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E-Government Development and its Role in Enhancing Government Effectiveness and Public Sector Governance: An Empirical Analysis from East Asia and the Pacific (2003–2024)

Imran Ullah Khan
Assistant Professor, Department of Public Policy and Administration, Hazara University, Mansehra-Pakistan. dr.imranullah@hu.edu.pk

Imtiaz Ahmad Khalil
Deputy Librarian, Hazara University, Mansehra. imtiazahmadkhalil@gmail.com

Arif Muhammad
MPhil Scholar, Department of Sociology, Hazara University Mansehra-Pakistan. arifsociologist@hu.edu.pk

Shakeel Ahmad*
Assistant Professor, Department of Sociology, Hazara University, Mansehra-Pakistan. Corresponding Author Email: shakeel.sociologist@gmail.com / shakeel.soicologist@hu.edu.pk. ORCID ID. https://orcid.org/0000-0003-1902-8698

Abstract
Digitization of the state administration has become a key initiative to all governments in the world in order to enhance their performance, quality of governance, and balance the rising demands of individuals in the 21st century. This paper reflects upon the dynamic connection between the e-government development and the government effectiveness with a narrow focus on the mediating variable of the relevant governance indicators: control of corruption, regulatory quality, rule of law, and voice and accountability. We use a Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model to analyze panel data of 27 countries in the East Asia and Pacific region in the period 2003 to 2024. The results denote a subtle correlation. Short-term effects E-government projects, in addition to the enhancement of corruption and quality control in regulations, have a positive effect on governmental performance. Nevertheless, the long-term study offers one important point of view: isolated e-government development, which is not accompanied by the simultaneous and effective institutional support, is negatively correlated with long-term effectiveness. An integrative mix of digital platforms and effective regulatory regimes, especially those that are strict in managing corruption, good regulatory environments and participative accountability is a fundamental driver of sustainable improvements. The research arrives at a conclusion that technology is a sufficient condition though not a necessity to long term reform. To get truly effective and resilient digital transformation projects, policymakers have to take a comprehensive governance-by-design approach, where digital transformation initiatives are integrated into the wider institutional capacity-building and regulatory modernization to build robust and resilient public sectors.

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1. Introduction

The onset of the digital age has triggered a paradigm shift in the organization, functions and expectations of the system of public administration in the world. Information and Communication Technologies (ICTs) have not only developed to become the fringe part of administrative support but also the core of contemporary governance and have essentially transformed the point of contact between states and their citizens (United Nations, 2024). This is summarized in the notion of e-government, which can be expressed as the use of ICTs, and especially the internet, to enhance the efficiency, transparency, accessibility, and quality of the delivery of the public services, as well as strengthening the citizen participation and accountability (World Bank, 2023). Recent global crises, the most notable of which is the COVID-19 pandemic, that proved to be a sharp stress test on the capabilities of the governments, has increased the impetus behind this digital shift forcing an unprecedented shift towards digital adoption to ensure the continuity of state functions (Alshehri and Drew, 2023).

At the same time, the global development agenda, which is defined in the United Nations Sustainable Development Goals (SDGs), connects explicitly between effective, accountable, and inclusive institutions (SDG 16) and the tool of implementation, i.e. technology (SDG 17). E-government is becoming more and more a positioned concept as a facilitator of the achievement of a whole range of SDGs, no longer as a simple administrative enhancement, but as a key device in the attainment of non-specifically a range of poverty reduction and health, education, and environmental sustainability (Alryalat et al., 2023). The central component of this nexus is the notion of government effectiveness which is a fundamental aspect of governance that involves the quality of the state services, the efficiency of the civil service, the ability of the bureaucracy to be free of political influences, and the plausibility of the government commitment to policies and the execution of the policies (Kaufmann, Kraay, and Mastruzzi, 2010). In a world of complicated global issues, climate change to economic insecurity, a good government becomes not an ideal but a condition to stability, prosperity, and trust by people.

The current academic and policy discussion is a mixed, even paradoxing, image of the effects of e-government. One positive branch of the literature assumes that there is a direct, positive relationship and contends that digitalization transforms bureaucratic processes into automation, cuts off possibilities of discretionary and corrupt behavior by transparency, and empowers the citizens, which makes the state generally more competent (Siau and Long, 2009; Bertot, Jaeger and Grimes, 2010). On the other hand, a more critical view also points at large contingencies and pitfalls. Researchers observe that the enabling pre-conditions of effective implementation and effects of e-government include sufficient digital infrastructures, high rates of literacy and skills, positive legal-regulatory systems, and strong institutions (Andersen and Henriksen, 2006; Scholl and Scholl, 2014). In their absence, e-government projects would be turned into an expensive white elephant, widen digital inequalities, or be sabotaged by vested interests (Anthopoulos et al., 2023).

The present study aims at making some contribution to this debate by not sticking to a simplistic binary methodology on whether e-government works.

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Rather, it examines the conditional and dynamic association between the development of e-government and the effectiveness of the government. We hypothesize that governance indicators, which are control of corruption, quality of regulations, rule of law, and voice and accountability are not co-occurring phenomena, but fundamental mediating institutions, which dictate whether technological potential is converted into real and sustained administrative performance or not.

Our research is guided by three interconnected questions:

1) How does the development of e-governments in East Asia and Pacific countries in the short-run and long-run affect the level of government effectiveness in these countries?
2) What is the role of key governance indicators in mediating and conditioning this relationship in the long-run?
3) Which integrated policy strategy will make the digital transformation guarantee sustainable changes in the governance of the public sector?

In answering these questions, we use a strict panel data analysis of twenty-seven economies in the dynamic East Asia and Pacific region between 2003 and 2024. By using the CS-ARDL approach, we take into consideration the cross-sectional dependence and heterogeneity to get strong short and long run estimates. The results provide the important evidence-based guidance to policymakers on the tricky path of digital governance, by noting that the way to efficiency is not to seek technology or institutions, alone, but rather to integrate them strategically and synergistically.

2. Literature Review

The academic discussion of e-government has come out of the initial examination of technical implementation to the more expansive examination of its socio-political, institutional, and developmental implications. This review summarizes the dynamic conversation based on central thematic domains and denotes the gap in research that is filled by this study.

2.1 E-Government and Delivery of Public Services: The Efficiency Paradigm

The e-government promise is based on the fact that it can revolutionize the delivery of public services. Initial studies created a powerful "efficiency story," proving that the digitization of administrative procedures causes a decrease in the transaction costs, processing times, and red tape (Heeks, 2006). According to Gil-Garcia and Pardo (2005), success factors in some technical and managerial areas were identified, and it was considered that well-organized digital platforms contribute to better responsiveness of the governments. This savings in efficiency puts into practice its practical benefits: higher levels of satisfaction in citizens, better resource allocation, reduced operational costs of governments (Margetts et al., 2015). Dawes (2008) put this in the context of a transition into a digital-era governance, in which technology allows a fundamental reconsideration of administrative processes, as opposed to automation.

2.2 Governance, Institutional Structures and Leadership

During the expansion of e-government projects, it became progressively notable that the achievement of the technological aspect is closely connected to the

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quality of governance and the structure of institutions. Janowski (2006) highlighted that successful digital transformation is a precondition of strategic planning and integrated policy frameworks. Carter and Belanger (2005) found that trust, perceived risk and regulatory clarity are some of the most important factors to the uptake of e-services by citizens. This highlights the fact that the institutional factors that are soft, i.e. legitimacy, trust as well as clear rules are important as much as the hard technology. First the leadership; research conducted by Belanger and Carter (2008) and Cordella and Bonina (2012) discovered that accountability and leadership are the key points to overcome the bureaucratic inertia and guarantee the e-government projects are aimed at the creation of value and not a detached island.

2.3 Technological, Infrastructural, and Socio-Economic Problems

A vast amount of literature exists regarding the major challenges to the success of e-government. On the technical front, there are insufficient IT infrastructure, system interoperability, cybersecurity issues, and the lack of technical skills (Scholl and Scholl, 2012; Hussein et al., 2007). Socio-economic issues are perhaps more difficult to resolve. Norris and Reddick (2013) eloquently explain the issue of the digital divide in which the disparity in access to technology and the internet along the geographic, economic, and demographic lines can transform the idea of e-government to an instrument of inclusion and then an instrument of exclusion, enhancing the existing inequalities. This virtual marginalization is a direct danger to the justice and validity of digital governance. Engagement, participation, and co-creation of citizens: This aspect highlights that the company actively involves the community in its activities and further emphasizes that those members can contribute to co-creation.<|human|>2.4 Citizen engagement, participation and co-creation: This point brings into the limelight the fact that the company is actively involving the community in its operations and moreover that the same members of the community can be used in co-creation.

Outside the service delivery context, another theme that is increasingly prevalent in the recent writings is how e-government is contributing to promoting a more active and participative form of governance- often described as e-governance or digital democracy. The concept of the we-government (citizen co-production) and e-government (one-way service delivery) is developed by Linders (2012). Online platforms allow new channels of citizen complaints, redressal of grievances, and even co-designing policies (Meijer, 2015). This participatory shift is associated with greater transparency and accountability since it is possible to empower citizens to monitor government activities and enhance trust because of open data movements and digital government performance tracking (Grimmelikhuijsen & Meijer, 2018; Nam and Pardo, 2011).

2.5 Interoperability and Integration to Wholesome Governance

To achieve the full potential of e-government, the disconnected digital systems have to be linked. Interoperability i.e. the varying information systems being able to share and make use of data is therefore a key technical and administrative issue. Study conducted by Scholl and Scholl (2014) presents the multidimensional obstacles: technical (incompatible systems), organizational (siloed departments), and semantic (different data standards). Interoperability goes beyond technical solutions and necessitates, over time, the cooperation of

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both IT experts and policy makers based on common protocols and data-sharing deals (Gil-García, Pardo, and Nam, 2012).

2.6 Sustainability, Long-term Impact and Creation of Public Value

An important field of research is doubting the sustainability and effectiveness of digital government projects in the long term. Research warns of the project-centric perspective and recommends the adaptive models of governance that could adapt to the change in technology (Sieber, 2016; Wirtz et al., 2023). The final measure of success is the generation of social value. A recent study by Dawes et al. (2016) and Misuraca and Savoldelli (2013) discusses the role of digital tools in transforming the way governance is performed to be more open, less corrupt, and create social innovation, thus generating value to the society that is even higher than the investment is. Moreover, the meeting of digital government and welfare state is being discussed with indicators of appearing, that means, digital transformation may enhance the efficiency and coverage of the social service delivery, which may solve inequalities (Estevez-Abe et al., 2019; Raman and Doni, 2019).

2.7 Early Trends: AI, Blockchain, and Future of Digital Government

The e-government research frontier is growing at a high rate to embrace the emerging technologies. Researchers are exploring the potential of Artificial Intelligence (AI) to decide and predict services to the population automatically and the way a blockchain can be used to secure records and improve trust in transactions, as well as the Internet of Things (IoT) to make a smart city (Scholl and Scholl, 2023; Dwivedi et al., 2024). These technologies do not only hold new strides of efficiency and innovation, they have also created new questions on a deeper level on morals, prejudice and privacy and the ever evolving role of the public servant.

2.8 Synthesis and Identified Research Gap

The literature has conclusively shown that e-government is a complex phenomenon that holds great potential but depending on the complex factors. Although much effort has been expended on its determinants and effects on particular outcomes such as corruption or service satisfaction, the critical gap still exists in the empirical modeling of the dynamic, conditional relationship between the e-government development and overall effectiveness of the government, including the interaction of core governance institutions both in the short and long term. The majority of such studies are aimed at cross-sectional correlations or lack an attempt to combine the institutional variables into a dynamic structure. This paper will fill this gap by utilizing a powerful panel econometric model (CS-ARDL) to unravel these interdependent relationships to give a more refined and practical insight into the post-2020 digital governance environment.

3. Research Methodology

3.1 Theoretical Framework and Hypotheses Development

The present work is based on the synthesis of the theoretical background of Public Value Theory (Moore, 1995) and Institutional Theory (North, 1990).
According to the Public Value Theory, the main endeavor by the public managers is to generate values to the citizens. The provision of e-government is regarded as

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a strategic asset to attain this through enhancing results, creating trust and establishing legitimacy. Our model (COC, RQ, ROL, VAA) reflects the fundamental aspects of the public good that are equity (ROL), efficiency (RQ), accountability (VAA), and fairness (COC).

The argument behind the Institutional Theory is that the environment in which organizations (including governments) operate influences its performance in the form of formal rules (laws, regulations) and informal norms (culture, conventions). It speculates that technological advancements such as e-government have a chance to succeed only when they are isomorphic or supported by the established institutional structure. By generalizing these views, we theorize e-government as an intervention whose effectiveness in generating public value (good government) will depend upon the vigor of the institutions around it. This results in the subsequent test hypotheses:

H1: The short run effects of developing e-governments are positive on government effectiveness.

H2: Corruption control (COC) and regulatory quality (RQ) have meaningful positive impacts on the effectiveness of governments both in the short and the long term.

H3: The long term beneficial impacts of e-government are dependent on the rule of law (ROL) and voice and accountability (VAA).

H4: In the long-run, absent the complementary institutional strengthening, the relationship between standalone e-government development and government effectiveness will be negative or non-significant.

3.2 Specification of Model and Variables

It is given that the long-run relationship is as follows:

$$GEit=\beta0+\beta1E\_GOVit+\beta2COCit+\beta3RQit+\beta4ROLit+\beta5VAAit+\epsilon it$$

Where:

Dependent Variable: GEit = Government Effectiveness index of country, I in year,t.

Core Independent Variable: E- GOVit = E- Government Development Index.

COCit, RQit, ROLit, and VAAit are all institutional mediating variables.

All variables of governance (GE, COC, RQ, ROL, VAA) are obtained using the World Bank Worldwide Governance Indicators (WGI) 2024 with a 2.5-scale.

The index of E-Government Development is derived based on the UN E-Government Survey (2003-2024 editions) and is rated out of 1. Interpolations are done on the non-survey years.

3.3 Data and Sample

This paper uses an unbalanced panel model of 27 countries in the East Asia and Pacific region between 2003 and 2024. The region has a lot of digital development and institution quality diversity, including developed digital champions (e.g., Singapore, South Korea), developing giants (e.g., China, Indonesia), and developing countries, which offers an excellent context to study.

3.4 Econometric Strategy: the CS-ARDL Approach

Since there is a probability of cross-sectional dependence (due to global technological shocks or regional economic integration), and cross-country heterogeneity, we use the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) estimator (Chudik and Pesaran, 2015). The way is

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the best in our case since:

1. It considers cross-sectional dependence (CD) by considering cross-sectional averages of the dependent and independent variables in the regression.
2. It offers stable estimations of both short and long-term dynamics of the relationship of the equilibrium.
3. It holds regardless of the type of variables, I(0) or I(1).

The empirical methodology entails:

1. Cross-Sectional Dependence Testing: Applying the CD test by Pesaran (2004).
2. Checking Stationarity: The order of integration can be performed using second-generation unit root tests (Pesaran CIPS test, 2007).
3. The estimation of the CS-ARDL Model: The overall equation is:

$$\Delta GEit=\phi i(GEi,t-1-\theta i'Xi,t-1)+j=1\sum p-1\lambda ij\Delta GEi,t-j+j=0\sum q-1\delta ij'\Delta Xi,t-j+j=0\sum s\eta ij'Z^{-}t-j+\epsilon it$$

In which is denotes the error-correcting rate of adjustment (which will be negative and significant to co-integration), θi are the long-run coefficients, Xit represents the regressor vector, and Z set comprises cross-sectional averages.

4. **Inference:** Mean Group (MG) procedure is a process used to obtain short-run and long-run estimates at the panel level through the averaging of country specific coefficients.

4. Results and Analysis

4.1 Preliminary Tests

The null hypothesis of no cross-sectional dependence is highly rejected by Pesaran (2004) CD test (CD = 12.45, p = 0.01), and this confirms our application of second-generation techniques. According to the CIPS unit root test, all the variables are non-stationary in level but in the first difference they are stationary or are integrated of order one, I (1), which is a major precondition of the co-integration analysis.

4.2 Short-Run Estimation Results

Table 1: ***CS-ARDL Short-Run Coefficient Estimates***

Variable	Coefficient	Std. Error	z-value	p-value
Error Correction Term (ECT)	**-0.131**	0.063	-2.060	0.039
Δ E_GOV	0.822	0.431	1.910	0.056*
Δ COC	0.263	0.099	2.670	0.008***
Δ RQ	0.231	0.095	2.420	0.016**
Δ ROL	-0.284	0.099	-2.860	0.004***

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Variable	Coefficient	Std. Error	z-value	p-value
Δ VAA	0.370	0.193	1.920	0.055*

(*p<0.10, **p<0.05, ***p<0.01)

The short-term outcomes are eye openers. The large negative value of the coefficient of the Error Correction Term (ECT = -0.131) establishes the presence of a stationary long-run co-integrating relationship amongst the variables, where an estimated 13 percent of any disequilibrium of the variables is corrected annually.

Support H1: The coefficient of 2E GOV is not negative and marginally significant (0.822, p=0.056) which means that when e-government progresses, the perceived government effectiveness improves immediately.

Support H2: ΔCOC and ΔRQ T-test values are high and significant (0.263 and 0.231 respectively), which also highlights the fact that temporary increases in fighting corruption and enhancing regulatory transparency have a direct positive impact on effectiveness.

- **The Rule of Law Puzzle**: ΔROL is strongly negatively correlated (-0.284). It implies that the hasty expansion or reformation of legal systems may cause friction within an organization or create compliance costs or loopholes in implementation that may temporarily lower perceived effectiveness, which is consistent with the goal of institutional theory on the cost of adapting.

Citizen Voice: ΔVAA positive and significantly small (0.370, p=0.055), which means that the improvement of participatory channels can be used to increase the responsiveness and legitimacy of the government rather quickly.

4.3 Long-Run Estimation Results

Table 2: ***CS-ARDL Long-Run Coefficient Estimates***

Variable	Coefficient	Std. Error	z-value	p-value
E_GOV	-0.834	0.360	-2.320	0.020**
COC	0.158	0.086	1.830	0.067*
RQ	0.231	0.095	2.420	0.016**
ROL	-0.274	0.099	-2.760	0.006***

This is the main point of investigation that is provided in the long-run results.

Critical Finding - H4: The long-run coefficient of E _GOV is negative with a significant value (-0.834). It is a significant finding which suggests that in the long run a greater degree of development of e-government is correlated with less effective government, after both the level of institutional control are held constant. This is a powerful argument in favour of the contingent opinion: digital

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tools absent institutional reinforcement are useless or even counterproductive.

Support of H2 and H3: COC and RQ have a positive significance in the long-run (0.158 and 0.231, respectively). These are pillars of the institutions that are foundational to the effectiveness of the sustainability.

- **Endemic Institutional Rigidity:** It is found that the long-run coefficient of ROL is negative (-0.274), which indicates that the legal systems that do not keep up with the digital pace may become chronic bottlenecks, preventing long-term administrative flexibility and effectiveness.

5. Discussion

The empirical results depict a subtle image which contributes a lot in the theoretical and policy discussion concerning digital government. The efficacy of the e-government and the anti-corruption practice in the short-run justifies the optimistic efficiency story that dominated the early 2000s (Bhatnagar, 2009; Heeks, 2003). Quick wins, such as digitization of front-end services and transparency portals, are fast and have a direct impact on the speed and decreased petty corruption, which translates into perceptions of effectiveness instantly.

The long-run analysis however basically contradicts a techno-centric approach. The most important contribution made by the study is the negative coefficient of e-government in the long-run equation. It shows in real life what institutional theorists have always maintained, that technology and institutions are systems that co-evolve (North, 1990). With the growth of digital systems at fast rates, but overlaid on weak, corrupt or inelastic institutional bases, a number of dysfunctions arise:

Isomorphic Failure: The new digital logic conflicts with the old bureaucratic logic and becomes resisted, there are workarounds and benefits are not achieved.

Sustainability Crisis: New technology demands lifelong investment, expert maintenance and re-investment. In the absence of well-organized institutions to oversee these processes, the system disintegrates in order to become untrustworthy and lose faith in the people.

Misaligned Incentives: Digital systems may be gamed or turned into new rent-seeking tools by advanced actors in the situation of weak corruption control (low COC).

Control of Corruption (COC) and Regulatory Quality (RQ) are not merely consequences but essential enabling factors as the positive role of these two factors in the long-run has been confirmed. A strong anti-corruption climate will help keep digital processes (e.g., in e-procurement) honest, whereas a high regulatory quality will mean that businesses and citizens will feel free to make their interactions with digital government a routine (Dwivedi et al., 2022).

The long-term negative indicator on Rule of Law (ROL) is something to think over. It can mean that either antique, sluggish law structures are frequently incapable of regulating rapid-paced digital fields such as data privacy, computer crime or regulating platforms. This generates a legal lag in which the digital activities exist in an in-between state that compromises the certainty and enforcement as foundations of effectiveness.

All the results are supportive of a Public Value view. Lasting effectiveness does not consist simply of administrative effectiveness but of the establishment of legitimate, accountable and fair institutions. The digital tools should be used with the purposes of promoting these larger objectives, such as combating

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corruption (COC) by using open data (VAA), and not as ends to themselves.

6. Policy Implications, Conclusion and Future Research

6.1 Conclusion

The paper finds that e-government is related to the government effectiveness, and this relationship is inherently conditional and dynamic. Digital transformation can be promising more efficient governance, however, only when the technological implementation is systematically and deliberate in combination with corresponding investments in institutional modernization. The synergy, rather than a trade-off, that exists between digital platforms and robust institutions, especially those that limit corruption, provide clarity in regulation and make governance accountable, can lead to sustainable government effectiveness. Technology that lacks institutional support will probably fail in the long, and well-established institutions can use technology to bring transformative social value.

6.2 Policy Implications

Become Governance-by-Design: Policymakers should require that any significant e-government project should have a clear-cut institutional part. There should be a new digital health system as well as changes in the healthcare procurement law (COC) and patient data protection law (ROL).

Introduction of Sequential, Integrated Investment: Development partners and national governments need to create funding programs to combine digital infrastructure loans with technical assistance to judicial reform, capacity building of the anti-corruption agency and regulatory impact assessment training.

Develop Agile and Adaptive Legal Architectures: Governments must establish systems of legal adaptation on an ongoing basis, like regulatory sandboxes of fintech, agile policymaking units, to alleviate the problem of legal lag and make the rule of law dynamic with technology.

Champion Inclusive Digitalization: There must be proactive policies that effectively bridge the digital divides in the form of affordable access, digital literacy programs, and friendly (e.g., mobile-first, offline-capable) service design. This is to make certain that the improvements on effectiveness are just and valid.

Enhance Interoperability as a Governance Ideal: Go beyond technical standards and develop governance structures of sharing data that are efficient, though not insecure and private, and trusted by the citizens, and which institutionalize cross-government silo working.

6.3 Limitations and Future Research Directions

This research is limited in the way that it is going to be used as a direction of future research. The aggregate indices used conceal sector-specific dynamics at the first stage, so in future research, disaggregated data on digital service maturity in individual sectors, such as health, education, or justice, should be used. Second, the power of the quantitative approach can be staunchly reinforced with Qualitative Comparative Analysis (QCA) to find out the particular forms of institutional and digital situations that result in high effectiveness in various national settings. Third, with AI and blockchain transitioning to scale, studies should create new frameworks to evaluate their effects on fundamental principles of governance, such as fairness, accountability, and human control. Lastly, longitudinal case studies of the co-evolution of certain digital reforms and

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institutional adjustments, which would be followed over 10-15-years would be the invaluable aspect to the dynamics that can be identified within this panel analysis.

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