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Implementation of Digital Transformation in Learning and School Governance at a Public Junior High School in Balikpapan, Indonesia

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Abstract

Digital transformation in schools is often inferred from device availability, leaving the mechanisms that connect technology, organizational capacity, and external support underexplained. This qualitative case study analyzes digital transformation in learning and school governance at a junior high school in Balikpapan, Indonesia through the Technology-Organization-Environment (TOE) framework and Vial's process view of digital transformation. The reported evidence comprises interviews with a principal, an Informatics teacher, and a student, triangulated with observations, school program documents, activity photographs, digital records, and evidence of application use. Thematic analysis identified five operational dimensions: digital infrastructure readiness, technology use in learning, administrative digitalization, human resource readiness, and digital work culture. The technological context was relatively strong, while support from the Education Office and private partners enabled resource mobilization. Organizational conditions determined whether these resources became routine practice: digital attendance was more standardized than technology-supported learning, and teacher competence and mentoring remained unevenly evidenced. The available data did not verify lifecycle budgeting, maintenance protocols, or formal data-privacy controls; these are therefore treated as governance gaps requiring assessment rather than as confirmed organizational failures. The study proposes a dynamic readiness-to-institutionalization model in which technological and environmental conditions enable change, organizational mechanisms translate readiness into learning and administrative use, and monitoring and reinforcement anchor digital culture. Because the interview sample covers only three roles and excludes administrative staff and non-Informatics teachers, the findings offer bounded analytical transferability rather than staff-wide saturation.

Keywords**:** Digital Transformation, Toe Framework, Digital Learning, School Governance, Digital Culture

INTRODUCTION

Digital transformation involves altering the processes, structure, relations, and value of organizations by means of digital technologies. Digital transformation, therefore, is not digitization, which is the conversion of information into digital form, or even isolated technological implementation. According to Vial (2019), digital transformation refers to the process through which disruptions and opportunities arising due to digital technologies drive strategic action on the part of the organization. Digital transformation of schools involves teaching, administrative, professional, communication, and data-driven decision-making aspects.

Education-related studies consistently identify conditions such as infrastructure, leadership, teacher competence, organizational culture, and policies as necessary for digital capacity in schools. However, such conditions are usually mentioned as lists in parallel without considering them as interconnected components of the process. According to Pettersson (2018a), digital capacity research puts emphasis on individual teachers' digital competence and does not consider the organization's infrastructure and strategic leadership

enough. In a similar way, Timotheou et al. (2023) point out that the digital transformation of schools is associated with multiple interrelated aspects beyond mere student performance. The issue that remains unresolved is how these capacities can be utilized.

The problem is approached in this study using Technology-Organization-Environment (TOE) approach. The TOE theory explains the process of technology adoption in organizations via three contexts namely, the technological context which includes technology availability and relevance, the organizational context which includes leadership, resources, structure, capability, and routine, and the environmental context which includes policy, institutional, partner and other pressures or supports (Baker, 2012; Tornatzky & Fleischer, 1990; Malik et. al. 2021; Amini & Jahanbakhsh Javid). It is important to apply TOE approach rather than acceptance theory in this research because of organizational rather than individual focus of this study.

TOE offers an explanatory model for diagnosing the context of adoption, whereas the framework of Vial (2019) is explanatory of the process through which digital technologies generate organizational action and change. Both perspectives are complementary, as technology and external support offer the enabling context, organizational leadership, competence, norms, and surveillance transform this context to utilization, and utilization repeated may institutionalize itself into a digital work culture. This theoretical combination also precludes the five empirical dimensions from being reduced to static pillars.

The Junior High School in Balikpapan, Indonesia is a good bounded case for the topic being discussed because there seem to be a difference in terms of the pace of development of both technological readiness and organizational institutionalization. The school has laptops for teachers, Chromebooks for students, belajar.id, internet connection, learning management systems, and even electronic attendance. However, having these does not automatically mean that there has been actual use and sustainability of them.

The previous literature focuses mainly on digital technology-based learning, educator's digital competence, and digital transformation of the school management process separately (Farrell et al., 2024; Mondragon-Estrada et al., 2023; Rasdiana et al., 2024; Suryadi, 2025; Pettersson, 2018b; Rubach & Lazarides, 2025; Pera et al., 2022; Köstler & Wolff, 2025; Müller & Wulf, 2020). There is an empirical gap that needs to be bridged by analyzing the interactions between technological, organizational, and environmental dimensions within learning and governing processes at a public junior high school that has an evident digital base. Analytically, there is an existing need for identifying the processes through which the

school moves from readiness to institutionalization, including any gaps that could be identified

In consequence, this research seeks to understand how technological, organizational, and environmental factors come together to influence digital transformation implementation and institutionalization processes in learning and school management at a junior high school in Balikpapan, Indonesia. The goal of the research is to explain the interactions between five operational factors and to build an empirical model that is dynamic in nature. The uniqueness of this research does not come from the setting of the school but rather in its ability to relate enablement, technological readiness, and organizational translation to use.

METHOD

The qualitative research design used in this paper was that of case study. Bounded by time and place, the case study in question was a junior high school in Balikpapan, Indonesia, while the unit of analysis was the institution's digital transformation in the realm of learning and governance. Case study methodology was chosen due to its exploratory nature.

In this case, informants were recruited using purposive sampling, in that the three informants were those who held the positions relevant to the issue at hand. It should be noted that only the participants for which there was evidence of interviews and quotations in the article have been considered (see Table 1). Role-based sampling allows a targeted collection of information power for the purpose of exploratory and bounded analysis (Malterud et al., 2016), but participant saturation has not been achieved. The lack of administration and non-Informatics teachers precludes generalizations on competence, resistance, and maintenance in the school as a whole and administrative processes.

Table 1. Informants, selection rationale, and analytical limits

Code	Number	Position	Selection rationale and contribution	Analytical limit
KS1	1	Principal	School policy, external coordination, infrastructure support, administration, and staff development	Managerial perspective; does not represent all staff experiences
GI1	1	Informatics teacher	Devices, learning platforms, technical support, training needs, and collaboration	Technology-proximate role may overstate readiness relative to general teachers
S1	1	Student	User experience with assignments, platforms, and digital attendance	Single student perspective; does not represent variation in access or learning needs

Data was gathered using semi-structured interviews, non-participant observations, and document analysis. The interviews included aspects such as infrastructure, technology-assisted learning, digitalization of administration, capacity building, collaboration, facilitating conditions, and constraints of implementation. Observations involved the use of devices, internet connectivity, learning platforms, and digital attendance. Triangulation involved documents and other artifacts like school program documents, photographs of activities, digital documents, and application usage. Detailed financial records, asset maintenance log, data protection policy, and digital competency assessment by all staff members did not fall under the verified evidence of this article.

Data were analyzed thematically following familiarization, data reduction, open coding, code grouping, category development, theme review, and interpretation stages (Braun & Clarke, 2006). The first stage of coding resulted in identification of five operational themes in the dataset. During the second stage of interpretation, the themes were aligned with the TOE contexts and subjected to analysis using Vial's transformation logic. The technological context included infrastructure and platform themes, whereas the organizational context comprised leadership, human resources, administration, and working practices themes. Support from the Education Office and private partners was categorized as the environmental context. Technology usage in learning and administrative functions was interpreted as enactment, while digital work culture was considered as institutionalization and not an independent input factor. The thematic coding matrix and theoretical alignment framework are shown in Table 2.

Table 2. Thematic coding matrix and theoretical mapping

Evidence excerpt or audit note	Initial code	Category	Operational theme	TOE/process interpretation
"Support has come from the Education Office and private companies."	External support	Resource mobilization	Infrastructure readiness	Environmental enablement
"Teachers have been provided with laptops ... students have access to Chromebooks."	Device availability	Technological resources	Infrastructure readiness	Technology context
"We use Classroom ... Pijar ... Google Meet ... Canva."	Platform enactment	Digital learning practice	Technology in learning	Technology translated into use

Evidence excerpt or audit note	Initial code	Category	Operational theme	TOE/process interpretation
“Every morning we scan our attendance.”	Standardized routine	Traceable administration	Administrative digitalization	Organizational routinization
“Their capacity can be further developed through training.”	Continuing competence need	Capability development	Human resource readiness	Organizational capability
“Cooperation among all stakeholders ... is necessary.”	Shared responsibility	Collaboration and reinforcement	Digital work culture	Institutionalization mechanism
No verified lifecycle-budget, maintenance-log, or data-protection material in the article dataset	Governance evidence gap	Unverified controls	Cross-dimensional bottleneck	Organizational boundary/risks requiring assessment

Credibility was further enhanced by source and method triangulation. Interviews' claims were triangulated based on the three roles, observations, and documents. The matrix for triangulation is shown below which highlights the difference between convergence and evidentiary boundaries, wherein the existence of documents or photographs is not sufficient evidence of effectiveness. The interview quotes were translated into English from Indonesian without altering the essence and role to which they pertain. The source-method triangulation and evidentiary boundaries are shown in Table 3.

Table 3. Source-method triangulation and evidentiary boundaries

Dimension	Interview evidence	Observation/document evidence	Convergence and boundary
Infrastructure	KS1 and GI1	Observed devices/connectivity; photographs and digital records	Availability converged; lifecycle funding and maintenance protocol were not verified
Learning	GI1 and S1	Observed platform use; evidence of application use	Use converged; frequency and pedagogical depth across subjects were not established
Administration	KS1 and S1	Observed morning scanning; attendance-related digital records and activity photograph	Routine converged; downstream use, access control, retention, and privacy procedures were not verified

Dimension	Interview evidence	Observation/document evidence	Convergence and boundary
Human resources	KS1 and GI1	Observed operation of devices; school program/activity materials	Need for continued development converged; no non-Informatics teacher or staff-wide competence assessment
Digital culture	GI1, supported by routines described by KS1 and S1	Repeated platform and attendance practices; school program materials	Emerging habituation supported; formal ethics, security, and reinforcement standards were not evidenced

RESULTS AND DISCUSSION

It was found that there were five operational dimensions as well as a cross-dimension mechanism. Technological resources and environmental support facilitated the creation of readiness; leadership, capacity, norms, and control defined the process of turning readiness into learning and governance, and continuous reinforcement led to the development of digital work culture. The findings presented below provide both convergent findings and the boundaries of data.

Digital Infrastructure Readiness: A Technological Base Enabled Externally

There were evident technological resources in the school which included teacher laptops, access to Chromebooks by the students, belajar.id accounts, internet connection, interactive resources, and WiFi. The headmaster associated the availability of technological resources with the involvement of the Education Office and private corporations, proving that infrastructure is both a technological factor and environmental product.

> *"Support has come from the Education Office and private companies. For example, teachers have been provided with laptops, students have access to Chromebooks, and learning is supported through belajar.id accounts. We also have internet facilities supported by Pertamina and the Education Office. Without these facilities, digitalization would not run smoothly."*

The Informatics teacher corroborated the operational availability of the resources:

> *"At a junior high school in Balikpapan, Indonesia, we have received interactive displays, other digital devices, and Chromebooks. In fact, each student has access to a Chromebook, and every grade cohort has its own set. Teachers have also received laptops. These devices are supported by Wi-Fi and internet connectivity."*

This is a converging point towards a conclusion regarding availability and not sustainability in the long run. The above-mentioned support mechanism establishes the enabling foundation; however, it shows the reliance upon external supply. The fact that lifecycle costs, replacement plans, repair duties, and maintenance records have not been authenticated makes it impossible to conclude anything about renewal/maintenance capability.

Technology Use in Learning: Enactment with Unevenly Evidenced Depth

Accounts for Google Classroom, Canva, Pijar, Google Meet, and belajar.id were utilized to deliver or complete assignments, communicate during lessons, and create content. According to the teacher of Informatics:

"The applications we use include Classroom; many teachers use it. We also use Pijar and Google Meet when learning is conducted online. Canva is very helpful for both teachers and students."

The student confirmed the user experience:

"We are most often asked to use Classroom or Canva to complete and submit assignments."

It becomes clear from these observations and testimonies that the technology is now a part of the learning process. However, it is yet to be proved that the use of the technology is equivalent for all subjects and teachers. The use of such expressions as "many teachers" and the fact that the observations and testimonies have been obtained from an Informatics teacher point to the same conclusion.

Administrative Digitalization: The Most Standardized Routine

Teacher and student attendance digitally was the most obvious standard administration practice. It transformed a repetitive process from manual documentation into a digitally trackable routine and linked school practice to the Education Office. The head teacher remarked:

"School services have been digitalized. In coordination with the Education Office, teacher attendance and student attendance are both recorded digitally."

The student confirmed the routine from the user side:

"Every morning we scan our attendance."

Consistency of evidence from interviews, observation, photography of attendance scanning, and digital records confirms that attendance scanning is institutionalized more than other activities. Yet, the data collection failed to confirm how the data on attendance is stored,

who has access to them, how mistakes are fixed, whether or not they are used for making decisions, and what kind of privacy and incident policies apply. The finding is thus evidence of regular digital recording, but not of mature data governance.

Human Resource Readiness: Basic Operation Is Not Staff-Wide Digital Competence

The headmaster felt that the teachers were capable of using the tools at their disposal and stressed further training:

> *"All teachers are capable of using the available tools. Their capacity can be further developed through training organized at the provincial level, including recent training on Gemini AI. Digital tools such as Gemini AI can make work easier."*

The Informatics teacher independently emphasized the continuing need for development:

> *"Teachers need to participate in training and seminars related to technological developments. Students also need guidance in using technology."*

All these claims point to a clear difference between access and pedagogical/administrative competence. These claims do not prove the abstract idea of teacher competence. None of the teachers other than those from Informatics were questioned. There was no competence survey among the whole staff. The only thing that can be proven by facts is basic readiness and further competence development.

Digital Work Culture: Emerging Habituation Requires Reinforcement

There was evidence of digital work culture through the frequent use of attendance systems and online learning platforms, yet it was not equally present in both realms. The informatics teacher linked sustainability to collective responsibility:

> *"Cooperation among all stakeholders - teachers, students, and parents - is necessary so that digital transformation can operate more effectively."*

Given the habitual nature of attendance, the cultural aspect of an online activity is characterized by having procedure, frequency, responsibility, and record of such practices. The learning platform usage seemed to be more influenced by the habitual procedures of teachers and subjects. There was no indication of any formal guidelines or standards of ethics, privacy, access security, feedback, and recognition for digital practices.

Cross-Dimensional Bottlenecks and Evidentiary Gaps

Four bottlenecks came up through the interaction among the dimensions. The first bottleneck involved how external resource support contributed to the dimension of readiness

but posed risks of continuity if the processes of replacements and maintenance were not institutionalized. The second bottleneck was that learning adoption had less standardization than attendance in terms of use depth. The third bottleneck involved training being recognized as essential but no evidence of differentiated competence map, mentoring process, and participation of general subject teachers. Finally, administrative digitalization produced data flow among students and staffs but lacked verified evidence of access, data retention, privacy, or incident response processes. The second and third bottlenecks are supported by the participants' accounts; while the first and fourth bottlenecks involve evidence gaps, which require governance assessment. Figure 1 shows uthors' analysis of the interview, observation, and document data set.

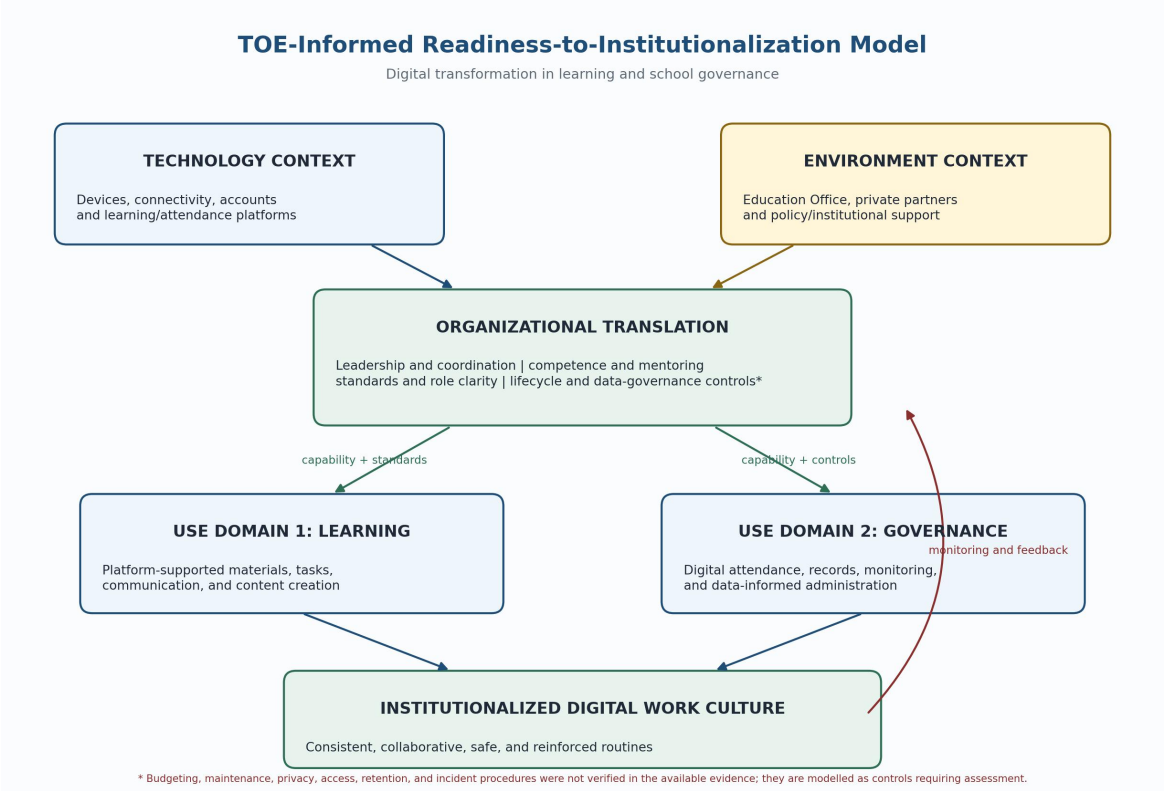

Figure 1. TOE-informed dynamic model of digital transformation in learning and school governance

TOE Explains the Interaction among the Five Dimensions

The results indicate that the five factors do not act as equal and independent pillars. The technical perspective sees devices, connectivity, accounts, and platforms as forming the basis. The environmental perspective sees the Education Office and the private actors making use of available resources and linking the school's practices to other systems. The organizational perspective sees the organizational factors determining how the material basis is turned into learning and governance. This is consistent with the TOE view that the

organizational adoption process is a function of technological, organizational, and environmental perspectives (Baker, 2012).

The case also illustrates the differentiation made by Vial (2019) between the availability and transformation of technology. Technology and platforms provide options; organizational reactions define the outcomes. Digital attendance at this particular school turned out to be a more institutionalized process due to its repeatability, visibility, and traceability. Usage of the learning platform was apparent but not very institutionalized.

From Infrastructure Readiness to Lifecycle Governance

The results concerning infrastructure correlate with existing studies on the fact that school capacity for digital activities stems from the interplay between various technical, human, and organizational aspects and not just the technical one (Timotheou et al., 2023) and that implementation at the organizational level, not just technical possibilities, allows digital transformation (Westergren et al., 2024). Although external support helped to ensure more widespread availability of these resources, sustainable development requires inventories of assets, their costs, replacement plans, maintenance plans, services, and contingencies. In the same vein, OECD (2023) sees funding, procurement, infrastructure, capabilities, and governance as components of a digital education ecosystem. The present study lacks information about these controls since the materials related to the budget and maintenance have not been verified.

Human Capability, Participation, and Selection Bias

Use of technology in learning is corroborated by both the Informatics teacher and learner, but informant data call for caution. Informatics teacher is more knowledgeable about technology compared to the average general subject teacher. The evaluation of capacity by the principal is management-oriented, not one involving all the staff members. Pettersson (2018a) advises against the narrowing down of digital competence in education to teacher capacity alone without considering other organizational factors. This is also noted in Rasdiana et al. (2024), who link teachers' professional digital competence to leadership, supervision, and digital culture. What needs to be noted is not the equality in teacher capacity, but the presence of a basic operational framework.

Therefore, continuous professional development must first start from a diagnosis based on roles and tasks. Whereas general subject teachers may need help with lesson planning, online assessment, accessibility, and classroom management, administrative personnel may require knowledge and skills in data quality, record keeping, and security.

More peer mentoring, demonstration teaching, and observation sessions are much more likely to translate attendance at workshops into practice than any stand-alone seminar session. Future research must include non-Informatics teachers and administrators as well.

Administrative Efficiency Must Be Coupled with Data Governance

The case of digital attendance shows how a consistent and well-defined process can lead to the obvious short-term benefit. Traceability, however, also involves governance responsibilities. According to OECD (2023), governance of reliable data and technology is one of the elements of a successful digital ecosystem in education, along with access, usage, interoperability, and security. The current evidence confirms scanning and digital recording but not privacy maturity. An appropriate reaction from the school should involve the definition of what data is collected, why and on what basis, how they may be accessed, stored, corrected, backed up, and escalated in case of problems.

Dynamic Model and Theoretical Contribution

Figure 1 reconceptualizes the previous five-pillars construct as one that is causal and recursive. The technology and environment provide the context for readiness. Organizational translation through leadership, coordination, competencies, standards, and governance controls translates the capabilities found in learning and administration. This use, observation, feedback, and reinforcement process creates an institutionalized digital workplace culture. The feedback from the use process will affect the following cycle of investments, maintenance, professional development, and policy refinement.

This paper provides an additional insight into researches highlighting system leadership and collaboration as crucial elements of digital transformation of education (McCarthy et al., 2023). At the same time, it explains why a school may be at different stages of digitalization in administration and learning because institutionalization is domain-specific, depending on how clearly the procedure is defined, how often it is practiced, and how much it is controlled and reinforced.

Practical and Policy Implications

These implications need to be put into practice both at the school and regional levels. The Education Office can address fragmentation through establishing standards for governance, funding of lifecycle expenses, and professional development of the staff. Schools, in their turn, can transform these resources into practices and improvement cycles. Instruments and indicators are presented in Table 4, not general recommendations.

Table 4. Actionable implications for schools and the Education Office

Actor and priority	Action	Operational instrument	Illustrative indicator
Education Office: scalable digital leadership	Create a school-leader and digital-coach network organized by school readiness level	Regional roadmap, quarterly clinics, peer review, and coaching assignments	Schools with an approved roadmap; coaching cycles completed; actions closed
Education Office: continuous professional development	Use role- and task-based competency diagnostics for general teachers, Informatics staff, leaders, and administration	Baseline rubric, differentiated modules, mentoring, classroom/office follow-up	Competency growth; participation by role; transfer into recurring practice
Education Office: lifecycle financing	Link procurement to maintenance, replacement, connectivity, and support costs	Asset register, total-cost-of-ownership template, service-level expectations, replacement schedule	Device uptime; repair turnaround; proportion of assets within planned lifecycle
Education Office: data governance	Set minimum controls for school platforms and student/staff data	Data inventory, access matrix, retention schedule, backup and incident protocol	Annual control review; access exceptions; incidents resolved within target
School: learning standards	Agree on a small set of minimum digital-learning practices while allowing subject adaptation	Platform standard, task-quality rubric, accessibility check, student feedback	Subjects meeting minimum practice; task quality; access problems resolved
School: improvement cycle	Review evidence and adjust support each term	Dashboard combining use, quality, competence, maintenance, and data-governance indicators	Documented review meetings; corrective actions; repeated improvement

Study Limitations

However, this research is subject to four key limitations. Firstly, there are only three informant roles represented in this research, with the sample lacking any representatives of administrative staff or teachers who do not belong to Informatics specialty. Thus, the study cannot provide any proof of participant saturation or equal competence of staff members. Secondly, there is only one student role represented; thus, variation in terms of access, disability, confidence level or connectivity at home can be disregarded. Thirdly, document

analysis allowed triangulation of data on devices, platform usage, attendance and school activity but lacked all the documents necessary for assessment of financial, maintenance, competence and protection maturity of governance. Fourthly, this research lacks any proof of statistical generalizability or causal connection due to its case study and cross-sectional nature.

CONCLUSION

The digital transformation in a junior high school in Balikpapan, Indonesia should be viewed as a readiness-to-institutionalization process. The technological context offered devices, connection, accounts, and platforms, while the environmental context offered the support of the Education Office and private organizations. The organizational context then decided if the resources were turned into learning and governance practices. The use of digital attendance was more institutionalized than learning using technology, but the continuous development of capacity was still an essential need.

The paper provides a TOE-based dynamic model of implementation where technology and environmental factors make changes possible, organization-level mechanisms help in translating readiness to usage, and feedback and reinforcement help in establishing a secure, stable, and collaborative digital working environment. The model also makes explicit what is not made explicit from current literature, especially budgeting for life cycle, maintenance procedures, competence across staff, and governance of data privacy. For regional policy making, this implies that procurement must go hand in hand with lifecycle financing, professional development tailored for differences, digital leadership on a larger scale, and data governance at least.

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