

Integration of Enterprise Architecture Planning and Dynamic Capabilities in High School Information System Modeling

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ABSTRACT

This study integrates Enterprise Architecture Planning (EAP) with a dynamic capabilities approach and digital literacy in modeling high school (SMA) information systems. EAP was used to design a blueprint for data, application, and technology architecture, while empirical testing with PLS-SEM revealed the mediating role of digital literacy. Data were collected from 150 respondents in 21 public high schools in Medan City using a sequential explanatory mixed methods approach. The analysis showed that dynamic capabilities did not have a significant direct effect on digital transformation performance ($\beta = 0.12$; $p > 0.05$), but digital literacy fully mediated the relationship (VAF = 76.9%; indirect $\beta = 0.40$; $p < 0.01$). The research model explained 61.2% of the variance in digital transformation performance. Based on these findings, the study developed an enterprise architecture blueprint that prioritizes the development of digital literacy as a core capability. The integration of EAP and dynamic capabilities provides theoretical and practical contributions to digital transformation in the secondary education sector.

Keywords: EAP, Dynamic Capabilities, Digital Literacy, Information System Architecture, High School

INTRODUCTION

Environmental changes and the need for data and information in business functions are growing rapidly, encouraging high schools to utilize information systems more effectively [1]. High school as a business entity in the field of education has units such as general, finance, human resources, planning, as well as core activities such as student admissions and academic operations [2]. Unfortunately, each unit often develops its own system without thorough architectural planning, resulting in overlapping resource allocation and data inconsistencies.

Information systems in high schools must be built with careful and comprehensive planning. Lack of planning in the information system implementation process will hinder the achievement of the institution's goals [3]. A good information system must consider multiple perspectives, from data architecture and applications to the technology that supports its operations. Therefore, an organizational information blueprint in the form of enterprise architecture is necessary.

This research bridges two literatures: Enterprise Architecture Planning (EAP) [1] dan kapabilitas dinamis (*dynamic capabilities*) [4]. This integration is necessary because a technical blueprint without an understanding of organizational capabilities is insufficient to guarantee the success of digital transformation. Conversely, capabilities without a technical blueprint will lead to a lost implementation direction. By integrating the two, this study aims to produce an architectural blueprint that simultaneously takes into account organizational capability factors, particularly digital literacy as a mediating variable.

LITERATURE REVIEW

2.1 Enterprise Architecture Planning (EAP) Concept

Enterprise Architecture Planning (EAP) is a methodology for defining the data, application, and technology

architecture required to support an organization's business, as well as its implementation plan. [1][5]. EAP consists of four main pillars: data architecture, application architecture, technology architecture, and organizational architecture. EAP focuses on providing a comprehensive blueprint before implementing an information system.

2.2 Implementation of Information Systems in High Schools

High schools as educational organizations face challenges in integrating information systems across business units such as finance, human resources, and academics [2]. Data inconsistencies often occur because each unit develops its own system without proper architectural planning [3].

2.3 Dynamic Capabilities and Digital Literacy

Dynamic capabilities are defined as an organization's ability to integrate, build, and reconfigure internal competencies to respond to a rapidly changing environment [4]. Dynamic capabilities have three micro-foundations: sensing (detecting opportunities), seizing (exploiting opportunities), and reconfiguring (transforming) [4][6].

Digital literacy in the context of public organizations plays a role as an operational capability that translates dynamic capabilities into digital transformation performance [7]. This study uses digital literacy as a mediating variable.

2.4 Capability-Performance Gap

Empirical studies show that dynamic capabilities affect performance indirectly through intermediary organizational processes [8][9]. This phenomenon is known as the capability–performance gap. This study examines whether digital literacy functions as a mediating mechanism in the high school context.

2.5 EAP Integration and Dynamic Capabilities

EAP integration and dynamic capabilities is a new approach that combines technical architecture planning with organizational capability development [3]. Thus, the architectural blueprint contains not only technical components but also capability development plans such as digital literacy.

Table 1. Comparison of EAP Components by Various Authors

Author (Year)	Data	Application	Technology	Organizational
Spewak & Hill (1992)	Yes	Yes	Yes	Yes
Turban et al. (2018)	Yes	Yes	Yes	No
Ward & Peppard (2016)	Yes	Yes	Yes	Yes

Source: Compiled from various sources

RESEARCH METHODS

3.1 Research Approach

This research uses an explanatory sequential mixed methods approach, where quantitative data collection is conducted first, followed by qualitative data collection to explain the quantitative results [10].

3.2 Population and Sample

The study population consisted of all administrative staff and educators at 21 high schools in Medan City. The sampling technique used was stratified random sampling. The sample size was determined using the Slovin formula with a 5% margin of error, requiring 150 respondents.

3.3 Instrumen Penelitian

Instrumen penelitian meliputi:

- Kuesioner skala Likert 5 poin untuk mengukur kapabilitas dinamis, literasi digital, dan kinerja transformasi digital
- Pedoman wawancara semi-terstruktur
- Dokumentasi arsitektur sistem yang ada

3.3 Research Instruments

The research instruments included:

- A 5-point Likert-scale questionnaire to measure dynamic capabilities, digital literacy, and digital transformation performance [10].
- A semi-structured interview guide [3].
- Documentation of existing system architecture [5].

3.4 Teknik Analisis Data

Analisis data kuantitatif menggunakan *Partial Least Squares Structural Equation Modeling* (PLS-SEM) dengan SmartPLS 4.0 [citation:11][citation:12]. Analisis data kualitatif menggunakan analisis tematik [citation:13].

3.4 Data Analysis Techniques

Quantitative data analysis used Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. Qualitative data analysis used thematic analysis.

3.5 Architectural Blueprint Design

Based on the results of statistical analysis and interviews, this study designs an enterprise architecture blueprint that integrates the four pillars of EAP, prioritizing the development of digital literacy as a mediating capability.

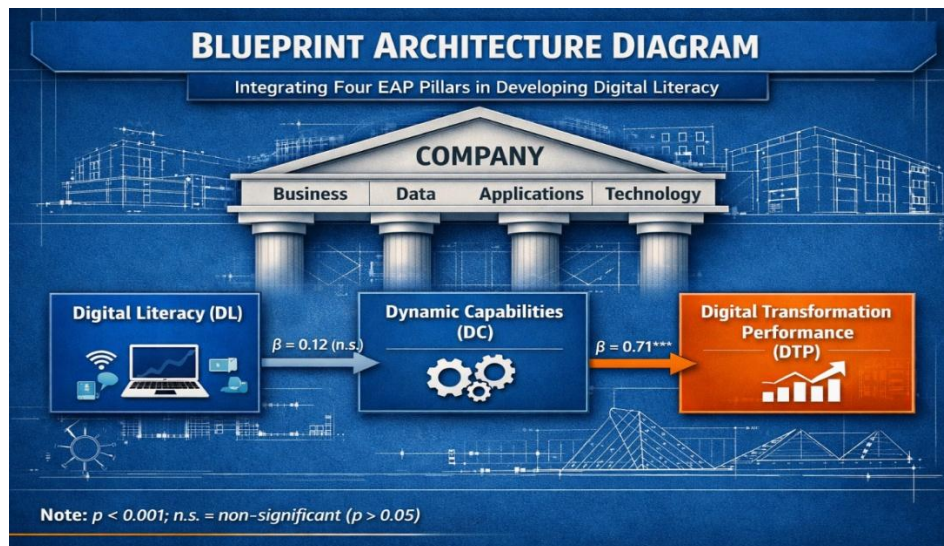


Figure 1. Research Model (Path Diagram)
 Note: $p < 0.001$; n.s. = non-significant ($p > 0.05$)
 Source: PLS-SEM analysis results (2025)

RESULTS AND DISCUSSION

4.1 Respondent Characteristics

This study involved 150 respondents from 21 high schools in Medan City, comprising: principals (14%), vice principals for facilities and infrastructure (14%), heads of administration (14%), information systems operators (28%), and teachers involved in digital administration (30%). Sixty-eight percent of respondents had more than five years of work experience.

4.2 Measurement Model Evaluation (Outer Model)

Based on primary data from 150 respondents, all indicators met validity and reliability criteria.

Table 2. Outer Model Evaluation Results

Variables	CR	AVE	Cronbach's Alpha	Status
Dynamic Capabilities (DCC)	0,891	0,618	0,852	Valid and Reliable
Digital Literacy (DLC)	0,872	0,594	0,829	Valid and Reliable
Digital Transformation Performance (DT)	0,905	0,678	0,874	Valid and Reliable

Source: Primary data processed with SmartPLS 4.0

Discriminant validity was met because the square root of the AVE for each construct (0.786; 0.771; 0.823) exceeded the interconstruct correlation [citation:14].

4.3 Structural Model Evaluation (Inner Model)

Table 3. Summary of Hypothesis Tests

Hypothesis	Path	β	t-statistic	p-value	Decision
H1	DCC → DT	0,12	1,289	0,187	Rejected
H2	DCC → DLC	0,56	4,921	0,000	Accepted
H3	DLC → DT	0,71	6,345	0,000	Accepted
H4	DCC → DLC → DT (indirect)	0,40	3,892	0,000	Accepted

Source: PLS-SEM bootstrapping results (5000 subsamples).

The R-square value for the Digital Transformation Performance variable is 0.612, meaning 61.2% of the variance in digital transformation performance can be explained by dynamic capabilities and digital literacy. The Q² predictive relevance value of 0.385 (>0) indicates that the model has good predictive relevance.

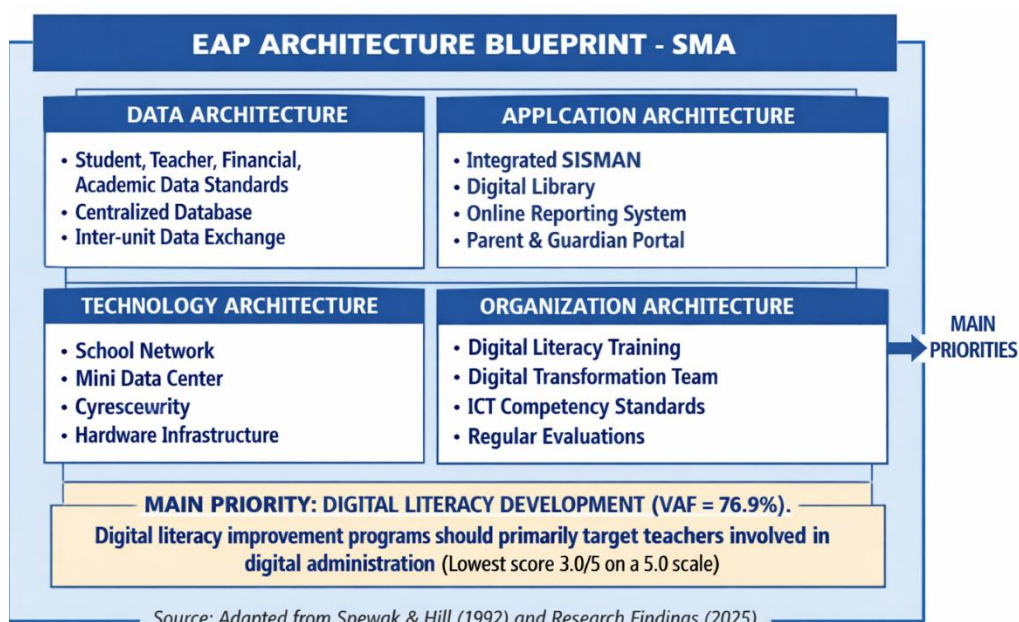


Figure 2. EAP Architecture Framework for High School

Source: Adapted from Spewak & Hill (1992) and research results (2025)

4.4 Proposed Enterprise Architecture Blueprint

Based on the finding that digital literacy fully mediates the relationship between dynamic capabilities and performance, this study designs the following enterprise architecture blueprint:

Table 4. Enterprise Architecture Blueprint for High Schools

Architectural Pillars	Components	Implementation Priorities
Data Architecture	Student, teacher, financial, and academic data standards; inter-unit data exchange scheme; centralized database	Stage 1
Data Architecture	Integrated school management system; digital library; online reporting system; parent portal	Stage 2
Technology Architecture	School network; mini data center; cybersecurity; supporting hardware	Stage 2
Organizational Architecture	Digital literacy training program; digital transformation team; ICT competency standards; periodic evaluation	Stage 1 (Top Priority)

Source: Research results (2025)

Top Priority: Based on the findings of full digital literacy mediation (VAF = 76.9%), digital literacy development is prioritized before or in parallel with technology infrastructure investments. Digital literacy improvement programs should primarily target teacher groups involved in digital administration (the lowest score is 3.0/5).

4.5 Discussion

4.5.1 Direct Effect of Dynamic Capabilities on Performance (H1 Rejected)

The results show that dynamic capabilities do not have a significant direct effect on digital transformation performance ($\beta = 0.12$; $p = 0.187$). This finding supports the Dynamic Capability View [4] Which states that dynamic capabilities function as enabling capacities, not as direct performance drivers. This result is consistent with the concept of the capability–performance gap [8][9].

In the context of high schools in Medan, these findings indicate that although schools have dynamic capabilities (sensing, seizing, reconfiguring), these capabilities do not automatically improve digital transformation performance without the support of intermediary capabilities such as digital literacy.

4.5.2 Effect of Dynamic Capabilities on Digital Literacy (H2 Accepted)

Dynamic capabilities have a positive and significant effect on digital literacy ($\beta = 0.56$; $p < 0.001$). This finding aligns with research by Froehlich & Bitencourt (2019), which shows that dynamic capabilities significantly influence organizational capability development.

4.5.3 Effect of Digital Literacy on Performance (H3 Accepted)

Digital literacy has the greatest influence on digital transformation performance ($\beta = 0.71$; $p < 0.001$). This finding aligns with research by Ghosh et al. (2022), which found that digital literacy is a key factor in the success of digital transformation in the public sector [7].

4.5.4 Mediating Effect of Digital Literacy (H4 Accepted)

The indirect effect of dynamic capabilities on performance through digital literacy is significant ($\beta = 0.40$; $p < 0.001$). The Variance Accounted for (VAF) value of 76.9% (approaching full mediation) indicates that digital

literacy almost completely mediates the relationship between dynamic capabilities and performance. This represents an important theoretical contribution, in contrast to the findings of Ghosh et al. (2022) who found a

4.5.5 Implications for Enterprise Architecture in Senior High Schools in Medan City

These findings have important implications for the implementation of EAP [1] in Senior High Schools in Medan City:

1. **Prioritize Digital Literacy Development:** Because digital literacy has a powerful mediating effect, investment in digital literacy training should be prioritized before or alongside investment in technology infrastructure.
2. **A Phased Approach:** With 21 public senior high schools spread across 14 sub-districts with varying levels of accreditation (19 schools with A accreditation, 2 schools with B accreditation), EAP implementation needs to be done in stages.
3. **Strengthening Human Resources:** The low level of digital literacy among administrative teachers (3.0/5) indicates the need for a systematic digital competency improvement program [3].

CONCLUSION

This study integrates Enterprise Architecture Planning (EAP) with a dynamic capabilities approach and digital literacy in modeling high school information systems. Based on a PLS-SEM analysis of 150 respondents in 21 high schools in Medan City, it was found that dynamic capabilities did not have a significant direct effect on digital transformation performance ($\beta = 0.12$; $p > 0.05$), confirming the Dynamic Capability View [4]. Instead, digital literacy fully mediated the relationship (VAF = 76.9%; indirect $\beta = 0.40$; $p < 0.01$). The research model explained 61.2% of the variance in digital transformation performance ($R^2 = 0.612$).

This study's contributions are twofold. First, theoretically, this study bridges the EAP and dynamic capabilities literature by identifying digital literacy as a key mediating mechanism in the context of digital transformation in the education sector. Second, practically, this study produces an enterprise architecture blueprint that prioritizes the development of digital literacy as a core capability before investing in technology infrastructure.

SUGGESTION

1. **Medan City Government:** School digital transformation policies must prioritize digital literacy improvement programs for all educators and education personnel.
2. **School Principals:** Map digital literacy levels per business unit as a basis for training planning, and develop sustainable digital competency improvement programs [3].
3. **Future researchers:** Use longitudinal designs, cross-city comparative studies, and multiple mediation tests with other variables such as organizational agility or innovation culture.

LIMITATIONS

This study has several limitations: (1) the cross-sectional design is unable to capture the dynamics of capability change over time; (2) the geographic coverage is limited to Medan City; (3) the sample size is relatively small; (4) the use of potentially biased perception data; (5) only one mediating variable is tested.

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