies, and the results indicate the importance of understanding EA principles to optimize academic and administrative processes. By considering variables in the selection of the EA framework, evaluating school readiness, and identifying existing challenges, this research aims to assist secondary schools in effectively implementing EA. The expected outcome of this research provides theoretical support for the adoption of EA, thus facilitating more efficient strategic and operational planning in secondary schools.

Keywords: enterprise architecture; framework; information and communication technology; secondary school.

Abstrak: Penggunaan teknologi informasi dan komunikasi (TIK) secara luas telah meningkatkan efektivitas dan kualitas dalam manajemen, penelitian, dan pendidikan di institusi pendidikan. Di era digital ini, sekolah menengah dituntut untuk meningkatkan efisiensi operasional dan strategi pendidikan melalui pemanfaatan teknologi informasi. Oleh karena itu, penerapan framework arsitektur enterprise (EA) menjadi penting untuk memastikan aliansi strategis antara tujuan pendidikan dan teknologi. Namun, sebelum penerapan framework dilakukan, sekolah harus mengevaluasi berbagai faktor yang mempengaruhi kesesuaian dan efektivitas EA, termasuk kebutuhan teknologi terkini, kompetensi staf, kondisi infrastruktur yang ada, dan faktor lainnya. Penelitian ini mengumpulkan dan menganalisis data dari studi terkait, hasilnya menunjukkan bahwa pentingnya pemahaman tentang prinsip-prinsip EA untuk mengoptimalkan proses akademik dan administratif. Dengan mempertimbangkan variabel-variabel dalam pemilihan framework EA, evaluasi kesiapan sekolah, dan identifikasi tantangan yang ada, penelitian ini bertujuan untuk membantu sekolah menengah dalam mengimplementasikan EA secara efektif. Diharapkan hasil dari penelitian ini memberikan kontribusi teoretis yang mendukung pengadopsian EA, sehingga memfasilitasi perencanaan strategis dan operasional yang lebih efisien di sekolah menengah.

Kata kunci: arsitektur enterprise; framework; sekolah menengah; teknologi informasi dan komunikasi.

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INTRODUCTION

Rapid advances in information and communications technology (ICT) are critical for organizations to make a significant impact and achieve business goals [1]. ICT has become a powerful driver of change, bringing dynamism to organizations and impacting the economy, society, work and organizational action [2]. It is now important for businesses to utilize ICT for agility, thereby enabling them to adapt and succeed in a turbulent environment [3].

One of the sectors affected by advances in ICT is education. Advances in ICT bring positive changes to school education and aim to arouse student's interest in the learning process [4]. Apart from the learning side, advance in ICT impact school management by integrating communication,information management, learning management, and administrative systems [5]. By looking at the many roles of ICT in education, schools need an information system design strategy.

Schools are currently required to have the ability to handle information effectively, quickly and accurately and meet requirements [6]. It is critical for schools to engage in sophisticated information systems strategic planning to ensure the smooth running of their business processes [7]. To design an information system plan, a framework is needed that will facilitate the design and management of IS/IT infrastructure, which is usually called Enterprise Architecture (EA) [8].

EA is not just a tool for strategic planning in the IS/IT field, but functions as a versatile instrument for various other business endeavors, including but not limited to risk management, compliance management, and continuity planning [9]. In designing an information system strategy, schools need to consider the alignment between IT infrastructure to support processes within the organization [10]. This research will discuss articles regarding enterprise architecture practices in secondary school educational environments.

This research focuses on secondary schools in Indonesia, examining the implementation of enterprise architecture practices in this educational context. By narrowing the scope to this specific region, the study aims to provide nuanced insights and practical recommendations tailored to the unique needs and challenges of these schools.

This research methodology involves a comprehensive literature review focused on strategic planning and enterprise architecture. The first phase identifies and clarifies research questions relevant to the secondary school educational environment. The second phase determines sources for the literature search. Next, article selection criteria are defined based on established parameters. The final phase involves data extraction and filtering to identify and select pertinent articles for further analysis.

This study investigates the application of enterprise architecture in secondary schools. It aims to explore applicable frameworks, identify variables and criteria for adoption, assess school's readiness for EA implementation, and identify implementation challenges. The findings will help schools build a strong foundation for advancing their information systems and processes, ensuring effective implementation.

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METHOD

The literature study in this article follows Wohlin's guideline based on Kitchenham [11]. The procedures include identifying objectives, setting criteria, conducting a literature search, and extracting data.

Research Objectives

This study aims to determine the role of EA in secondary education. Using the PICOC framework (Population, Intervention, Comparison, Outcome, Context) for identifying research questions [12]. The criteria for these questions are shown in Table 1.

Table 1. PICOC framework for identifying research questions

Element	Description
Population	Secondary school
Intervention	EA framework implementation
Comparison	Schools with/without EA
Outcome	Influential variables, readiness, challenges
Context	Secondary school environment

Based the PICOC framework, the research questions for this study can be seen in table 2.

Table 2. Research questions

Id	Questions
RQ1	What variables influence the selection of an EA framework in secondary schools?
RQ2	How are secondary schools ready to implement the EA framework?
RQ3	What challenges hinder the implementation of an EA framework in secondary schools?

Search Criteria

Inclusion and exclusion criteria, detailed in table 3, were used to select studies for the literature analysis, ensuring research consistency and integrity.

Table 3. Inclusion and exclusion criteria

Id	Inclusion Criteria	Id	Exclusion Criteria
I1	EA framework application studies	E1	Non-EA framework studies
I2	Junior and senior high school subjects or similar education level institutions	E2	Non-junior or high school level institutions
I3	Journal articles and conference papers	E3	Non-journal or conference writings
I4	Indexed at least SINTA 3, non-Q for SCOPUS or credible publishers	E4	Indexed under SINTA 3 or non-credible publishers
I5	Indonesian or English language studies	E5	Non-Indonesian or English language studies
I6	Publication between 2020-2024	E6	Publication 2019 and below

Literature Search

The literature search began with an exploration of various digital databases, including Google Scholar, ResearchGate, IEEE Xplore, ScienceDirect, Scopus, Semantic Scholar, and IOPscience, to access the latest publications in the research area. To enhance search results,

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boolean operators 'AND' and 'OR' were integrated into the search strategy. The keywords used were ("Enterprise Architecture" OR "Framework" OR "Information System") AND ("High School" OR "SMA" OR "SMP" OR "Education").

Data Extraction

The rules used to extract data are PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) rules which are explained using the flow diagra:

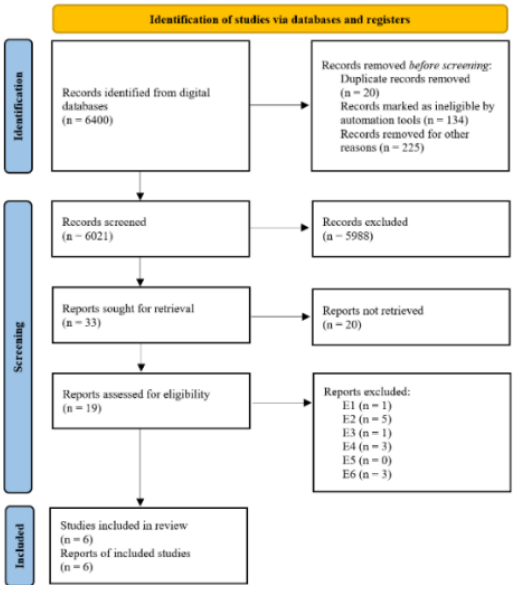

Image 1. Flow diagram of writing literature using PRISMA rules

RESULT AND DISCUSSION

The findings from the literature review are presented to address the previously defined research questions. These findings are systematically organized into a table for clarity and conciseness in answering the research questions. Based on the studies that have been carried out, there are several variables that are used as reasons for selecting an enterprise architecture framework which are described in table 4.

Table 4. Enterprise architecture framework selection variables

source	Framework	Selection Variables
[13]	TOGAF	Frequently used, open source, ADM cycle, neutral, internationally accepted, holistic, planning/design tools
[14]	TOGAF	Flexibility, clear vision/principles, architectural development, process optimization
[15]	TOGAF	Defines business needs, complete process, flexible implementation, management guide, supports organizational change
[16]	Zachman	Strategic planning, development control, systematic approach, strategy guide
[17]	Zachman	Comprehensive approach, critical aspect mapping, business/IT relationship, documentation/analysis, supporting school needs, holistic
[18]	OADP Framework	Business needs oriented, structured, consistent phase approach, business process support, integration/scalability, strategic roadmap

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Before implementing the EA framework, schools must assess their readiness, including IT infrastructure, business processes, and other organizational conditions. Studies, including research in [18], provide insights into pre-implementation conditions and requirements. These findings are summarized in table 5.

Table 5. Institutional conditions before implementing the EA framework

Source	Case Study	Institutional Conditions
[13]	Indonesian Senior High School Institutions	Utilizes basic tech like Excel for record-keeping and online forms for admissions. Traditional learning without specialized tech, inactive website, centralized data on one admin computer, and manual record-keeping.
[14]	Sekolah Menengah Pertama Negeri 17 Pekanbaru	Server for data processing, network management, laboratory facilities, and adequate network infrastructure.
[15]	Igasar Pindad Vocational High School Bandung	Comprehensive IT infrastructure, computer labs, structured business processes, but fragmented IT services.
[16]	ABC Islamic Boarding School with a secondary school	IT in operations, challenges in personnel management, suboptimal business process facilities.
[17]	SMK Al Hikmah Anjatan	Manual admissions, multiple stakeholders involved, lacks integrated IT system.
[18]	Vocational High School	Unintegrated IT infrastructure, inefficient data management, existing but not fully supported business processes, focus on international quality education, and producing competitive science and technology graduates.

In implementing the EA framework, there are challenging conditions that will be faced, an explanation of the types of challenges that will be faced is presented in the following presentation:

Table 6. Challenges faced by institutions in implementing the EA framework

Source	Challenges
[13]	Incomplete tech use causing data loss and delays, poor integration of websites and social media, slow traditional methods hinder effectiveness, centralized data hampers quick access and decisions.
[14]	Need more tech components like firewalls and servers, absence of electronic attendance and e-learning systems, need to integrate teaching and management for efficiency, require updates with better IT to support smart schools
[15]	Harmonizing IT with school goals is often difficult, managing ongoing architectural changes, need to update complex IT infrastructure for labs, managing dynamic architectural needs, securing support from educational leaders and technicians
[16]	Difficulty managing large volumes of data, existing systems insufficient for needs, better integration (data, processes, and networks) needed, training staff for the new framework, effective scheduling and resource allocation required, need support from principals and staff
[17]	Adapting tech to business processes for efficiency, integrating zachman framework perspectives, managing process changes and HR, training users for effective system adoption, ensuring security and privacy of student data, limited resources hindering development, ongoing maintenance and technical support needed.
[18]	Difficulty integrating separate systems, lack of competent IT staff, high costs for IT infrastructure and software, need strong stakeholder support, dependence on vendors limits flexibility, challenges in routine maintenance, need to train users effectively.

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Based on the responses to the research questions previously addressed, institutions intending to implement the EA framework can refer to the model illustrated in image 2 below.

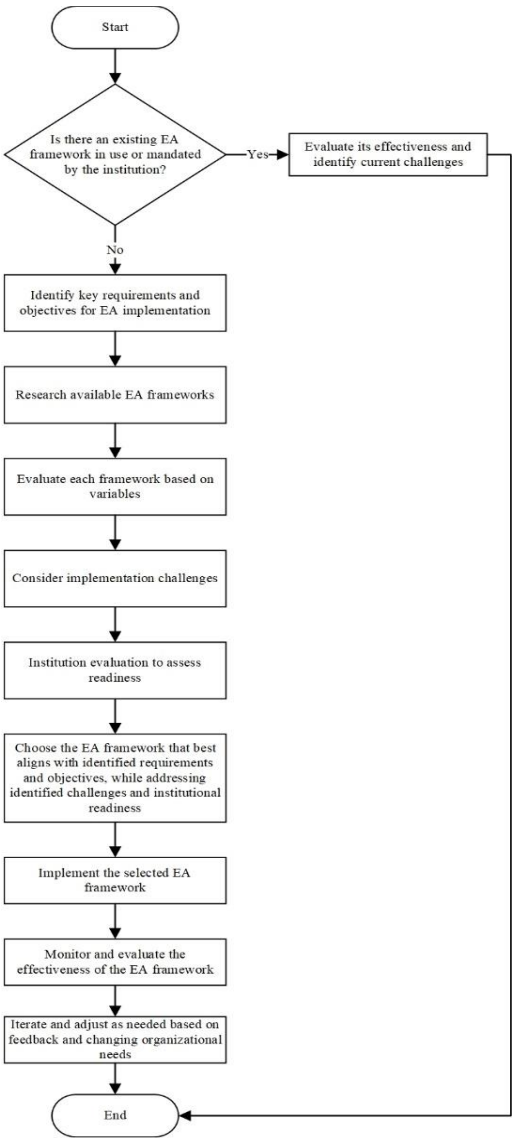

Image 2. Enterprise architecture framework selection process

CONCLUSION

Enterprise architecture framework have potential to enhance operational efficiency in secondary schools, dependent on factors like adaptability, systematic structure, and strategic planning. It also highlights implementation challenges, including system integration and effective change management. Schools considering an EA framework should conduct a thorough internal evaluation to ensure alignment with institutional needs. A detailed implementation strategy, including system integration, change management, and staff training, is advised. By addressing these recommendations, schools can overcome challenges and maximize the benefits of EA frameworks, enhancing strategic and operational planning. The study's findings may inspire more schools to adopt suitable EA frameworks.

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