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Application of the TOEH Framework to Analyze Readiness for Adoption of Information Technology in Institutions in Central Java

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Abstract

Digital transformation within the public sector requires a high level of organizational readiness to ensure the successful adoption of information technology (IT). This study investigates the key factors influencing IT adoption readiness in public agencies in Central Java, employing the TOEH framework—Technology, Organization, Environment, and Human Resources—as the analytical foundation. Data were collected through a structured survey involving 102 respondents, selected using purposive sampling from relevant government institutions. The questionnaire utilized a five-point Likert scale to capture perceptions across the four dimensions. Validity tests confirmed that all items in the instrument were statistically valid, while reliability analysis indicated that the Technology variable had the highest internal consistency (Cronbach's Alpha = 0.899), followed by Organization (α = 0.659), Human Resources (α = 0.587), and Environment (α = 0.485). The findings reveal that technology-related factors—such as security, compatibility, and perceived usefulness—are the strongest drivers of readiness. Organizational support, employee competence, and policy environments also play critical roles, though to varying degrees. This study highlights the necessity of a synergistic approach that integrates internal capacities and external influences to build holistic digital readiness in the public sector. The results offer practical implications for policymakers and institutional leaders seeking to accelerate digital transformation agendas.

Keyword: adoption of information technology, organizational readiness, public sector, TOEH framework, digital transformation

1. Introduction

Digital transformation has become imperative for public sector institutions in the era of Industry 4.0. The ability of government organizations to adopt and utilize information technology (IT) determines their effectiveness in providing services that are efficient, transparent, and accountable. However, successful IT adoption is not solely about technological availability—it requires comprehensive readiness at the organizational level, including human competencies, innovation culture, and external environmental support.

In Indonesia, the push for digital transformation in the public sector is being accelerated through national programs such as Sistem Pemerintahan Berbasis Elektronik (SPBE) and Smart City initiatives. These programs are designed to increase the transparency, efficiency, and accountability of public services through the integration of IT. However, these top-down initiatives must be met with a bottom-up readiness within individual institutions, which includes the availability of supportive infrastructure, skilled personnel, and organizational commitment.

Studies have shown that IT initiatives often fail not due to technical inadequacies but because lack of leadership support or resistance from end users. Managerial support, infrastructure availability, system compatibility, and workforce skills are all essential enablers. For instance, research by Fareed et al. (2023) [1] emphasizes the role of transformational leadership in ensuring project success, while Wang et al. (2021) [2] highlight the importance of human capital and innovation speed in digital performance.

Previous studies have confirmed that factors such as managerial support, employee competence, infrastructure availability, and system security have a significant influence on determining the success of IT implementation.

Therefore, it is important to examine how these factors play a role in an institution's efforts to accelerate the digitalization of its services and systems.

The TOE framework (Technology-Organization-Environment), as shown in Figure 1, is widely used in IT adoption research, provides a comprehensive model to examine the determinants of organizational readiness. However, many scholars have argued that this framework needs to include human capital explicitly. Research in 2015 and 2017 adopted the TOE framework [2], [3], [4] as the basis for research, then integrated external environmental pressures into the environmental dimension and added the human dimension to the TOE dimension framework, resulting in a new framework, namely the TOEH framework [5], [6], [7]. The TOEH framework was introduced, adding Human Resources (H) as a separate pillar to account for the increasingly critical role of human competencies in digital adoption.

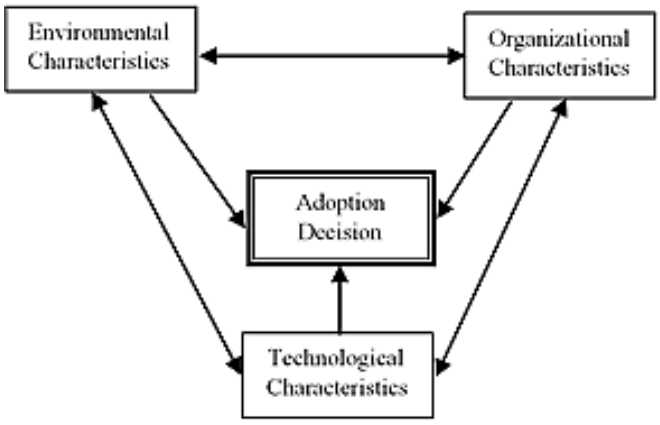

Figure 1. TOEH Framework

In this study, the framework is used to identify and analyze the extent to which technological, organizational, environmental, human, and feedback factors influence IT adoption readiness in institutions in Central Java, as well as to answer the question: "What factors influence IT adoption readiness in institutions in Central Java according to the TOEH framework?". The expected contribution of this study lies in offering empirical insights that can guide policymakers and institutional leaders in designing interventions to support IT adoption. By identifying key enablers and barriers across the four TOEH dimensions, the study aims to provide a diagnostic tool for assessing institutional digital readiness in the public sector context.

1. Method

This study employed a quantitative research design using a survey approach. The population consisted of civil servants and employees involved in the use and implementation of IT systems within various institutions in Central Java. A total of 102 respondents were selected using purposive sampling based on their direct involvement in IT usage or management.

Instrument Development:

The questionnaire was structured around the TOEH framework [5], [6], [7] As shown in Figure 2, covering four primary constructs: Technology, Organization, Environment, and Human Resources. Each construct included multiple items rated on a 5-point Likert scale:

1) 1 = Strongly Disagree
2) 2= Disagree
3) 3 = Neutral
4) 4 = Agree
5) 5 = Strongly Agree

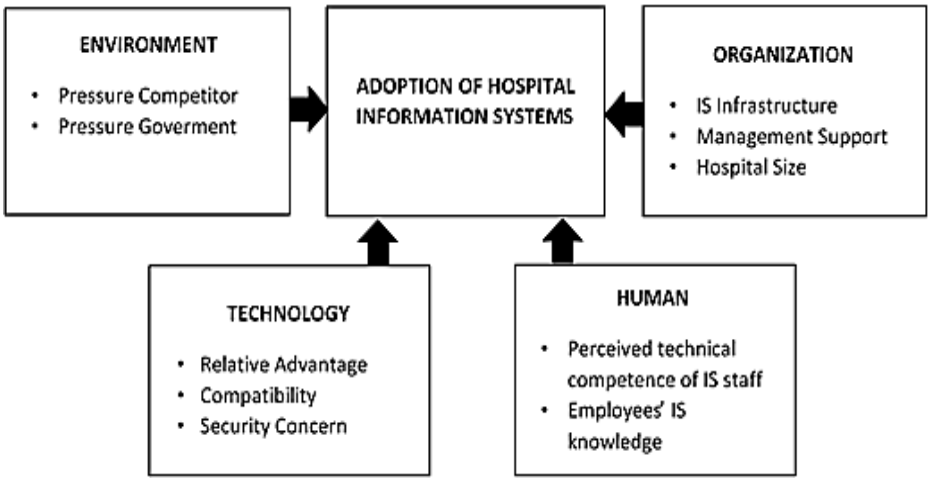

Figure 2. TOEH Framework

Data Collection and Analysis

Data collection was conducted through a structured survey using a Likert-scale questionnaire instrument. The instrument was designed to measure perceptions of IT adoption readiness across four dimensions—Technology, Organization, Environment, and Human Resources (HR)—as derived from the TOEH framework. The survey was distributed to employees from selected public agencies in Central Java, with a total of 102 valid responses obtained through purposive sampling. This sampling method was chosen to ensure that respondents had relevant roles or experiences related to digital initiatives within their organizations.

Data Analysis Procedures

The collected data were analyzed through descriptive statistics to summarize:

- Demographic characteristics (e.g., age, gender, education),
- Central tendencies (mean, median, mode) of each item,
- Response patterns across variables.

To assess instrument quality, two main procedures were performed:

1. Validity Testing:
    - Pearson's product-moment correlation was used to evaluate the construct validity of each item by correlating individual items with their corresponding total scores.
    - A significance value (p-value) < 0.05 was the threshold for determining validity.
    - The results showed that all questionnaire items were statistically valid, indicating that each item effectively measured its intended construct.
2. Reliability Testing:
    - Cronbach's Alpha was used to determine the internal consistency of each variable.
    - Interpretation was based on standard thresholds:
        - ≥ 0.7 = Good
        - 0.6–0.7 = Acceptable
        - < 0.6 = Low/Needs Improvement, though may still be retained based on theoretical relevance.

Reliability Results and Interpretation

The results of Reliability and Interpretation are shown in the data in Table 1.

Table 1. Reliability Results and Interpretation

Variable	Cronbach's Alpha (α)	Interpretation
Technology	0.899	Very High Reliability
Organization	0.659	Acceptable Reliability
Human Resources	0.587	Borderline Acceptable
Environment	0.485	Low Reliability, Retained for Relevance

- The Technology dimension showed excellent reliability, indicating that the items under this construct were highly consistent and well-understood by respondents.
- The Organization dimension yielded a reliability score of 0.659, which falls within the acceptable range, suggesting moderate consistency across items related to managerial support, infrastructure, and governance.
- The Human Resources (HR) dimension had a slightly lower alpha (0.587), suggesting some variability in responses. However, due to the theoretical importance of HR in digital readiness (e.g., employee skills and training), items under this dimension were retained for further analysis and interpretation.
- The Environment dimension showed the lowest reliability (0.485). While this would typically raise concerns, the construct was retained in the study due to its conceptual relevance—external forces such as policy and regulation often exert heterogeneous influences in public sector settings, which may explain the wider range of perceptions.

The overall results of the data quality assessment indicate that the measurement instrument was valid and generally reliable for use in analyzing IT adoption readiness. The Technology dimension stood out as the most statistically robust, while the Environment dimension, despite lower internal consistency, provided meaningful insights into the external pressures and policy drivers influencing digital transformation in the public sector.

2. Results

This section presents the main findings from the analysis of questionnaire data collected from 102 respondents. The analysis includes demographic characteristics, instrument validity and reliability, and responses to each variable studied.

1. Respondent Characteristics

Respondents' demographic profiles are summarized in Table 2.

Table 2. Demographic Characteristics of Respondents (n = 102)

Variable	Category	Frequency	Percentage (%)
Age	20–29 years	18	17.6
	30–39 years	48	47.1
	40–49 years	25	24.5
	≥50 years	11	10.8
Gender	Male	72	70.6
	Female	30	29.4
Education Level	Bachelor (S1)	20	19.6
	Master (S2)	75	73.5
	Doctorate (S3)	7	6.9

The data shows that respondents are mostly in their 30s, predominantly male, and highly educated, with a strong concentration at the master's level, suggesting a mature and academically capable population.

2. Validity and Reliability of Instruments

All indicators passed the validity test with significance values below 0.05. Cronbach's Alpha values for each construct are shown in Table 3.

Table 3. Instrument Reliability (Cronbach's Alpha)

Variable	Number of Items	Cronbach's Alpha	Interpretation
Technology	5	0.899	Very High Reliability
Organization	4	0.659	Acceptable
Human Resources	3	0.587	Marginal
Environment	3	0.485	Low, but usable
Feedback	2	0.605	Acceptable

While Technology shows excellent internal consistency, HR and Environment variables are slightly below the general reliability threshold, but are still considered for their conceptual contribution.

3. Responses to Key Research Variables

Respondents' agreement with key items for each construct is summarized in Table 4.

Table 4. Summary of Respondents' Agreement on Key Variables

Variable	Key Indicator	Agreement (%)
Technology	Security (Confidentiality, Integrity, Availability)	92.2%
	Compatibility	90.2%
	Perceived Benefits	91.2%
Organization	Top Management Support	90.2%
	Infrastructure Readiness	90.2%
Environment	Government Policy	85.3%
	Competitor Pressure	71.6%
Human Resources	Employee Knowledge	90.2%
	Employee Competence	83.3%

Across all variables, support for security, organizational commitment, and human resource competence is consistently high. Slightly lower responses on environmental competitiveness suggest it is perceived as less pressing than internal enablers.

3. Discussion

The results of this study underscore the significance of five key variables—Technology, Organization, Environment, and Human Resources (HR) — in shaping the digital readiness of institutions to adopt information technology (IT). Each variable contributes uniquely and interacts dynamically with others to form a holistic digital transformation framework. The discussion below explores the contribution of each variable and links the findings to the relevant body of literature.

1. Technology

Among all variables, technology factors emerged as the most dominant contributor, evidenced by the highest Cronbach's Alpha (0.899) and the strongest level of respondent agreement (above 90% on key indicators).

Key elements driving this result include:

- System security: encompassing confidentiality, integrity, and availability, it is perceived as essential for building trust in IT systems.
- Compatibility: High compatibility with existing processes and systems ensures minimal disruption and facilitates smoother integration.
- Perceived benefits: these motivate users to support and engage with new systems, especially when technology brings visible efficiency and productivity gains.

These findings are consistent with the Technology-Organization-Environment-Human (TOEH) framework, which posits that technological readiness is the foundational requirement for IT adoption. Similar conclusions were drawn by previous studies [5], [6], [7], which emphasizes the centrality of technical factors such as security, system reliability, and usability in determining adoption outcomes. Technological readiness is not just about the availability of tools but also about the perceived *quality* and *reliability* of those tools. When systems are secure, compatible, and beneficial, adoption becomes significantly more feasible.

2. Organization

Organizational factors play a strategic enabling role in technology adoption. The findings show a high level of agreement (90.2%) regarding the importance of top management support and infrastructure availability.

Key organizational drivers include:

- Strategic leadership: Top management support provides clear direction, legitimacy, and resource prioritization for IT projects.
- Infrastructure and governance: Adequate physical and digital infrastructure, budget allocation, and structured governance mechanisms ensure that the implementation process is well-supported.

These results align with existing literature, particularly [1], [8], [9], which highlights executive support as a critical success factor in digital initiatives. Leadership commitment influences organizational culture and helps overcome resistance to change, both essential in digital transformation. A technologically capable organization without strategic backing from leadership is unlikely to achieve sustainable adoption. The combination of visionary leadership and structural readiness creates a fertile ground for digital innovation.

3. Environment

Although the reliability score for environmental factors was lower (0.485), their substantive influence remains significant, particularly in the public sector.

Environmental influences noted in the findings:

- Government regulations: serve as external motivators and enablers, often setting the agenda for digital transformation through mandates, standards, and incentives.
- Competitive pressure, especially in inter-agency benchmarking or service innovation, motivates organizations to modernize.

These insights are in line with the literature on policy-driven digital transformation [10], [11], [12], where public initiatives such as Smart City programs, e-Government, and digital bureaucracy reforms act as catalysts for IT adoption. The external environment may not be controllable, but it shapes institutional behavior by providing *policy incentives* and *peer-driven benchmarking*. A responsive environment nudges organizations toward readiness, even if their internal motivation is low.

4. Human Resources (HR)

The knowledge and competencies of employees are foundational for successful technology use. This study found that 90.2% of respondents agreed on the importance of knowledge, while 83.3% supported competence as a crucial factor.

HR as a key internal asset:

- Knowledgeable employees can more effectively utilize and troubleshoot IT systems.
- Competent teams can adapt faster to technological change and participate in continuous improvement.

This supports the Human Capital Theory, which asserts that employee capability directly affects the success of innovation efforts [13], [14], [15]. Organizations with strong human resources are better equipped to absorb, adapt, and optimize new technology. Even the most advanced systems will fail without the human skills required to operate them. Thus, human resource development should be integrated into every digital strategy.

The data reinforces the idea that digital readiness is a product of systemic interaction, not a result of one dominant variable. Each dimension—technology, organization, environment, and human resources—must synergize to enable effective IT adoption.

- Technology provides capability.
- The organization provides strategic alignment and infrastructure.
- HR provides operational ability.
- The environment provides external motivation and policy support.

This holistic perspective affirms the TOEH model as a robust framework for assessing readiness. It highlights the interdependence among internal and external factors in shaping digital transformation pathways. The path to successful IT adoption is multidimensional. Isolated readiness in one area cannot compensate for a lack in another. The most effective strategy is one that balances and integrates these domains into a coherent readiness ecosystem. The interplay among TOEH dimensions suggests that digital readiness is not the result of a single dominant factor but the outcome of a systemic synergy. Technological capacity must be aligned with organizational support, empowered by knowledgeable employees, and supported by conducive policy environments. These findings support a holistic approach to digital transformation.

4. Conclusion

The findings of this study confirm that four key dimensions—Technology, Organization, Environment, Human Resources, and Feedback—collectively shape the readiness of agencies in adopting information technology (IT). The integrated effect of these factors suggests that efforts to accelerate digital transformation should be multidimensional and strategically aligned. Based on these findings, several practical recommendations are offered to improve IT adoption readiness:

1. Increase Investment in Security and Compatibility of IT Systems

The dominance of technology factors in this study, particularly the strong emphasis on security (confidentiality, integrity, and availability) and system compatibility, highlights the need for agencies to allocate sufficient resources toward technical enhancements.

- Security investment ensures protection against data breaches, system failures, and cyber threats, which are especially critical in public sector digital services.
- Compatibility investment enables seamless integration with existing systems, ensuring that new technologies do not disrupt ongoing workflows or require excessive adjustments.

Agencies should prioritize secure, interoperable platforms that comply with national standards while adopting modular and scalable technologies that can evolve with changing needs.

2. Provide Managerial Support and Strengthen Digital Infrastructure

The study found that top management support and infrastructure availability are crucial organizational enablers of IT adoption. Without a clear mandate from leadership and sufficient structural support, even well-designed systems may fail to be adopted.

- Managerial support ensures alignment between digital initiatives and institutional goals.
- Infrastructure development includes not only IT hardware and networks but also governance structures, maintenance systems, and operational procedures.

Institutions should promote strategic leadership by involving top management in digital planning and establishing dedicated digital transformation teams. Infrastructure investment should be holistic, combining physical systems with institutional capacity.

3. Increase the Capacity and Competence of IT Human Resources

Human capital plays a central role in technology adoption. This study found that employee knowledge and competence directly affect the ability of agencies to absorb and implement IT systems.

- Employees with strong digital skills can adapt more quickly, make better use of systems, and drive innovation from within.
- Lack of technical competence, on the other hand, becomes a bottleneck to technology utilization and service improvement.

Agencies should develop continuous learning programs, certifications, and career development paths focused on IT skills and digital literacy. These initiatives can be delivered through in-house training or collaboration with universities and professional institutions.

4. Encourage Policies and Regulations that Support Innovation and Digitalization

Although the environmental variable had a lower reliability score, its influence remains significant, particularly in the form of government policy, regulatory frameworks, and peer benchmarking. Public sector agencies are often driven to adopt IT not only by internal demand but also by external mandates.

- National and regional programs such as e-Government, Smart City, and digital bureaucracy reforms often trigger organizational readiness.
- Regulatory clarity helps minimize uncertainty and provides a shared direction for all stakeholders.

This study reinforces the view that digital transformation is not merely a technical endeavor but a strategic organizational shift. Success depends on balancing investment across all TOEH dimensions:

- Technology provides tools,
- Organization provides structure and commitment,
- Human resources provide capability,
- The environment provides context and policy direction, and
- Feedback (if assessed) informs continuous improvement.

A holistic, multi-stakeholder approach is essential to realize sustainable digital transformation in public agencies. Each recommendation should be treated not in isolation, but as part of a unified digital strategy.

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