JEPP
Journal Ekonomi Pembangunan dan Perencanaan
https://journal.psg.ac.id/index.php/jepp

Vol. 1, No. 1, 2026
e-ISSN: XXXX-XXX
pp. 22-32

Public Debt Sustainability in the Digital Economy: Fiscal Capacity, Institutional Quality, and Economic Resilience

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Article History:
Received: September 4, 2026
Revised: October 15, 2026
Accepted: November 24, 2026

Keywords:
Public Debt Sustainability; Fiscal Capacity; Economic Resilience

Abstract: *Public debt sustainability has become more complex as governments confront digital transformation, volatile financing conditions, recurrent shocks, and rising demands for public investment. This study develops an integrative framework explaining debt sustainability in the digital economy through the interaction of fiscal capacity, institutional quality, and economic resilience. An integrative literature review synthesizes peer-reviewed studies published between 2022 and 2025, prioritizing Scopus-indexed research on sovereign debt, fiscal space, institutional quality, digitalization, public finance, and macroeconomic resilience together with relevant Indonesian evidence. Findings indicate that sustainable debt cannot be assessed from debt ratios alone because interest-growth differentials, revenue capacity, primary balances, maturity structures, market access, and exposure to aggregate risk jointly determine fiscal space. Institutional quality strengthens debt management by improving policy credibility, governance, revenue mobilization, and the productive use of borrowed resources. Digital-economy development can expand formal transactions, fiscal transparency, and information capacity, but it may also require substantial public investment and new regulatory capabilities. Economic resilience determines whether governments can absorb shocks without destabilizing debt dynamics or sacrificing essential development spending. Evidence from Indonesia suggests that debt remained manageable after major crises when fiscal adjustment, growth recovery, and institutional frameworks supported financing capacity. The proposed framework therefore treats digital transformation as an amplifier whose fiscal consequences depend on governance quality and state capacity. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions today.*

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How to cite:

INTRODUCTION

Public debt sustainability has re-emerged as a central challenge after successive global shocks increased borrowing needs while interest rates and risk perceptions became more volatile. Sovereign debt is not inherently unsustainable, because borrowing can stabilize economies and finance productive investment, but sustainability depends on governments' capacity to service obligations without disruptive adjustment. Mitchener and Trebesch (2023) emphasize that modern sovereign debt crises involve rollover risk, bank-sovereign

linkages, legal complexity, domestic debt, and official creditors. These features make debt sustainability a multidimensional problem rather than a simple debt-to-GDP threshold. In the digital economy, this complexity increases as governments finance technological infrastructure while relying on increasingly data-intensive revenue and financial systems.

Fiscal capacity determines how much debt a government can safely issue and service. Jiang et al. (2023) argue that aggregate risk materially affects fiscal capacity and that conventional comparisons between interest rates and growth are insufficient when government revenues and taxpayer insurance obligations are uncertain. This insight is important for digital economies because technological transformation can raise productivity and the tax base while simultaneously requiring large investments in connectivity, cybersecurity, skills, and digital public infrastructure. Debt-financed digital investment is sustainable only when expected economic and revenue gains strengthen future repayment capacity relative to financing risks.

Institutional quality is another central determinant. Lee et al. (2023) identify threshold effects of institutional quality on debt sustainability across income groups and show that stronger institutions are particularly important for lower-middle- and low-income countries. Institutions influence fiscal discipline, tax administration, expenditure quality, debt transparency, and the credibility of policy commitments. Digital tools can strengthen these functions through better information and monitoring, but technology cannot substitute for governance. A digitally advanced fiscal system operating within weak institutions may still produce poor borrowing decisions, inefficient expenditure, or hidden liabilities.

Evidence from developing economies further demonstrates that institutions shape the growth consequences of debt. Nguyen (2022) finds that public debt crowds out private investment in developing countries while governance supports investment, highlighting the importance of institutional conditions surrounding borrowing. Digital transformation may reduce information costs and support private-sector productivity, yet excessive public borrowing can still tighten financing conditions or redirect resources away from firms. Sustainable debt policy should therefore protect space for private investment while directing public borrowing toward infrastructure and services that raise economy-wide productivity.

Economic resilience links debt sustainability with the capacity to withstand shocks. Zheng (2023) shows that sovereign debt responses during the COVID-19 pandemic were strongly shaped by fiscal and financial conditions, demonstrating how crises alter borrowing needs and sovereign risk. Resilient economies can use fiscal space countercyclically and recover revenue more quickly, while fragile economies may experience persistent debt increases after shocks. Digital technologies can support resilience through continuity of services, payments, information, and economic activity, but they also create cyber, concentration, and implementation risks that fiscal institutions must manage.

Digital-economy development can influence fiscal sustainability through revenue capacity and intergovernmental balances. Li and Yang (2024) find that digital-economy development can reduce vertical fiscal imbalances in Chinese local governments and that fiscal transparency strengthens this relationship. This evidence suggests that digitalization may improve fiscal capacity by formalizing activity, expanding information, and improving transparency. However, benefits depend on institutional arrangements that convert digital activity into sustainable revenues and disciplined expenditure.

Governments should therefore evaluate digital transformation not only as a growth strategy but also as a fiscal-capacity strategy.

Indonesia provides a useful context because it combined pandemic-era fiscal expansion with a return to fiscal rules and maintained relatively moderate public debt. Rahman et al. (2023) analyze Indonesian debt sustainability after the financial crisis and during COVID-19, emphasizing the importance of debt dynamics, fiscal response, and macroeconomic conditions. The Indonesian experience illustrates how emerging economies must balance stabilization, development investment, and debt prudence. Digitalization can potentially strengthen tax administration and public financial management, but the fiscal benefits depend on implementation quality, economic growth, and credible debt governance.

Despite growing research on sovereign debt, institutions, digitalization, and resilience, these strands are often analyzed separately. This study addresses the gap by integrating fiscal capacity, institutional quality, digital-economy transformation, and economic resilience into one conceptual framework. The framework proposes that fiscal capacity determines feasible borrowing space, institutional quality determines how effectively that space is governed, digital transformation influences revenue and productivity potential, and resilience determines the capacity to absorb shocks. Public debt is sustainable when these mechanisms jointly support solvency, liquidity, development, and credible adjustment without undermining long-term growth.

THEORETICAL METHODS

The theoretical framework combines the intertemporal budget constraint, fiscal-capacity theory, institutional economics, and resilience theory. The intertemporal budget constraint links current debt with expected future primary balances and financing costs. Fiscal-capacity theory emphasizes the state's ability to mobilize revenues and maintain market access under risk. Institutional economics explains how governance quality affects policy credibility, resource allocation, and transaction costs. Resilience theory focuses on the ability to absorb shocks, adapt, and recover without persistent loss of productive capacity. In the digital economy, these perspectives interact because technology can expand the tax base and productivity while also changing expenditure needs, information systems, and risk exposure.

The proposed model contains four connected mechanisms. Fiscal capacity includes revenue mobilization, primary-balance flexibility, debt maturity, financing costs, and market access. Institutional quality includes government effectiveness, rule of law, transparency, debt governance, and fiscal credibility. Digital-economy capability includes digital infrastructure, formalization, information availability, digital payments, and fiscal transparency. Economic resilience includes diversified growth, financial stability, shock absorption, and recovery capacity. Digitalization can strengthen fiscal capacity, but its contribution to debt sustainability is conditional on institutions that translate technology into productive investment, credible revenue, transparent liabilities, and adaptive macroeconomic management.

REASERCH METHODS

This study employed an integrative literature review and conceptual synthesis to examine public debt sustainability in the digital economy. Peer-reviewed studies published between 2022 and 2025 were prioritized, with emphasis on Scopus-indexed research in sovereign debt, fiscal capacity, institutional quality, fiscal rules, digital economy, economic resilience, and public investment together with relevant Indonesian evidence. Search concepts included public debt sustainability, fiscal space, fiscal capacity, institutional

quality, digital economy, fiscal transparency, sovereign risk, debt management, resilience, and economic growth. The qualitative synthesis followed data reduction, categorization, interpretation, and conclusion-development principles described by Sugiyono (2022).

The synthesis proceeded through three stages. First, studies were coded for conventional debt-sustainability mechanisms, including debt ratios, primary balances, interest-growth differentials, maturity, fiscal rules, market access, and fiscal space. Second, evidence was coded for institutional and digital mechanisms, including governance quality, transparency, digital infrastructure, tax capacity, and information efficiency. Third, resilience mechanisms were mapped through growth recovery, investment, financial stability, and shock absorption. No fabricated primary dataset was introduced. Published empirical findings were used to construct relationships and propositions suitable for future cross-country, national, and subnational testing.

Source quality was assessed through publication recency, peer-review status, journal credibility, relevance to the research framework, and DOI traceability. International findings were triangulated with Indonesian evidence to strengthen contextual relevance for emerging economies. Future empirical studies can measure fiscal capacity through tax revenue, primary balances, interest burdens, and market access; institutional quality through governance indicators and debt transparency; digitalization through infrastructure, digital payments, e-government, and digital-economy indices; resilience through growth volatility, recovery speed, and financial stability; and debt sustainability through fiscal-reaction functions, debt-stabilizing balances, or probabilistic debt paths. Dynamic panel models, threshold regressions, local projections, and spatial models are suitable validation methods.

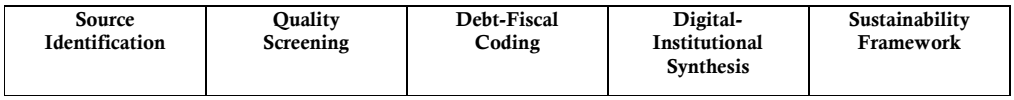

Figure 1. Integrative Review and Digital-Era Debt Sustainability Framework

RESULT AND DISCUSSION

First, sovereign debt sustainability in the twenty-first century is shaped by a broader set of risks than the debt ratio alone. Mitchener and Trebesch (2023) emphasize rollover problems, bank-sovereign feedback, legal risks, domestic debt, and the expanding role of official creditors. These mechanisms matter in digital economies because financial integration and real-time information can accelerate changes in investor sentiment. Governments therefore need diversified financing, transparent debt data, and maturity structures that reduce refinancing pressure. Digital debt-management systems can improve monitoring, but technology does not remove fundamental solvency constraints. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality.

Second, fiscal capacity should incorporate aggregate risk rather than rely mechanically on favorable interest-growth differentials. Jiang et al. (2023) show that risk-adjusted fiscal capacity can be substantially smaller than conventional calculations suggest. Governments facing uncertain growth cannot assume that low borrowing costs will persist precisely when fiscal resources are most needed. Digital transformation may improve productivity and tax collection, but it can also expose budgets to technology investment costs and new operational risks. Debt strategies should therefore stress-test revenues, growth, and financing conditions jointly. Overall the evidence supports prudent credible institutional

digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic resilience productive investment.

Third, institutional quality changes the conditions under which debt becomes sustainable. Lee et al. (2023) find threshold effects across income groups, with stronger institutions supporting sustainability particularly in lower-income settings. Institutions improve debt outcomes by strengthening revenue collection, expenditure control, policy credibility, and the government's response to rising debt. Digitalization can reinforce these channels through better records, electronic payments, and integrated financial information, but weak governance can limit the benefits. The policy implication is that digital fiscal reform should be paired with institutional reform. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic resilience productive investment.

Fourth, governance quality influences how public debt affects private investment. Nguyen (2022) finds evidence of crowding out in developing economies while governance supports investment performance. This relationship matters for economic resilience because private investment is essential for productivity, employment, and tax-base expansion. If public borrowing absorbs domestic financial resources without generating complementary infrastructure, debt can weaken the very growth needed for sustainability. Digital-economy investments should therefore prioritize public goods that crowd in private activity, including broadband infrastructure, interoperable digital services, cybersecurity, and skills. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic resilience productive investment accountable.

Fifth, fiscal space affects governments' ability to respond to financial crises. Salamaliki and Venetis (2024) show that debt and market-access conditions influence fiscal responses after financial distress. Countries with limited fiscal space may be forced into procyclical adjustment when stabilization is most necessary. Economic resilience therefore depends partly on preserving borrowing capacity before shocks occur. Digital fiscal systems can improve real-time monitoring and scenario analysis, helping authorities detect deteriorating conditions earlier. However, analytical capacity must be matched by credible policy action. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic resilience productive investment accountable governance and.

Sixth, debt sustainability can be strengthened through growth-supporting expenditure rather than mechanical consolidation. Ciaffi et al. (2024) find that government spending shocks can generate positive multipliers and reduce debt-to-GDP ratios under certain OECD conditions, with nonlinear effects across debt regimes. This evidence cautions against assuming that expenditure reductions always improve sustainability. In the digital economy, productive public investment in infrastructure, skills, and government technology may raise potential output and revenue capacity. The critical issue is expenditure quality. Debt-financed spending is more defensible when projects have

credible productivity effects, transparent procurement, and measurable outcomes that strengthen future fiscal capacity. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across.

Seventh, fiscal rules do not automatically guarantee sustainable debt. Abubakar et al. (2025) find that debt relief improves sustainability in sub-Saharan Africa, whereas restrictive fiscal rules can have adverse effects under certain conditions. The result highlights the importance of institutional context and policy design. Rules should support credibility without preventing appropriate responses to recessions, disasters, or productive investment needs. Digital monitoring can improve compliance and transparency, but rule design must still account for economic cycles and escape clauses. Sustainable governance combines constraints with flexibility, allowing temporary borrowing when it protects productive capacity while requiring credible medium-term adjustment. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing.

Eighth, debt sustainability interacts with monetary policy, inflation, and risk premiums. Cavuoti and Nisticò (2022) show in a nonlinear public-debt model that fiscal rules alone may be insufficient to stabilize debt and that monetary-policy interactions matter. This is relevant to digital economies because faster financial transmission and digital payment systems may alter liquidity conditions without eliminating macroeconomic constraints. Governments should therefore coordinate debt maturity, fiscal policy, and monetary conditions while protecting central-bank credibility. Resilience requires avoiding fiscal strategies that depend on persistently favorable rates or inflation surprises. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic.

Ninth, public debt can support sustainable and inclusive growth when borrowing is aligned with productive development and institutional quality. Olaoye (2022) examines debt-financed growth in sub-Saharan Africa and emphasizes heterogeneity related to institutions, income, and resources. The implication is that debt thresholds are context-dependent rather than universal. Digital investment may raise growth potential, but returns differ with connectivity, human capital, competition, and governance. Governments should therefore evaluate borrowing against project-level and macroeconomic returns rather than headline digitalization targets. Strong institutions increase the likelihood that debt finances assets capable of expanding productivity and future revenues. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions.

Tenth, external debt outcomes depend strongly on governance. Manasseh et al. (2022) find that governance matters for the relationship between external debt and economic growth in sub-Saharan Africa. This reinforces the argument that institutional quality is not merely a control variable but a mechanism shaping debt effectiveness. Transparent contracting, reliable procurement, anticorruption controls, and credible investment appraisal can determine whether external borrowing supports resilience or creates vulnerability. Digital public-finance tools can improve traceability and disclosure, yet they require data standards and enforcement. Institutional quality converts information into

accountability and borrowing into productive capacity. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through.

Eleventh, digital-economy development can strengthen fiscal sustainability by reducing vertical fiscal imbalances. Li and Yang (2024) find that digital development mitigates fiscal imbalances in Chinese local governments and that fiscal transparency reinforces the effect. Digitalization can broaden formal economic activity, improve information, and reduce administrative frictions, thereby strengthening revenue capacity. However, these benefits depend on transparency and institutional design. Governments should integrate digital-economy strategy with fiscal federalism, revenue administration, and public financial management. When digital transformation improves the match between expenditure responsibilities and revenue capacity, it can reduce structural borrowing pressures and support more sustainable subnational debt. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing.

Twelfth, debt sustainability is linked with broader environmental and intergenerational objectives. Baret and Menuet (2024) show that fiscal and environmental sustainability can interact when governments finance environmental expenditure through taxation or debt under a long-run debt target. Digital economies face similar intertemporal choices because infrastructure and transition investments create upfront fiscal costs but may generate future productivity and resilience benefits. Debt should therefore be evaluated against the assets and risk reductions it finances. Borrowing for projects that strengthen energy efficiency, climate adaptation, digital infrastructure, or public-service continuity may improve long-run resilience when fiscal governance ensures credible returns. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing.

Thirteenth, Indonesia's experience demonstrates the importance of macroeconomic recovery and disciplined fiscal management after shocks. Rahman et al. (2023) examine public debt sustainability after the financial crisis and during the COVID-19 pandemic and find evidence relevant to Indonesia's ability to manage changing debt conditions. The case illustrates that emerging economies need buffers, credible institutions, and growth recovery to prevent temporary crisis borrowing from becoming persistent vulnerability. Indonesia's expanding digital economy can support revenue formalization and productivity, but sustainable debt still depends on tax capacity, financing costs, and expenditure quality. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional.

Fourteenth, debt sustainability can exhibit fiscal fatigue as debt rises. Makala (2022) analyzes CEMAC countries using fiscal reaction and fiscal-space concepts and shows why governments' ability to generate stronger primary balances may weaken beyond certain debt conditions. This nonlinearity is important for digital-era borrowing. Governments should not assume that future digital growth will automatically create sufficient revenues to service any level of debt. High debt can reduce policy flexibility before expected technology gains materialize. Fiscal authorities should preserve buffers, sequence digital

investment, and use conservative revenue assumptions. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic.

Fifteenth, institutional quality can directly reduce public debt burdens in the digital era. Ain et al. (2025) analyze a broad country panel and report that stronger institutional quality is associated with lower public debt, while higher tax revenue also supports better debt outcomes. This synthesis supports a conditional view of digital-era debt sustainability: technology can expand fiscal capacity only when institutions transform digital growth into reliable revenue, productive investment, transparent liabilities, and resilient economic structures. Overall the evidence supports prudent credible institutional digital growth aware transparent adaptive responsible resilient public debt management and sustainable economic development across changing global financial conditions through stronger fiscal capacity institutional quality economic resilience productive investment accountable governance and careful risk management for governments in.

Table 1. Public Debt Sustainability Framework in the Digital Economy

Dimension	Core mechanism	Key risk	Sustainability contribution
Fiscal capacity	Revenue, primary balance, market access	Financing and rollover pressure	Debt-service capacity
Institutional quality	Credibility, transparency, governance	Weak allocation and hidden liabilities	Productive and accountable borrowing
Digital economy	Formalization, information, infrastructure	Investment costs and cyber risks	Revenue and productivity potential
Economic resilience	Shock absorption and recovery	Persistent output and revenue losses	Stable debt dynamics
Integrated governance	Coordinated fiscal-digital strategy	Overoptimistic technology assumptions	Sustainable development financing

CONCLUSION

This study concludes that public debt sustainability in the digital economy depends on the interaction of fiscal capacity, institutional quality, and economic resilience rather than on debt ratios alone. Fiscal capacity determines whether governments can mobilize revenue, maintain market access, and generate credible primary balances. Institutional quality determines whether borrowing is transparent, productive, and governed by credible rules. Economic resilience determines whether shocks can be absorbed without persistent deterioration in debt dynamics. Digital transformation can strengthen all three mechanisms, but it can also create new investment requirements and risks when governance is weak.

The evidence supports a conditional approach to digital-era borrowing. Debt-financed investment can improve sustainability when it raises productivity, expands the formal tax base, strengthens infrastructure, and crowds in private investment. Conversely, borrowing can weaken resilience when it finances low-return expenditure, crowds out private activity, or relies on optimistic growth and interest-rate assumptions. Governments should therefore integrate debt management with digital-economy strategy, tax administration, public investment appraisal, fiscal transparency, and institutional reform. Stress testing should incorporate macroeconomic, financial, technological, and operational risks rather than treating digital transformation as an automatic source of fiscal gains.

Future research should test the proposed framework using cross-country and subnational panel data. Empirical models can examine whether digitalization improves debt sustainability through tax revenue, fiscal transparency, productivity, or lower information costs and whether these effects depend on institutional thresholds. Dynamic panel threshold models, fiscal reaction functions, local projections, and probabilistic debt-

sustainability analysis can identify nonlinear relationships. Longitudinal studies should also measure how digital public infrastructure affects government revenue, contingent liabilities, expenditure efficiency, and resilience during shocks. Such evidence can help governments distinguish productive digital borrowing from debt accumulation that merely postpones fiscal adjustment.

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