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# Integrated IT Governance Framework for a Sustainable Information Technology Roadmap at Universitas Negeri Manado

**Johan Reimon Batmetan[1*]**

[1]Department of Information and Communication Technology Education, Universitas Negeri Manado, Indonesia

*Corresponding author: john.reimon@unima.ac.id

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## ABSTRACT

Information technology (IT) governance has become a critical factor for higher education institutions in ensuring that digital investments align with strategic objectives while delivering long-term value. This study develops an integrated IT governance framework to design a sustainable information technology (IT) roadmap for Manado State University (UNIMA). Using a qualitative descriptive approach, the research employed the TOGAF Architecture Development Method (ADM) and COBIT 2019 to analyze the current state of ICT, identify governance gaps, and formulate a roadmap. Data were collected through interviews, surveys, observations, and document analysis involving university leaders, faculty representatives, and IT staff. The findings indicate that UNIMA's ICT infrastructure is fragmented, with limited integration across academic and administrative systems, an absence of a formal IT governance committee, and a lack of alignment between IT initiatives and institutional goals. The proposed roadmap is structured into three horizons: short-term (1–5 years), focusing on establishing governance structures and integrating basic systems; medium-term (6–15 years), emphasizing development of integrated applications for research, community service, and student services; and long-term (16–25 years), achieving full digital transformation toward an ICT-based campus supported by big data, cloud computing, and artificial intelligence. This research contributes theoretically by contextualizing global IT governance models within Indonesian higher education and practically by providing a structured pathway for UNIMA's digital transformation. The framework enhances institutional efficiency, strengthens academic and research competitiveness, and offers a scalable model for other universities pursuing sustainable ICT governance.

***Keywords***: digital transformation, higher education, ICT roadmap, IT governance, Sustainable

## INTRODUCTION

The rapid advancement of information and communication technology (ICT) has significantly transformed the higher education landscape, reshaping the way universities deliver education, conduct research, and manage administrative operations. ICT has become a strategic enabler that supports innovation, enhances institutional performance, and increases competitiveness in a globalized education market (De Haes et al., 2020). In this context, information technology (IT) governance plays a critical role in ensuring that ICT initiatives are aligned with institutional missions, vision, and long-term goals. Effective IT governance frameworks enable higher education institutions to optimize their digital resources, minimize risks, and maximize the return on investment from ICT infrastructure (Fonstad & Robertson, 2020).

Despite the growing importance of ICT, many universities, particularly in developing countries, still face challenges in implementing structured IT governance mechanisms. These challenges often manifest as fragmented systems, duplication of efforts, lack of integration between academic and administrative platforms, and limited alignment between IT strategies and organizational goals (Rusu et al., 2020). Without a coherent governance framework, ICT investments risk being underutilized, resulting in inefficiencies and missed opportunities to support teaching, learning, and research excellence (Ali & Green, 2012).

Manado State University (UNIMA), as one of the leading higher education institutions in Eastern Indonesia, is not immune to these challenges. Although the university has invested in ICT infrastructure, the current systems remain largely partial and unit-based, with little integration across faculties or administrative units. The absence of a formal IT governance committee and a long-term roadmap exacerbates the issue, leading to inefficiencies in data management, limited interoperability of systems, and challenges in strategic decision-making. This condition mirrors findings from global studies, which reveal that institutions without structured IT governance frameworks often struggle to achieve digital transformation goals (Debreceny & Gray, 2013).

To address these challenges, this research aims to develop an integrated IT governance framework tailored for UNIMA, with a focus on creating a sustainable ICT roadmap that spans short-term, medium-term, and long-term horizons. The proposed framework leverages international best practices, particularly the TOGAF Architecture Development Method (ADM) and COBIT 2019, while contextualizing them within the realities of Indonesian higher education. By doing so, the study contributes both theoretically and practically to the discourse on IT governance in universities.

Theoretically, this research extends the application of IT governance models, traditionally designed for corporate environments, into the higher education context of a developing country. It integrates global frameworks with local needs, addressing governance gaps specific to Indonesian universities. Practically, the proposed roadmap provides a structured guide for UNIMA to transition toward a digital campus. The roadmap emphasizes institutional ownership, strategic alignment, integration of academic and administrative systems, and the adoption of emerging technologies such as big data analytics, cloud computing, and artificial intelligence.

Several universities worldwide have successfully implemented IT governance frameworks to guide their digital transformation journeys. For instance, the Massachusetts Institute of Technology (MIT) developed a centralized IT services and technology department (IS&T) that provides integrated academic, research, and administrative services. Similarly, Harvard University adopted a decentralized yet coordinated IT governance model that balances autonomy with institutional standards, while the University of British Columbia (UBC) implemented an e-strategy framework to align technology initiatives with strategic goals (Henderson et al., 2020). In Asia, the National University of Singapore (NUS) established a Digital Transformation Office to integrate research, teaching, and administrative functions through digital platforms (Wang & Lim, 2021), while Seoul National University (SNU) has adopted smart campus initiatives using IoT, AI, and big data to enhance both learning and operational efficiency (Kim & Lee, 2022). These cases demonstrate that universities that adopt structured IT governance frameworks are better positioned to enhance institutional efficiency, competitiveness, and innovation capacity.

Building on these insights, this study formulates a roadmap for UNIMA that not only addresses immediate governance gaps but also sets a long-term vision for sustainable ICT development. The roadmap is divided into three horizons: (1) short-term (1–5 years), focusing on governance structures and foundational integration; (2) medium-term (6–15 years), emphasizing integrated academic, research, and student services; and (3) long-term (16–25 years), targeting full digital transformation toward an ICT-based campus.

In summary, this research seeks to answer the following questions:

1) What are the current gaps in ICT governance at Manado State University?
2) How can an integrated IT governance framework be designed to address these gaps?
3) What roadmap can ensure sustainable ICT development for the next 25 years?

By addressing these questions, the study contributes to the literature on IT governance in higher education while offering practical guidance for institutional leaders in Indonesia and similar contexts. The findings are expected to serve as a benchmark for other universities seeking to strengthen their ICT governance and digital transformation strategies.

## LITERATURE REVIEW

IT governance has been defined as the structures and processes that ensure the alignment of IT strategy with business goals while managing risks and delivering value (Weill & Ross, 2004). Contemporary frameworks such as COBIT 2019 and TOGAF provide structured methodologies for governance and enterprise architecture planning (ISACA, 2019). Studies highlight that successful universities adopt governance mechanisms that integrate academic, administrative, and research systems into a unified roadmap (Fonstad & Robertson, 2020). Global best practices, such as MIT's IS&T model, Harvard's decentralized but coordinated IT structure, and UBC's e-strategy, illustrate the importance of institutional ownership and stakeholder participation (Henderson et al., 2020; Kim & Lee, 2022). In Asia, universities like NUS and SNU demonstrate how digital transformation strategies based on smart campus initiatives and integrated platforms enhance competitiveness (Wang & Lim,

2021). These models inform the adaptation of IT governance frameworks to the Indonesian higher education context.

## IT Governance: Concepts and Importance

IT governance refers to the processes, structures, and relational mechanisms that ensure IT investments support organizational goals and deliver value while managing risks effectively. According to Weill and Ross (2004), IT governance defines decision rights and accountability frameworks to encourage desirable behaviors in the use of IT. Effective IT governance is increasingly recognized as a strategic enabler for higher education institutions, helping align ICT initiatives with academic and administrative missions (De Haes et al., 2020).

The role of IT governance has expanded beyond operational efficiency to include digital transformation, innovation, and global competitiveness (Fonstad & Robertson, 2020). In universities, IT governance ensures that digital resources support teaching, learning, research, and administration coherently and sustainably (Rusu et al., 2020).

## IT Governance Frameworks: COBIT 2019 and TOGAF

Two widely adopted frameworks underpin modern IT governance: COBIT 2019 and TOGAF.

- COBIT 2019 is a comprehensive governance framework developed by ISACA, offering principles, objectives, and processes to align IT with enterprise goals (ISACA, 2019). It emphasizes governance components such as organizational structures, policies, skills, information, and culture. COBIT 2019 is particularly relevant for higher education institutions that must balance compliance, risk management, and innovation.
- TOGAF (The Open Group Architecture Framework) provides a structured methodology for enterprise architecture development. Its Architecture Development Method (ADM) guides organizations through phases such as vision, business architecture, information systems architecture, and technology architecture (The Open Group, 2018). In universities, TOGAF helps design ICT systems that integrate academic, research, and administrative functions into a coherent enterprise model (Sharma & Singh, 2020).

Together, COBIT and TOGAF offer complementary approaches: COBIT ensures governance and management objectives are met, while TOGAF provides technical and architectural guidance for implementation.

## IT Governance in Higher Education Institutions

The application of IT governance in universities is gaining attention globally. Studies have shown that universities with structured IT governance frameworks achieve better alignment of ICT with strategic goals, leading to improved academic and administrative performance (Wiedenhöft et al., 2020). Effective governance also enhances transparency, accountability, and stakeholder trust in digital initiatives (Ali & Green, 2012).

However, challenges persist, especially in developing countries. A systematic review by Rusu et al. (2020) highlighted that many higher education institutions lack formal IT governance committees, rely on fragmented systems, and often fail to integrate ICT initiatives with broader institutional

missions. This situation reduces the value derived from ICT investments and undermines competitiveness.

### Global Best Practices in IT Governance

Several universities worldwide provide benchmarks for effective IT governance:

- Massachusetts Institute of Technology (MIT): Through its Information Services & Technology (IS&T) division, MIT has centralized IT services supporting academic, research, and administrative functions. Its governance model emphasizes innovation, collaboration, and service orientation (MIT, 2021).
- Harvard University: Adopts a decentralized IT governance model coordinated by a central CIO office. This allows faculties autonomy while maintaining institutional standards through advisory groups and committees (Harvard CIO, 2020).
- University of British Columbia (UBC): Implemented an e-strategy framework to align IT initiatives with institutional goals, focusing on collaboration, strategic planning, and integration across units (UBC, 2020).
- National University of Singapore (NUS): Established a Digital Transformation Office that integrates academic, research, and administrative ICT systems. This office oversees initiatives such as digital learning platforms, data analytics, and smart services (Wang & Lim, 2021).
- Seoul National University (SNU): Adopted smart campus initiatives leveraging IoT, big data, and artificial intelligence to enhance campus operations and academic services (Kim & Lee, 2022).
- University of Cambridge: Developed a long-term digital strategy that emphasizes stakeholder participation, integration of ICT systems, and alignment with research and teaching priorities (Henderson et al., 2020).

These examples illustrate the diversity of IT governance approaches while underscoring common principles: institutional ownership, stakeholder engagement, policy alignment, and sustainability.

### IT Governance Challenges in Indonesia

In the Indonesian context, universities face structural and cultural barriers to effective IT governance. Studies highlight limited resources, fragmented ICT infrastructure, and insufficient stakeholder involvement as recurring challenges (Suryanto et al., 2021). Additionally, many institutions lack formal governance frameworks such as COBIT or TOGAF, resulting in ad-hoc decision-making and inconsistent ICT policies.

For institutions like Manado State University, adopting an integrated IT governance framework provides an opportunity to address these gaps. By learning from global best practices and adapting them to local contexts, UNIMA can develop a sustainable ICT roadmap that supports its vision of becoming a competitive institution in the national and international arena.

## METHOD

This research employed a qualitative descriptive method combined with enterprise architecture planning. Data collection was carried out through interviews, surveys, observations, and document

analysis involving UNIMA stakeholders such as the rector, deans, IT managers, and faculty heads. The analysis applied TOGAF's Architecture Development Method (ADM) and COBIT 2019 to design an integrated IT governance roadmap. Key tools included SWOT, PEST, Porter's Five Forces, and Critical Success Factor (CSF) analysis to identify gaps and requirements. The research was conducted over six months, from April to August 2025.

## Research Design

This research employed a qualitative descriptive approach combined with enterprise architecture planning to design an integrated IT governance framework for Manado State University (UNIMA). The qualitative approach was chosen to capture institutional realities, stakeholder perspectives, and governance challenges in detail. Enterprise architecture planning (EAP), guided by the TOGAF Architecture Development Method (ADM) and the COBIT 2019 framework, was used as a methodological foundation to structure the proposed roadmap.

The research design consisted of three main phases:

1) Exploratory Analysis: Identifying current ICT conditions, governance practices, and strategic gaps through stakeholder engagement.
2) Framework Development: Mapping existing processes against TOGAF and COBIT 2019 to construct a governance model aligned with institutional goals.
3) Roadmap Formulation: Structuring short-term, medium-term, and long-term initiatives into a sustainable ICT roadmap.

## Data Collection

Data were collected from April to August 2025 using multiple techniques to ensure validity and reliability:

1) Semi-structured interviews: Conducted with university leaders (rector, vice rectors, deans), IT managers, and faculty heads. The interviews explored perceptions of current ICT usage, challenges in governance, and expectations for digital transformation.
2) Surveys and questionnaires: Distributed to academic staff, administrative personnel, and IT staff to gather quantitative indicators of ICT maturity and satisfaction with existing systems.
3) Observations: Direct observation of ICT infrastructure and system utilization within faculties, administration offices, and learning environments.
4) Document analysis: Examination of strategic plans, ICT policy documents, financial reports, and accreditation requirements to assess alignment between institutional vision and IT initiatives.

Triangulation of these sources ensured a comprehensive understanding of governance gaps and opportunities.

## Analytical Tools

Several analytical tools were applied to interpret data and construct the framework:

- SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats): Used to identify UNIMA's internal ICT strengths and weaknesses, as well as external opportunities and threats affecting governance.

- PEST Analysis (Political, Economic, Social, Technological): Assessed macro-environmental factors influencing ICT development in the Indonesian higher education context.
- Porter's Five Forces: Analyzed the external ICT environment, focusing on competitive pressures, stakeholder expectations, and emerging technological trends.
- Critical Success Factors (CSF): Identified institutional priorities that must be achieved for IT governance to succeed, including leadership commitment, stakeholder engagement, and system integration.

These tools provided a multi-dimensional assessment of the university's ICT ecosystem and informed the development of a governance framework tailored to UNIMA's context.

### Application of TOGAF and COBIT 2019

The TOGAF ADM was applied to design UNIMA's enterprise architecture across four domains:

1) Business Architecture: Defined the alignment of ICT initiatives with the university's academic, administrative, and research missions.
2) Information Systems Architecture: Mapped current and future application landscapes, ensuring integration across units.
3) Technology Architecture: Designed ICT infrastructure requirements, including networks, data centers, and security systems.
4) Opportunities and Solutions: Prioritized ICT initiatives and structured them into a roadmap across three horizons (short, medium, long term).

The COBIT 2019 framework complements TOGAF by providing governance objectives and performance measures. COBIT's components, such as organizational structures, policies, processes, skills, and culture, were mapped to UNIMA's current ICT governance maturity. This helped identify gaps, such as the absence of a governance committee, limited leadership involvement, and a lack of monitoring and evaluation mechanisms.

### Research Scope and Limitations

The research focused on ICT governance at the institutional level of UNIMA, covering academic, administrative, and research functions. While the study provided a comprehensive roadmap, it did not include cost-benefit analysis or detailed implementation budgets, which are recommended for future studies. Additionally, the scope was limited to internal stakeholders, and external stakeholders (such as alumni, employers, and government agencies) were not directly engaged, although their perspectives were considered through secondary documents.

### Ethical Considerations

The study adhered to ethical standards in qualitative research. Participation in interviews and surveys was voluntary, with informed consent obtained from all respondents. Data confidentiality was maintained, and findings were reported anonymously to avoid potential conflicts of interest within the institution

## RESULTS AND DISCUSSION

### *Current State of ICT at UNIMA*

The findings reveal that ICT infrastructure at UNIMA remains fragmented across units, with no central governance or strategic roadmap. Applications for academic and administrative purposes are partially implemented but lack integration, resulting in data duplication and inefficiencies. There is no formal IT governance committee, and decision-making is largely ad hoc and technical rather than strategic.

The analysis revealed that UNIMA's ICT infrastructure is fragmented and lacks institutional integration. Academic information systems, financial management platforms, and administrative applications are implemented in silos, leading to data redundancy and inefficiencies. For instance, student data is stored separately across faculties without centralized access, resulting in inconsistencies and duplication of records. Moreover, ICT infrastructure remains limited, with insufficient bandwidth, outdated hardware, and minimal cloud adoption.

Stakeholder interviews highlighted that decision-making regarding ICT remains ad hoc and technical in nature, with limited involvement of university leadership. This aligns with previous studies noting that many Indonesian universities lack structured IT governance, resulting in inefficiencies and poor alignment with institutional missions (Suryanto et al., 2021).

The current state of ICT at Manado State University (UNIMA) reflects a fragmented and underdeveloped ecosystem that limits the institution's ability to fully leverage digital technologies for academic and administrative purposes. Findings from interviews, observations, and document analysis indicate gaps in infrastructure, applications, governance structures, and human resources. These challenges mirror broader trends in Indonesian higher education institutions, where ICT governance maturity remains low compared to global best practices (Suryanto et al., 2021).

#### *ICT Infrastructure*

UNIMA's ICT infrastructure is characterized by limited network coverage, insufficient bandwidth, and reliance on outdated hardware. While internet access is available across most faculties and administrative offices, the capacity is often inadequate to support high-volume traffic, particularly during peak periods such as online registration or examinations. This aligns with findings by Rahayu and Alam (2020), who noted that infrastructure inadequacy is a common barrier to ICT integration in Indonesian universities. Moreover, the university lacks advanced infrastructure such as cloud computing environments and centralized data centers, both of which are essential for scalability and resilience (Marques & Ferreira, 2020).

#### *Applications and Information Systems*

The university operates multiple applications for academic administration, finance, human resources, and student services. However, these systems function largely in silos, with minimal interoperability. For example, student information systems in different faculties are not linked, causing duplication of records and inconsistencies in reporting. Similarly, finance and human resources applications lack integration, resulting in redundant manual processes. A survey by Rusu et al. (2020)

confirms that fragmented systems remain a major obstacle in higher education ICT governance, often leading to inefficiencies and reduced transparency.

*ICT Governance Structures*

Currently, UNIMA does not have a dedicated IT governance committee responsible for aligning ICT strategies with institutional goals. ICT-related decisions are typically made by individual units or technical staff, without systematic involvement of university leadership. This absence of a formal governance structure has led to reactive rather than proactive ICT policies, focusing more on troubleshooting technical issues than on long-term planning. Previous studies indicate that a lack of leadership involvement is a key factor contributing to governance immaturity in universities (De Haes et al., 2020; Weill & Ross, 2004).

*Human Resources and Capacity*

Human resources for ICT at UNIMA are limited both in number and expertise. IT staff often lack training in advanced areas such as enterprise architecture, cybersecurity, and data analytics. Most staff are focused on operational support rather than strategic development. Similar issues have been documented in Indonesian higher education institutions, where limited capacity-building hampers the ability to adopt global IT governance frameworks such as COBIT or TOGAF (Suryanto et al., 2021). This gap reduces the institution's ability to innovate and sustain long-term digital transformation (Fonstad & Robertson, 2020).

*ICT Policies and Strategic Alignment*

UNIMA does not yet have a formal ICT master plan or roadmap aligned with its institutional strategic vision. Policies are developed in response to immediate needs rather than guided by a long-term strategy. The lack of monitoring and evaluation mechanisms further exacerbates this issue, as there are no performance indicators to assess the contribution of ICT to academic or administrative outcomes. Henderson et al. (2020) emphasized that universities without strategic ICT policies often struggle to integrate digital initiatives with teaching, research, and community engagement.

*Comparative Analysis*

Compared to global best practices, UNIMA is still in an early stage of ICT maturity. For instance, while the National University of Singapore (NUS) has established a dedicated Digital Transformation Office to oversee integrated ICT services (Wang & Lim, 2021), UNIMA continues to operate without centralized governance. Similarly, Seoul National University (SNU) has adopted smart campus initiatives leveraging IoT and AI (Kim & Lee, 2022), whereas UNIMA remains focused on basic infrastructure and system integration. This highlights the urgent need for UNIMA to establish formal governance mechanisms and adopt international frameworks to accelerate digital transformation.

### *IT Governance Gaps*

Key governance gaps identified include: (1) absence of a formal IT Governance Committee; (2) limited leadership involvement in strategic ICT decisions; (3) lack of monitoring and evaluation mechanisms; and (4) no adoption of international governance frameworks such as COBIT or TOGAF.

Several governance gaps were identified:

1) Absence of an IT Governance Committee: There is no formal body coordinating ICT strategy across academic and administrative units.
2) Lack of Strategic Policies: ICT policies are reactive, addressing immediate technical problems rather than long-term objectives.
3) Minimal Monitoring and Evaluation: No performance indicators are used to measure the contributions of ICT to institutional outcomes.
4) Limited Use of International Frameworks: UNIMA has yet to adopt structured frameworks such as COBIT 2019 or TOGAF to guide ICT planning and governance.

These gaps mirror global findings that emphasize the importance of formal governance mechanisms to ensure IT investments support institutional missions (Weill & Ross, 2004; De Haes et al., 2020).

The analysis of Manado State University's (UNIMA) ICT ecosystem revealed several significant governance gaps that hinder the effective alignment of IT with institutional goals. These gaps span governance structures, policies, monitoring mechanisms, resource management, and strategic frameworks. Similar challenges have been reported in other Indonesian universities, where governance maturity remains at an initial or developing stage (Suryanto et al., 2021).

#### *Absence of a Formal IT Governance Committee*

One of the most critical gaps identified is the absence of a formal IT Governance Committee. At UNIMA, decision-making related to ICT is primarily technical, delegated to IT staff within individual units without coordination at the institutional level. There is no clear accountability framework or defined decision rights for IT-related investments. This situation contrasts with best practices in leading universities, such as Harvard, where an institutional IT governance committee ensures alignment between IT initiatives and academic priorities (Harvard CIO, 2020). The lack of such a structure at UNIMA results in fragmented decision-making and duplication of initiatives.

#### *Lack of Strategic ICT Policies and Long-term Roadmap*

UNIMA has yet to establish formal ICT strategic policies or a master plan aligned with its institutional vision. Current ICT initiatives are reactive, focusing on short-term problem-solving rather than proactive strategic planning. This gap is critical, as effective governance frameworks emphasize policy formulation and strategic alignment as foundational components (ISACA, 2019; Weill & Ross, 2004). Without a long-term roadmap, ICT development at UNIMA risks stagnation, with investments failing to generate sustainable value.

#### *Limited Monitoring and Evaluation Mechanisms*

Another major gap lies in the absence of systematic monitoring and evaluation (M&E) mechanisms. UNIMA does not employ performance indicators to assess ICT's contribution to academic,

research, or administrative outcomes. Internationally, frameworks such as COBIT 2019 emphasize performance measurement through key governance objectives and metrics (De Haes et al., 2020). The absence of M&E mechanisms reduces transparency and accountability, making it difficult to justify ICT investments or measure progress toward digital transformation.

*Fragmented ICT Systems and Lack of Integration*

Although several ICT applications exist at UNIMA, they function in silos, without integration across faculties or administrative units. For example, student and financial data systems are maintained separately, creating duplication and inefficiencies. Rusu et al. (2020) highlight that system fragmentation is a common challenge in higher education institutions lacking governance frameworks. Integration is essential for efficiency, data accuracy, and informed decision-making, but this remains underdeveloped at UNIMA.

*Insufficient Human Resource Capacity in ICT Governance*

The limited number and expertise of ICT personnel further exacerbate governance challenges. Most IT staff at UNIMA are trained in technical support but lack skills in strategic governance, enterprise architecture, and risk management. Similar findings were observed in Indonesian universities, where limited ICT capacity-building initiatives hinder the implementation of global frameworks like TOGAF and COBIT (Suryanto et al., 2021). This human resource gap prevents UNIMA from adopting advanced governance practices that require multidisciplinary expertise.

*Lack of Alignment with International Frameworks*

Finally, UNIMA has not adopted or adapted international ICT governance frameworks such as COBIT 2019 or TOGAF. These frameworks provide comprehensive guidelines for aligning IT with organizational goals, ensuring accountability, and managing risks (ISACA, 2019; The Open Group, 2018). Without leveraging such frameworks, UNIMA risks lagging behind peer institutions globally, where formalized IT governance has become a standard practice for digital transformation (Henderson et al., 2020; Wang & Lim, 2021).

*Comparative Insights*

These governance gaps indicate that UNIMA remains at an early stage of ICT governance maturity, similar to other Indonesian institutions identified by Rusu et al. (2020). In contrast, global universities such as MIT, UBC, and NUS demonstrate how structured governance committees, strategic policies, performance indicators, and adoption of international frameworks create an enabling environment for innovation and transformation (MIT, 2021; UBC, 2020; Wang & Lim, 2021).

Addressing these governance gaps is crucial for UNIMA's digital future. Establishing a formal IT governance structure, creating strategic policies, adopting frameworks such as COBIT and TOGAF, and strengthening human resources are key steps toward achieving sustainable ICT development.

## *Proposed Roadmap*

The proposed roadmap is structured into three horizons:

1) Short-term (1–5 years):

- Establish an IT Governance Committee chaired by university leadership.
- Develop and formalize ICT strategic policies.
- Integrate academic and administrative systems into a centralized platform.

2) Medium-term (6–15 years):
   - Expand integration to research management, community service, and digital student services.
   - Develop advanced e-learning platforms and digital libraries.
   - Implement data governance and cybersecurity frameworks.
3) Long-term (16–25 years):
   - Achieve full digital transformation into an ICT-driven smart campus.
   - Adopt emerging technologies such as artificial intelligence, big data analytics, and cloud-based services.
   - Strengthen international collaboration through digital platforms.

**Table 1**. UNIMA IT Governance Roadmap

| Time Horizon | Key Focus |
|---|---|
| Short Term (1–5 years) | Governance foundation: establishment of an IT Governance committee, development of strategic ICT policies, and integration of academic and administrative systems. |
| Medium Term (6–15 years | Development of integrated applications for research, community service, and digital-based student services. |
| Long Term (16–25 years | Full digital transformation: ICT-based campus with an adaptive digital ecosystem for academics, research, administration, and external collaboration. |

Please pay attention to the following Unima IT Governance Roadmap Figure 1

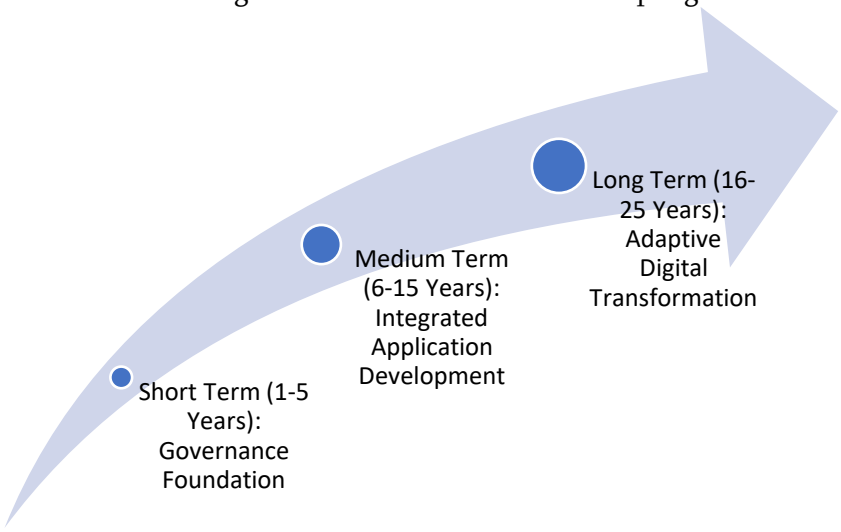


**Figure 1**. IT Governance Roadmap

Table 1 and Figure 1 illustrate the IT Governance roadmap for Manado State University (UNMA) in three different time horizons: short-term, medium-term, and long-term. In the short term (1–5 years), the primary focus is on building a solid governance foundation. This phase includes the establishment of an IT Governance Committee, which serves as a strategic oversight and direction for all IT-related decisions. This committee's existence is crucial to ensure that UNIMA's ICT policies are not merely technical but also aligned with the university's vision, mission, and strategic plan. This aligns with research by De Haes et al. (2020), which emphasized the importance of a formal governance structure for IT investments to generate strategic value. Furthermore, the development of a strategic ICT policy is essential to ensure that all work units share common guidelines for developing and managing information systems. Integration between academic and administrative systems is also a priority, given the current state of data fragmentation and information duplication, which hamper operational effectiveness (Ross & Weill, 2004). Furthermore, in the medium term (6–15 years), the roadmap emphasizes the development of integrated applications that can more optimally support the implementation of the Tri Dharma of Higher Education. At this stage, UNIMA is directed to develop a research and community service information system connected to the academic system, so that lecturers and students can access research data and community service activities on a single, integrated platform. Furthermore, digital-based student services such as online registration, online academic guidance, and application-based student administration services need to be consistently developed. According to Rusu et al. (2020), the success of IT governance in higher education depends heavily on the institution's ability to align information systems with the needs of users, both academics and students. By achieving this integration, universities not only improve the quality of internal services but also expand information accessibility for the academic community. This intermediate stage serves as a bridge between the governance foundation established initially and the vision of full digital transformation in the future.

In the long term (16–25 years), the roadmap targets the realization of full digital transformation towards an ICT-based Campus concept. At this stage, UNIMA is expected to have an adaptive digital ecosystem capable of integrating all academic, research, administrative, and external collaboration activities into a single, integrated platform. The university's information system not only functions as operational support but also serves as a key enabler for learning innovation, research collaboration, and international networking expansion. The use of big data analytics, cloud computing, and artificial intelligence has significant potential to improve the quality of learning and research effectiveness (Fonstad & Robertson, 2020). This is consistent with the global trend where leading universities are adopting digital technologies to create smart and globally competitive campuses (Ghosh et al., 2023). By achieving this stage, the university will be able to compete with other universities at the national and international levels, and utilize ICT as a key instrument in improving the quality, relevance, and competitiveness of the institution.

### *Horizon A — Short Term (1–5 years)*

Main objectives: Establish a formal governance framework, align strategies, and integrate priority systems.

Main Activities and Milestones

1) Establish an IT Governance Committee (ITGC)

- Duties: Develop strategic IT policies, approve roadmaps, and monitor KPIs.
- Composition: Rector (chair/ownership guarantor), relevant Vice Rectors, Deans from each faculty, Head of the Computer Technical Implementation Unit (UPT), representatives from the Office of Information Technology (BAAK/BKD), representatives from research lecturers, student representatives, and the technical secretariat from the Office of IT.
- Milestone: Establishment Decree + Terms of Service (TOR) & quarterly meeting schedule within the first 3 months.

2) Develop an ICT Strategic Policy & Roadmap Document (version 1.0)
   - Output: Policy document, basic security policy, Data and Privacy Policy, and a map of priority projects for 1–3 years.
   - Milestone: Draft policy within 6 months, final and ratified within 9–12 months.
3) Academic & Administrative System Integration (Quick Wins)
   - Activities: audit of existing applications, definition of master data (student master data), integration of SIAKAD with finance and HR via middleware or API.
   - Milestone: Interoperability of basic data and integrated reporting within 12–24 months.
4) Initial Architecture Determination using TOGAF (Architecture Vision + Business Architecture)
   - Output: High-level overview of architecture (data, applications, technology) and medium-term target architecture.
   - Milestone: Architecture Vision completion within 6–9 months.
5) Human Resource Strengthening: Basic training for IT staff and management
   - Focus: Governance awareness, project management, architecture fundamentals (TOGAF overview), and security.
   - Milestone: Training program for 100% of IT staff within 12 months.

- Responsible Person
  - Chair: Rector/Vice Rector for Education or IT (guarantor of ownership).
  - Technical implementers: Office of IT / Head of Computer Unit; ITGC secretariat.

- KPI (parent)
  - ITGC Decree issued and TOR approved (yes/no).
  - Strategy and roadmap documents completed and ratified (date).
  - Percentage of student data integration between faculty and center (initial target: 70% by the end of the second year).
  - Percentage of IT staff certified/trained (target: 100% basic training in the first year).
  - Quarterly ITGC reports are available.

- Resources
  - Funding sources: UNIMA PNBP allocation, grants, or national/regional budgets (APBN/regional budgets, if available). (Initial budget reference in the proposal: IDR 50,000,000 for research/pilot activities; institutional projects will require additional budgeting.)

- Internal human resources + architecture/COBIT/TOGAF consultants for the initial phase.

- Risks & mitigation
  - Risk: Faculty unit resistance to data centralization.
  - Mitigation: Involve faculty representatives from the outset; establish a controlled exception mechanism; communicate the benefits of integration.
  - Risk: Underfunding.
  - Mitigation: Project phasing (pilot before scaling), seek donor/grant collaboration.

- Mapping to TOGAF & COBIT
  - TOGAF: Architecture Vision, Business Architecture (phases A & B).
  - COBIT: EDM (Evaluate, Direct, and Monitor) for governance, APO (Align, Plan, and Organize) for strategy and policy. (ISACA, 2019; The Open Group, 2018)

(References: Weill & Ross, 2004; ISACA, 2019; The Open Group, 2018)

### *Horizon B — Medium Term (6–15 years)*

Main objective: Strengthen service integration, data governance, security, and digital services that support the Tri Dharma.

1) Main activities and milestones
   - Development and implementation of integrated enterprise applications
   - Focus: Research management system (RMS), institutional repository, integrated learning management system (LMS), alumni portal, and automated financial services.
   - Milestone: Implementation of RMS and institutional repository from years 3–6; LMS integrated across all faculties in years 6–8.
2) Implementation of Data Governance and Master Data Management (MDM)
   - Activities: Create a data steward, data quality policy, metadata management, and data catalog.
   - Milestone: MDM operational in year 6.
3) Strengthen cybersecurity and continuity planning
   - Activities: Advanced security policies, SIEM or monitoring, offsite/cloud backup, DRP.
   - Milestone: Basic security certification (e.g., ISO 27001 roadmap) starting in years 4–7.
4) Digital services for students and staff: e-services, mobile apps
   - Milestone: Full availability of e-registration, e-payment, and e-guidance services in years 6–10.
5) Mid-level human resource capacity building & architecture certification
   - Focus: TOGAF foundation/COBIT training for IT architects, project managers, and unit representatives.
   - Milestone: At least 3 TOGAF/COBIT-certified IT architects/leads in years 8–10.
6) IT business value measurement: KPI & dashboard reporting
   - Output: KPI dashboard approved by ITGC, reporting frequency, and annual cost-benefit review.

- Responsible Person
  - ITGC (supervision), Office of IT (implementation), faculty/functional unit (application owner), Finance Bureau (payment integration).
- KPI (parent)
  - Enterprise application integration level (target > 85% integrated core modules).
  - Data quality (error rate < 5% on critical datasets).
  - Service recovery time (RTO) and service availability level (uptime > 99% on critical services).
  - Number of TOGAF/COBIT-certified IT staff.
  - Reduction of manual processes (percentage of digitized processes).

- Resources
  - Hardware and cloud services investment; LMS/RMS licensing; training budget; security audit costs.

- Risks & Mitigation
  - Risk: Large application implementations trigger service disruptions.
  - Mitigation: modular and pilot approaches, change management, clear SLAs.
  - Risk: data compliance and privacy issues.
  - Mitigation: data policies, compliance monitoring by ITGC, data awareness training.

- Mapping to TOGAF & COBIT
  - TOGAF: Information Systems Architecture, Technology Architecture (phases C & D).
  - COBIT: BAI (Build, Acquire and Implement), DSS (Deliver, Service and Support), MEA (Monitor, Evaluate and Assess).

  (References: The Open Group, 2018; ISACA, 2019; De Haes et al., 2020)

### *Horizon C — Long Term (16–25 years)*

Main objective: Achieve an adaptive smart campus based on AI, analytics, and cloud-based services, with mature governance and international collaboration.

Main Activities and Milestones

1) Transformation to a Smart ICT-based Campus
   - Initiatives: IoT for facilities management, AI for adaptive learning and academic analytics, integrated research data lake.
   - Milestone: PoC for AI analytics in years 12–15; scaled adoption in years 16–20.
2) Enterprise Data Analytics & Research Ecosystem
   - Activities: Data lake, analytics platform, research collaboration platforms, open science services.
   - Milestone: Data-driven decision-making as standard practice at ITGC in years 18–20.
3) Cloud-Native & Hybrid Infrastructure
   - Activities: Transition to cloud-native architecture for scalability and resilience; DevOps automation.

- Milestone: Most non-critical services moved to the cloud in years 15–20.

4) Governance Maturity: Continuous Architecture Change Management
   - Activities: architecture change management, continuous improvement, policy refresh cycles.
   - Milestone: Change management process automated and integrated with KPIs, and architecture review every 2 years.
5) Sustainable Financing Scheme & International Collaboration
   - Activities: Mixed funding model, international research collaboration, and regional infrastructure participation.
   - Milestone: At least 2 international research collaborations based on digital platforms in years 20+.

- Responsible Person
  - ITGC (policy & oversight), Office of IT + Center for Data & Analytics, Office of Research, external partners.

- KPI (parent)
  - Percentage of strategic decisions supported by analytics (>80%).
  - Number of publications/research utilizing digital infrastructure.
  - Resilience metrics: RTO/RPO according to SLA.
  - Adoption rate of AI-enabled services by users (staff & students).

- Resources
  - Long-term investment in cloud, AI platforms, data science teams, and R&D partnerships.

- Risk & Mitigation
  - Risk: Cloud vendor dependency.
  - Mitigation: Hybrid architecture, multicloud strategy, strong service agreements.
  - Risk: AI ethics and privacy issues.
  - Mitigation: Data & AI ethics policy, ethics committee oversight.

- Mapping to TOGAF & COBIT
  - TOGAF: Opportunities & Solutions, Migration Planning, Implementation Governance, Architecture Change Management (Phases E–H).
  - COBIT: MEA (monitoring & assurance) enhanced, EDM (evaluate & direct) mature.
    (References: De Haes et al., 2020; The Open Group, 2018; ISACA, 2019)

*Governance Implementation Roadmap — Implementation Principles*

1) Phased delivery: pilot → scale-up → institutionalize.
2) Stakeholder engagement: faculty, administration, students, and external representatives from the planning stage.
3) Value-based prioritization: projects are ranked based on strategic value, cost, and risk.

4) Continuous monitoring: centralized KPI dashboard, quarterly reports to ITGC, and annual reports to the Senate/Rectorate.
5) Change management & communication: communication plan, ongoing training, incentive alignment.

(Governance theory references: Weill & Ross, 2004; De Haes et al., 2020)

### *Budget and Funding Estimates*

Initial phase (1–2 years): costs for establishing governance, architectural consultation, core system integration, and training. Medium estimate: several hundred million to several billion rupiah, depending on scale and cloud usage. UNIMA's initial research proposal budgeted IDR 50,000,000 for research/pilot activities; A larger institutional budget will be required for campus-scale implementation.

Medium & long-term phases: investment in infrastructure, licensing, human resources, and cloud services; possible sources: PNBP, national/international grants, industry collaboration, or government funding.

Summary of key deliverables per horizon

- Years 1–2: ITGC, ICT policy, Architecture Vision, student data integration pilot.
- Years 3–6: MDM, RMS, integrated LMS, security & continuity program.
- Years 7–15: comprehensive digital student services, mature data governance, certified staff.
- Years 16–25: smart campus, AI analytics, cloud-native operations, international collaboration.

*Note: The figures here are indicative; an RFP and business case are required for exact figures.*

The integrated IT governance roadmap for Manado State University (UNIMA) was designed as a phased strategy across three horizons: short-term (1–5 years), medium-term (6–15 years), and long-term (16–25 years), to ensure gradual yet sustainable digital transformation. In the short-term horizon, the priority is to establish the foundational governance structures required for ICT integration. This includes the formation of an IT Governance Committee chaired by university leadership, which will provide strategic oversight and ensure institutional ownership of ICT initiatives. Parallel efforts involve the formulation of comprehensive ICT strategic policies, the development of a formal ICT master plan, and initial system integration projects, such as linking academic information systems with administrative and financial applications. This stage also emphasizes capacity building through training programs for IT staff and management to enhance awareness of governance and enterprise architecture. These initiatives correspond with TOGAF's Architecture Vision and Business Architecture phases and COBIT's Evaluate, Direct, and Monitor (EDM) and Align, Plan, and Organise (APO) domains, which highlight leadership involvement and strategic planning as critical success factors (ISACA, 2019; The Open Group, 2018).

The medium-term horizon focuses on expanding the scope of ICT integration to support the university's Tri Dharma Perguruan Tinggi: teaching, research, and community service. This includes the implementation of enterprise applications such as a research management system, an institutional repository, and an advanced learning management system integrated across faculties. Simultaneously, the roadmap calls for the establishment of master data management policies, data governance frameworks, and improved cybersecurity mechanisms, including disaster recovery and business

continuity plans. Digital services for students and faculty, such as mobile applications and e-services, are also prioritized to enhance user experience and administrative efficiency. By embedding monitoring and evaluation mechanisms and introducing performance dashboards, this horizon aligns with COBIT's Build, Acquire, and Implement (BAI) and Deliver, Service, and Support (DSS) domains, as well as TOGAF's Information Systems and Technology Architecture phases. Such efforts are consistent with global best practices, as demonstrated by the University of British Columbia's e-strategy and the National University of Singapore's Digital Transformation Office, both of which emphasize integration, service innovation, and performance monitoring (UBC, 2020; Wang & Lim, 2021).

The long-term horizon envisions a fully digital, smart-campus environment that leverages advanced technologies such as artificial intelligence (AI), big data analytics, Internet of Things (IoT), and cloud-native infrastructures. This stage emphasizes the establishment of enterprise-wide analytics and research ecosystems, enabling data-driven decision-making at both academic and administrative levels. AI-driven platforms will support adaptive learning and predictive analytics for student success, while IoT systems will enhance campus operations such as facility management and security. Governance maturity will be institutionalized through continuous architecture change management, ensuring policies and strategies are regularly reviewed and adapted to technological advances. Furthermore, sustainable financing models and international partnerships will be developed to support ongoing innovation and resilience. This phase aligns with TOGAF's Opportunities and Solutions, Migration Planning, and Architecture Change Management stages, as well as COBIT's Monitor, Evaluate, and Assess (MEA) domain. Comparable strategies can be observed in Seoul National University's adoption of smart campus initiatives and Cambridge's digital strategy, which demonstrate how long-term vision, advanced technology adoption, and institutionalized governance frameworks can reinforce global competitiveness (Kim & Lee, 2022; Henderson et al., 2020).

Overall, the proposed roadmap provides a structured pathway for UNIMA to evolve from fragmented ICT practices to a mature governance environment that supports sustainable digital transformation. By addressing governance structures in the short term, expanding integration and data governance in the medium term, and adopting advanced technologies in the long term, the framework ensures both immediate improvements and long-term resilience. More importantly, the roadmap contextualizes global frameworks such as COBIT 2019 and TOGAF to the Indonesian higher education system, providing both theoretical contributions to IT governance research and practical guidance for institutional leaders navigating digital transformation (De Haes et al., 2020; Rusu et al., 2020).

The roadmap aligns IT governance with UNIMA's mission, providing both theoretical and practical contributions. Theoretically, the framework adapts global governance models to the Indonesian higher education context. Practically, it offers a structured plan for digital transformation. Compared to best practices, UNIMA's roadmap shares similarities with NUS's digital transformation office, SNU's smart campus initiative, and Cambridge's Digital Strategy. These cases emphasize the importance of integration, stakeholder participation, and long-term vision.

This study extends IT governance literature by contextualizing COBIT 2019 and TOGAF ADM within the Indonesian higher education setting. Previous research has shown the importance of adapting global frameworks to local contexts (Rusu et al., 2020; Sharma & Singh, 2020). By integrating governance and architecture perspectives, the framework ensures both strategic alignment and technical feasibility.

*Practical Implications*

The roadmap offers a structured pathway for UNIMA's digital transformation. In the short term, institutional ownership is reinforced by the establishment of a governance committee, aligning with best practices at Harvard and Cambridge, where leadership plays a central role in ICT strategy (Harvard CIO, 2020; Henderson et al., 2020). In the medium term, system integration parallels UBC's e-strategy and NUS's digital transformation office, emphasizing collaboration and service delivery (UBC, 2020; Wang & Lim, 2021). In the long term, the roadmap aspires toward smart campus initiatives, comparable to Seoul National University's adoption of IoT and AI (Kim & Lee, 2022).

*Comparative Insights*

When compared with global universities, UNIMA's current ICT governance is at a nascent stage. However, the proposed roadmap provides a realistic, phased approach to bridge this gap. Unlike MIT, which has long-established centralized IT services, UNIMA must gradually build governance capacity and infrastructure. Yet, by learning from these models, UNIMA can leapfrog into sustainable digital transformation, enhancing both academic and administrative competitiveness.

*Future Opportunities*

Future research may integrate adaptive governance models based on artificial intelligence and machine learning to support decision-making. Additionally, cross-institutional collaboration with other Indonesian and ASEAN universities could enhance benchmarking and knowledge sharing. These opportunities align with the broader vision of Indonesia's higher education digital transformation agenda (Suryanto et al., 2021).

## CONCLUSION

This study developed an integrated IT governance framework to support a sustainable ICT roadmap at Manado State University (UNIMA). The research revealed that UNIMA's current ICT ecosystem remains fragmented, with siloed systems, limited infrastructure, insufficient governance structures, and a lack of alignment between ICT initiatives and institutional goals. These challenges are consistent with previous findings on the low maturity of ICT governance in Indonesian higher education (Suryanto et al., 2021; Rusu et al., 2020). To address these gaps, a three-horizon roadmap was formulated, combining the governance principles of COBIT 2019 with the architectural guidance of TOGAF. The roadmap emphasizes the establishment of formal governance structures and strategic policies in the short term, expansion of integration and data governance in the medium term, and full digital transformation through advanced technologies in the long term. This study demonstrates that UNIMA's ICT is still fragmented and lacks strategic direction. The proposed integrated IT governance framework provides a sustainable roadmap across three horizons: short-term, medium-term, and long-term. Implementation of this roadmap is expected to improve academic and administrative efficiency, support research and community engagement, and enhance UNIMA's global competitiveness. Future

research may expand this framework by incorporating adaptive AI governance models and cross-institutional collaborations. Theoretically, this study contributes to IT governance research by contextualizing global frameworks within the realities of a developing country's higher education system. It demonstrates how COBIT and TOGAF, typically applied in corporate or advanced institutional environments, can be adapted to align with the governance needs of Indonesian universities. Practically, the roadmap provides a structured guide for UNIMA's leaders to strengthen institutional efficiency, enhance transparency, and improve service delivery. Moreover, by comparing UNIMA's challenges and solutions with global best practices from institutions such as Harvard, NUS, and SNU, the study highlights pathways for benchmarking and international collaboration.

### *Recommendations*

Several recommendations arise from the findings. First, UNIMA must institutionalize IT governance through the immediate establishment of an IT Governance Committee under the direct supervision of university leadership. This body will ensure accountability, coordination, and ownership of ICT initiatives. Second, the university should prioritize the development of a comprehensive ICT master plan, supported by policies on data governance, cybersecurity, and digital services. Third, capacity building for ICT staff and leadership is essential, particularly in enterprise architecture, risk management, and emerging technologies. Finally, UNIMA should actively pursue partnerships with international universities and industry to accelerate technology adoption, secure funding opportunities, and ensure global competitiveness.

Future research should explore the integration of adaptive governance mechanisms, such as AI-driven decision support systems, to enhance governance responsiveness. Cross-institutional studies across Indonesian and ASEAN universities could also provide comparative insights, enabling the development of a regional framework for sustainable ICT governance. By adopting this roadmap and pursuing continuous improvement, UNIMA can position itself as a leading digital university in Eastern Indonesia, contributing to national education goals and the broader vision of digital transformation in higher education.

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