Leveraging smart governance for Ukraine's macroeconomic recovery and stabilisation

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Abstract

Objectives: The study aims to develop a strategic framework for integrating smart governance instruments into Ukraine's macroeconomic policy to enhance recovery and stabilisation. This research is vital for maximising the effectiveness of massive international aid, meeting the stringent EU integration criteria, and stimulating private sector growth by mitigating corruption and bureaucratic friction. The paper identifies SG mechanisms to achieve prioritised economic goals (e.g., economic growth, price and labour market stability, attracting FDI). **Prior Work**: The EU Smart Governance model and institutional resilience ground the paper, postulating that institutional quality is essential during economic crises and stabilisation. It builds directly on empirical data from Ukraine's pioneering e-governance solutions, such as Prozorro and Diia, linking their performance to measurable economic outcomes. **Approach**: We utilised a mixed-methods approach to capture practical evidence. The paper involves comparative analysis to quantify digital transparency, macroeconomic indicators, and qualitative methods, including case studies on implementing digital instruments in the EU and Ukraine's policy-making. **Results**: Findings confirm a significant role of digital governance transparency in macroeconomic policy design. The study identifies critical economic and administrative bottlenecks in permitting and regulation that digital tools must eliminate. It concludes that existing SG systems have high technical readiness, but suffer from low inter-system integration at the macro-planning level, inhibiting full economic effect. **Implications**: The study offers several significant implications for the academic community by providing new empirical data detailing the performance of advanced digital governance tools (e.g., Diia, Prozorro) under active large-scale war-crisis and engaged in rapid reconstruction of the economy, establishing new conceptual links between the quality of digital institutions and macroeconomic outcomes, and opening avenues for future research. The conclusion regarding high technical readiness but low inter-system integration highlights a new area for research on the challenges and determinants of seamless data-driven governance policy. **Value**: The core contribution is establishing a prescriptive, data-driven link between digital governance quality and macroeconomic stability in a unique, crisis-affected context. The paper is original in synthesising a practical instruments of SG solutions specifically tailored to address Ukraine's current fiscal and regulatory recovery challenges.

Keywords: digital transformation, macroeconomic policy, smart policy design.

1. Introduction

The full-scale invasion of Ukraine by the Russian Federation in 2022 triggered an unprecedented macroeconomic shock unmatched in modern European history. The contraction of GDP by approximately 30% in the first year of the war [1] reflects not just a cyclical recession but a fundamental relocation of the country's productive forces. The destruction of physical capital – from energy generation facilities to metallurgical plants – was accompanied by mass displacement of human capital, disruption of logistical chains, and the loss of access to traditional export markets.

In this context, traditional tools of macroeconomic stabilisation, such as inflation targeting or fiscal measures through aggregate demand management, are inadequate. The economy functions under conditions of extreme uncertainty, where

market mechanisms are temporarily suspended due to national security concerns. The main challenge is not only in restoring lost potential but also in developing a new economic framework capable of effectively handling large-scale streams of international aid and private investment without descending into hyperinflation or corruption-driven disorder.

The concept of Smart Governance is often linked to Smart Cities, where technologies are used to improve urban infrastructure. According to Mkhitaryan et al. [2], a smart city is broadly defined as an integrated urban system in which information and communication technologies (ICTs) are employed to enhance public services, optimise resource use, and foster citizen engagement.

The initial ideas of Smart Governance emerged from the world's first "Smart Nation" vision, which, according to Sipahi and Saayi [3], has made Singapore the world's first smart country. Launched in 2014, the Smart Nation initiative builds on decades of e-government reforms to create a fully digitalised state. Its goal is to utilise data, digital infrastructure, and ICTs to enhance the quality of life, strengthen businesses, and modernise public services, thereby forming the foundation of smart governance. Sipahi and Saayi [3] emphasised that through projects such as the National Digital Identity, Smart Nation Sensor Platform, GoBusiness and the Punggol Digital District, Singapore develops a model of smart governance. It moves toward becoming the world's first fully integrated smart nation.

However, in the context of the Ukrainian war, the concept of Smart Governance takes on a much broader and more fundamental significance. Hong et al. [4] describe Smart Governance as a new system of state innovations that combines intelligent technologies to promote stakeholder involvement in the policy-making process and to address the limitations of current governance. For this study, we define Smart Governance as an innovative managerial framework that employs digital technologies for the co-creation of public policy solutions, thereby maintaining institutional resilience and enhancing the effectiveness of macroeconomic regulation.

Unlike traditional E-governance, which focuses on digitising existing procedures, Smart Governance involves a fundamental overhaul of decision-making processes. Concerning macroeconomic regulation, several key features should be emphasised. First, Smart Governance enables a shift from delayed statistical reporting to real-time monitoring of economic activity (Real-time Data), including transactions, cash flows, income and expenditure, tax revenues, and budgetary outlays. Misch et al. [5] emphasise that utilising daily fiscal data for real-time macroeconomic analysis is especially valuable in countries where high-frequency GDP statistics are not available. Second, Smart Governance integrates advanced data analytics (AI &

Analytics) through algorithms designed to identify anomalies, forecast crises, and simulate policy impacts. This supports the development of "digital twins," which, according to Shephard [6], are digital models of real-world systems that process data in near real-time and maintain an accurate representation of the system of interest. Third, Smart Governance promotes inclusion and transparency by involving stakeholders in the managerial process through the use of open data and digital platforms. According to the European Parliamentary Research Service [7], this decreases informational asymmetries and strengthens trust in public institutions.

Ukraine entered the war with an already established digital foundation, which became a critical factor of survival. The concept of a "State in a Smartphone", encompassing more than 20 million Ukrainians [8], and implemented through the *Diia* ecosystem [9], transformed from a convenience tool into an instrument of national resilience. Digitalization preserved state functionality even amid the physical destruction of administrative buildings, mass forced migration, and dispersion of civil servants.

The contemporary digital architecture of Ukraine's recovery is based on the integration of three key platforms: Diia (citizen and business interaction) [9], *Prozorro* (public procurement management) [10] and DREAM (recovery project management) [11]. In addition, Ukraine has introduced a range of digital platforms providing access to information on government activities, particularly in public finance, as well as social services for citizens. These platforms form a unified digital contour that ensures transparency in the flow of every hryvnia – from donor to final contractor. As mechanisms of macroeconomic stabilization, they enable public oversight and stakeholder participation in decision-making, reduce investor risk premiums, and ensure targeted allocation of scarce resources.

This study aims to develop a strategic framework for integrating smart governance instruments into Ukraine's macroeconomic policy to enhance recovery and stabilization. We propose an in-depth analysis of how smart governance models are embedded into macroeconomic recovery policy, thereby shaping a new reality for post-war Ukraine.

2. Macroeconomic crisis and the digitalization of governance in Ukraine: contemporary assessments

The period from 2020 to 2024 exhibits sharp fluctuations in Ukraine's key macroeconomic indicators, driven by the combined shocks of the COVID-19 pandemic and Russia's full-scale armed aggression. Taken together, these factors have induced a profound transformation not only in the real sector of the economy but also in the fiscal, monetary, and external domains.

Table 1. Macroeconomic instability indicators in Ukraine

	2020	2021	2022	2023	2024
Real sector					
Real GDP growth, annual %	-3,8	3,4	-28,8	5,5	2,9
Fiscal sector					
State budget deficit, % of GDP	5,2	3,6	17,6	20,4	17,7
General government gross debt, % of GDP	53,9	43,3	71,6	79,4	87,4
Monetary sector					
Consumer price index (CPI), % annual	5,0	10,0	26,6	5,1	12,0
External sector					
Exchange rate, annual % change	4,3	1,2	18,5	13,1	9,8
Balance of goods and services deficit growth, annual %	-81,0	12,3	863,6	47,2	1,9
Social sector					
Unemployment rate, %	9,5	9,9	22,4	19,5	15,9
Real gross wage growth, annual %	7,4	10,5	-7,9	41,5	15,5

Source: Author`s calculation based on [12], [13], [14], [15], [16]

The real sector is characterised by cyclicality. The decline of 3.8% in 2020 (a consequence of COVID-19) was followed by a recovery of 3.4% in 2021. In 2022, a catastrophic shock-induced contraction of GDP by 28.8% occurred, directly resulting from the full-scale invasion, destruction of infrastructure, territorial occupation, and disruption of logistics. Subsequently, the economy demonstrated adaptation—expanding by 5.5% in 2023 and 2.9% in 2024. At the same time, it is important to note that despite the "positive" growth rates, the overall size of the economy remains significantly below the 2021 level.

Persistent budget deficits have influenced the fiscal sector; they remained moderate (3–5%) until 2022 but surged sharply with the onset of the war, reaching 17.6% in 2022 and 20.4% in 2023. Expenditures — primarily defence-related — dramatically exceeded the state's own revenues, with the economy sustained primarily through external assistance and monetary issuance. Under these conditions, the debt burden rose from a manageable 43.3% of GDP in 2021 to a critical 87.4% in 2024.

Inflationary spikes characterise the monetary sector. In 2022, the CPI increased by 26.6%, driven by currency depreciation, supply chain disruptions, and monetary issuance to cover fiscal needs. In 2023, inflation was substantially contained (to 5.1%), yet in 2024 it rose again to 12.0%, primarily due to energy tariffs and renewed depreciation.

The external sector experienced a significant depreciation of the hryvnia in 2022 (18.5%), with the pace subsequently slowing but remaining pronounced (9.8% in 2024). The most notable development was the 863.6% surge in the goods and services deficit in 2022. Port blockades curtailed exports, while critical imports (fuel, weapons, humanitarian goods) continued, explaining this outcome. Although the situation stabilised, the deficit continues to grow.

The social sector experienced a sharp rise in unemployment, from approximately 9–10% to 22.4% in 2022, driven by the destruction of business capacities in war-affected territories. The indicator gradually declined to 15.9% in 2024. Labour market revitalisation reflects the mobilisation of the economy for defence needs, yet unemployment remains elevated because military conscription and migration reduce the available workforce. Dynamics of real wages also fluctuated, but by 2023, wages had increased by 41.5%. The slowdown of inflation, wage indexation, and labour shortages that compelled businesses to raise salaries drove this optimistic trend.

External shocks and the large-scale war create high volatility in Ukraine's macroeconomic dynamics from 2020 to 2024. Despite significant fiscal imbalances, inflationary pressures, and labour market transformations, signs of gradual stabilisation emerged in 2023–2024, indicating the economy's capacity for recovery under conditions of international support and structural reforms. We can define the key features of Ukraine's wartime economy:

- Resilience: despite the massive shock of 2022, the system did not collapse and shifted toward stabilisation and moderate recovery in 2023–2024;
- Dependence: the enormous budget deficit and rapid debt accumulation underscore the critical reliance of macroeconomic stability on external financing;
- Imbalances: high unemployment and persistent external trade deficits remain the principal structural challenges.

The assessment of progress in the digital transformation of the public governance system covers an insufficiently long period to enable a complete evaluation of its impact on macroeconomic stabilisation outcomes. Since 2022, the Ministry of Digital Transformation of Ukraine has been developing the *Index of Digitalisation of Regions and Communities of Ukraine*, which provides a score-based assessment of the digitalisation results in local government bodies across eight defined parameters (Fig. 1).

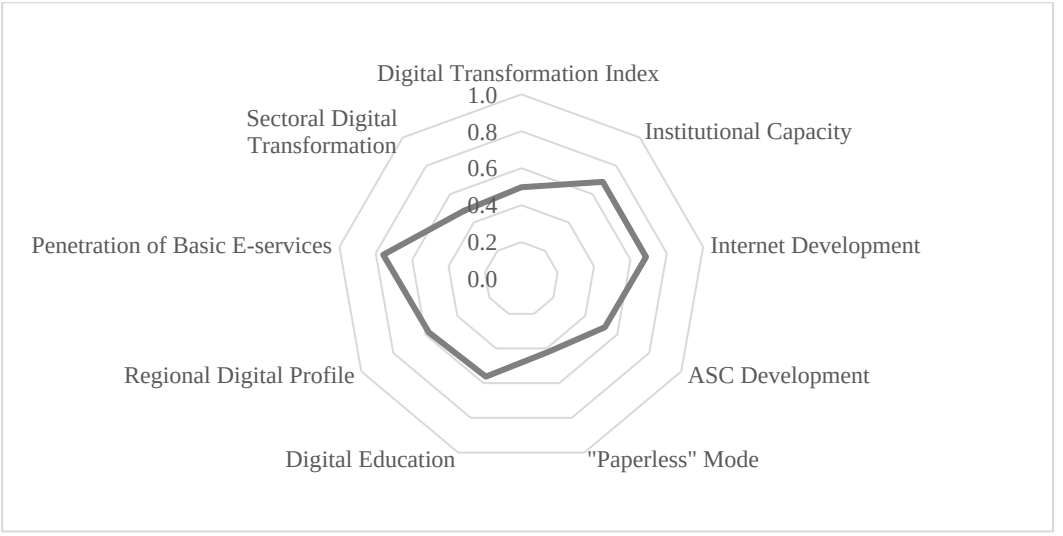

Fig. 1. Components of Index of Digitalization of Regions and Communities of Ukraine 2024 (max=1)
Source: Developed by the author from data [17], [18], [19]

An analysis of the consolidated scores of the Regional and Community Digitalisation Index for Ukraine as a whole in 2024 reveals a clear gap between administrative-organisational achievements and infrastructural-sectoral indicators. The highest index values are demonstrated by components related to service provision and local governance: Regional Digital Profile, which reflects the effectiveness of regional digitalisation policies facilitated by the institution of CDTOs in regional administrations and communities; Penetration of Basic E-services, confirming that mass electronic services have become the standard and enjoy broad population coverage; and Institutional Capacity, indicating that the state apparatus has, overall, adapted to new digital realities.

Problematic areas rely on physical infrastructure and deeper integration: Internet Development suffers from damage to telecommunications and energy networks; Sectoral Digital Transformation shows that digitalisation has not yet been sufficiently embedded within specific sectors of the economy; and Digital Education highlights the need for new approaches to enhancing digital literacy among the population or addressing the shortage of qualified specialists in the labour market. As of 2024, Ukraine's model of digital transformation demonstrates administrative success, as authorities have established an effective vertical of governance, while facing infrastructural challenges such as the physical condition of networks – particularly the Internet – and the insufficient depth of digitalisation in specific economic sectors.

Ukraine has also begun implementing a system for assessing the progress of digital transformation in public administration – the Digital Economy and Society Index

(DESI) [20] , which the European Union has used since 2014. Since 2023, the State Statistics Service has started calculating selected indicators; however, it has not yet produced a comprehensive index because adequate data remain unavailable (Fig. 2).

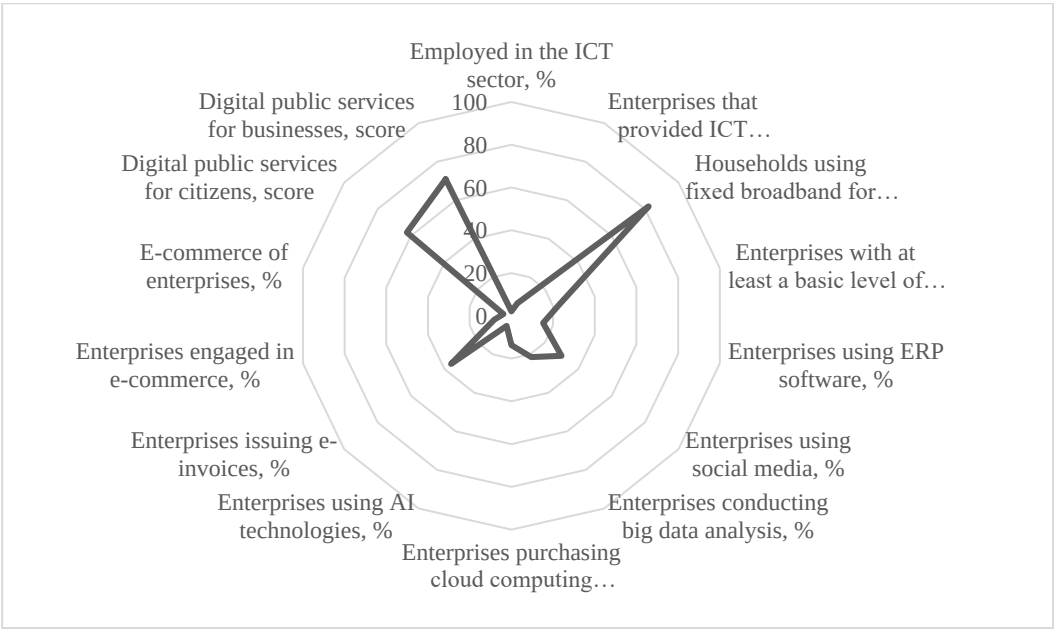

Fig. 2. Components of the Digital Economy and Society Index of Ukraine (2024 or latest available year)
Source: Developed by the author from data [21]

The analysis of DESI components for Ukraine reveals a critical disproportion between the level of development of digital infrastructure and public services, on the one hand, and the degree of integration of digital technologies within the business sector, on the other. High values in indicators of physical access to high-speed internet and digital public services demonstrate that the state acts as the primary driver of change, providing quality services to both citizens and businesses.

At the same time, technological backwardness in the corporate sector is evident: the use of artificial intelligence, big data analytics, and cloud computing remains critically low, as does engagement in electronic commerce (E-commerce). This situation highlights an obvious *"digital paradox"*: while the population enjoys widespread internet access and an advanced *"state in a smartphone"* ecosystem, the corporate sector remains weakly integrated into the broader digital environment (Table 2).

Table 2. Changes in macroeconomic instability indicators and digital transformation indicators in Ukraine (2024 compared to 2022)

Macroeconomic Instability Indicators		Digital Transformation Indicators			
		Digital Transformation Index (*score change of max 1*)		Digital Economy and Society Index (*percentage point*)	
		Positive changes			
Real gross wage growth, *%*	↑63,5	Institutional Capacity	↑0,05	Enterprises conducting big data analysis	↑13,2
Real GDP growth, *%*	↑8,6	Digital Education	↑0,2	Enterprises using enterprise resource planning (ERP) software	↑9,3
Unemployment rate, *percentage point*	↓6,5	Penetration of Basic E-services	↑0,1	Enterprises purchasing cloud computing services	↑3,9
				Enterprises engaged in e-commerce	↑2,6
				Enterprises using social media	↑0,9
				Enterprises with at least a basic level of digital	↑0,6
		Negative changes			
General government gross debt as a % of GDP, *percentage point*	↑15,8	Digital Transformation Index	↓0,2	Enterprises using artificial intelligence technologies	↓0,2
Consumer price index (CPI), *%*	↑17,7	ASC Development	↓0,2	E-commerce of enterprises	↓2,1
Exchange rate, *%*	↑24,1	"Paperless" Mode	↓0,3	Enterprises issuing e-invoices	↓3,7
Balance of goods and services deficit growth, *%*	↑50,0	Internet Development	0,0	Enterprises that provided ICT training, Households using fixed broadband for Internet access	n/a
		Regional Digital Profile	0,0		
		Sectoral Digital Transformation	0,0	Digital public services for citizens	
				Digital public services for businesses	

Source: Author`s calculation based on [12], [13], [14], [15], [17], [18], [19], [21], [16]

A comparison of the dynamics of macroeconomic and digital indicators reveals that Ukraine's economic system in 2022–2024 continued to operate under the influence of structural shocks induced by the war, while digital transformation progressed unevenly. The analysis reveals the absence of a direct correlation between economic stability and the pace of digital development, a pattern characteristic of countries undergoing recovery and dependent on external factors.

Positive macroeconomic shifts – real GDP growth (+8.6%), a decline in unemployment (–6.5 percentage points), and an increase in real wages (+63.5%)—indicate a post-crisis recovery of economic activity, the adaptation of enterprises and the labour market to wartime conditions, and the resumption of production processes. Against this backdrop, key components of the Digital Transformation Index—such as Institutional Capacity, Digital Education, and Penetration of Basic

E-services—also show moderate growth. The Digital Economy and Society Index (DESI) likewise records positive changes in the share of enterprises utilising data analytics, ERP systems, cloud services, and electronic commerce. These trends suggest that the private sector is actively adapting to digital technologies, thereby enhancing its efficiency and resilience.

Negative macroeconomic trends – such as rising public debt, inflation, currency depreciation, and trade balance deficits – correspond to limited progress in institutional and sectoral digital reforms, including *ASC Development*, *Paperless Mode*, *Internet Development*, and *Sectoral Digital Transformation*. The expansion of digital solutions occurs primarily within the business sector, while the infrastructural dimension remains the most vulnerable.

The results demonstrate:

- Moderate macroeconomic recovery despite high risks and structural constraints;
- Asymmetric development of digital transformation, with businesses adapting more dynamically than public institutions or individual sectors;
- Preservation of digital potential, yet a slowdown in systemic digital reforms due to economic limitations.

Digitalisation in Ukraine is a resilient process, though its intensity largely depends on macro-financial stability and the availability of investment in digital infrastructure. The resilience of the digital economy indicates long-term recovery potential, which stakeholders can realise by sustaining investment support and developing infrastructure.

3. Smart governance model: EU and Ukraine

"Smart Governance" within the European Union refers to a comprehensive transformation of public administration that integrates modern information and communication technologies (ICT) with democratic values to enhance the quality of decision-making, transparency, and citizen engagement. The EU's Smart Governance model reflects the transition toward *Digital Era Governance*, where the central focus lies on service integration and citizen satisfaction, achieved through business process reengineering.

The strategic foundation of the EU's Smart Governance model is the Digital Decade Programme [22], which sets measurable targets to be achieved by 2030. Authorities distribute these objectives across four key domains: connectivity, digital skills, digital business, and—most crucial for public administration—digital public services. The Digital Decade allows the EU and its Member States to collaborate through multilateral projects, pooling investments into large-scale cross-border

initiatives, while EU authorities systematically monitor progress toward policy goals. The State of the Digital Decade 2024 report underscores the need for intensified efforts, highlighting insufficient progress and significant disparities among Member States.

Pan-European initiatives, notably the Horizon Europe program, further support the advancement of innovative governance processes. For instance, the GREENGAGE project represents a continent-wide effort to promote innovative governance practices and assist public authorities in shaping policies aimed at mitigating and adapting to climate change. This project examines the model of Smart Urban Governance and its pathways of development and adoption, as well as the strategy of Twin Green and Digital Transitions as a response to significant climate resilience challenges [23].

A cornerstone of the EU's Smart Governance architecture is the European Interoperability Framework (EIF) [24]. The EIF comprises 47 recommendations for Member States, defining the procedures for establishing and ensuring interoperability of information systems necessary for delivering cross-border public services to citizens and businesses. It incorporates twelve principles that provide the contextual foundation for designing European public services. These principles establish the framework for EU action (subsidiarity, proportionality), interoperability requirements (openness, technological neutrality), and user-oriented values (user-centricity, inclusiveness, accessibility, security, and privacy).

The EU Smart Governance framework is built around guarantees of data protection and transparency. The General Data Protection Regulation (GDPR) 2016/679 [25] ensures the proper processing and safeguarding of personal data, granting citizens a high level of control, including access to their data and the ability to report inaccuracies. To stimulate economic growth and innovation, the EU has also implemented the Open Data Directive [26]. which promotes the publication of dynamic datasets and extends its scope to data held by public enterprises.

For the purposes of state macroeconomic policy making, we identify the following as the fundamental pillars of the EU Smart Governance model:

- *Smart Decision Making* – The integration of artificial intelligence (AI), digital platforms, and stakeholder engagement seeks to enhance the legitimacy, efficiency, and transparency of EU policymaking. AI systems are employed to identify societal challenges, forecast policy outcomes, and evaluate effectiveness. Hofmann et al. [27] advocate for a comprehensive approach that integrates legal, policy, and technological considerations to establish accountability standards for automated decision-making systems;

- *Evidence-Based Policy Making* – grounded in empirical data rather than assumptions, this pillar emphasises the importance of strengthening institutional capacity and reinforcing science-policy linkages. The Joint Research Centre report [28] highlights the critical role of evidence-based frameworks in ensuring informed decision-making across government structures;
- *Smart Administration (E-Government)* – refers to the digital transformation of public services and administration, aiming to improve efficiency, transparency, and accessibility for both citizens and businesses. E-government initiatives in the EU have significantly advanced public administration by fostering efficiency and citizen engagement. Nonetheless, persistent digital divides and the need for robust legal frameworks remain pressing challenges to ensure equal benefits for all EU citizens [29]. A cornerstone principle in service delivery is the "Once Only" rule [30], enshrined in the Single Digital Gateway Regulation (SDGR), whereby citizens provide information to the state only once, with public authorities subsequently exchanging data autonomously;
- *Smart Democracy / E-Participation* – implemented through platforms for electronic petitions, consultations, and voting, this pillar enables citizen involvement in the co-creation of public services. The EU has witnessed a surge in digital platforms for citizen engagement, including participatory budgeting, e-consultations, and the European Citizens' Initiative (ECI). These instruments aim to make governance more open and responsive.

Carboni [31] defines citizen participation as an essential dimension of a Smart City, which entails the active engagement of residents in decision-making processes, thereby enhancing transparency and accountability. E-governance supports this participation by using ICT to deliver government services, exchange information, communicate with citizens, and facilitate various transactions. According to Kumar [32] meaningful citizen participation requires integrating smart city initiatives into institutional contexts and aligning them with broader institutional goals. Without such transformation, citizen engagement and smart city efforts can be hindered. Rigid institutional structures and practices often undermine participation, making effective civic engagement far more challenging than it appears. However, as Karlsson [33] notes, while digital tools expand opportunities for participation, their actual impact on policymaking remains limited, with many participatory designs having a limited substantive influence on policy outcomes.

A distinctive feature of the EU's Smart Governance model is its organisation not as a hierarchical structure but as a network of platforms encompassing all key dimensions of interaction [34]:

- G2C (Government to Citizen) – provision of services and citizen participation;
- G2B (Government to Business) – processes related to registration, taxation, and procurement;
- G2G (Government to Government) – data exchange among registries and public institutions.

The Ukrainian model of public administration aspires to align with the EU's Smart Governance framework, as European integration processes necessitate policy harmonisation, particularly in the sphere of digital transformation. Ukraine has achieved notable progress in technological development and the implementation of Smart Administration services. However, in areas concerning advanced data analysis for political decision-making (Smart Decision Making) and the legal regulation of artificial intelligence, the process of integration with EU practices remains ongoing (Fig. 3).

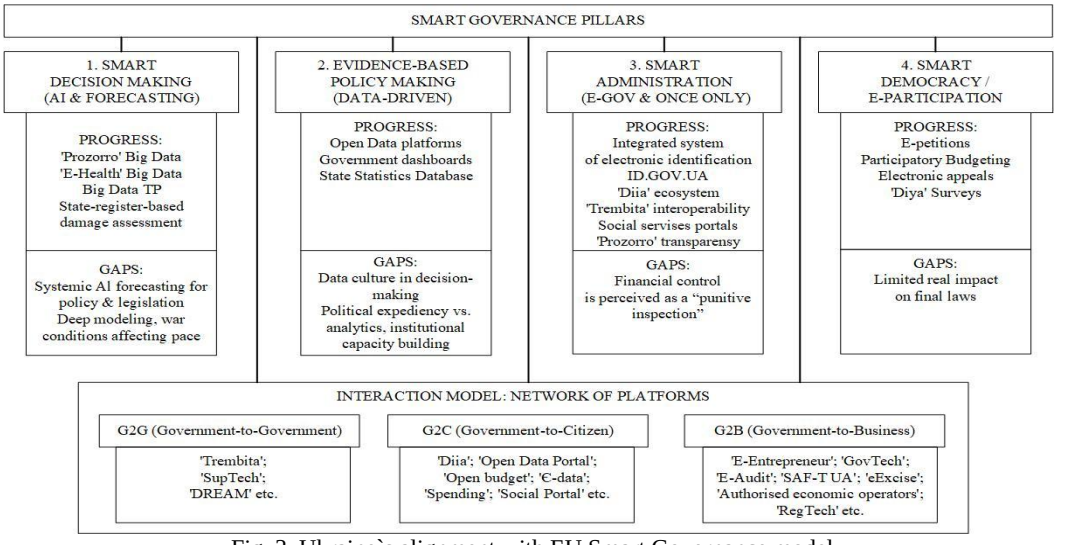

Fig. 3. Ukraine`s alignment with EU Smart Governance model
Source: Developed by the author

Ukraine has been actively adopting elements that constitute the cornerstones of the EU Smart Governance framework.

- A robust ecosystem of digital governance has been established, with the Diia application and portal serving as its central interface. Diia embodies *user-centricity* and corresponds to the G2C (Government-to-Citizen) approach;
- Authorities implement the "Once Only" principle, ensuring that citizens provide information to the state only once during registration, regardless of the number of services or procedures they subsequently access;

- The national Trembita system [35] facilitates data exchange among government registries, local self-government bodies (G2G), and businesses (G2B), aligning with the European Interoperability Framework (EIF);
- Instruments of electronic participation have been introduced, including e-petitions (on the websites of the President, Cabinet of Ministers, and local councils), participatory budgeting, and surveys conducted via Diia. These tools exemplify large-scale co-creation, enabling millions of citizens to participate in voting on public decisions;
- Authorities have adapted legislation on personal data protection to comply with GDPR standards;
- The interaction model develops a network of platforms (G2C, G2B, G2G) that deliver public services to citizens and businesses while ensuring openness, transparency, and accountability of government activities.

Digital platforms have had a stimulating effect on Ukraine's economic recovery. The Diia ecosystem has become the primary interface between the state and society. By the end of 2024, more than 21 million Ukrainians were using the application, which provided access to 24 digital documents, over 30 services within the app, and more than 125 services on the portal [36]. For the economy, Diia significantly reduces the time and cost of obtaining administrative services. A study conducted by Civitta estimates annual savings from digitalisation through Diia at 59.6 billion UAH, resulting from reduced waiting times, fewer trips to government offices, and lower paper and logistics costs [37].

The automatic registration of sole proprietors (FOPs) within minutes via Diia lowers entry barriers for small businesses, fostering the legalisation of informal employment and the creation of new jobs. In wartime conditions, where large enterprises suffer destruction, small businesses have become drivers of economic adaptation. Analysts forecast that by 2035, digital services could generate up to 5.3% of Ukraine's GDP [37].

Diia also functions as a highly efficient channel for fiscal stimulus, enabling targeted payments through programs such as "eSupport" (during COVID-19 and the early stages of the war), "eRecovery" (housing compensation), and the National Cashback scheme. These mechanisms enable direct transfers with minimal administrative costs, prevent fraud, and maintain aggregate demand during critical periods.

For social services, Ukraine has launched social e-services, including the Social Portal [38], designed to improve interactions among service recipients, social sector professionals, and welfare authorities. Additional platforms include the Electronic

Account for Persons with Disabilities, the State Prosthetic Care Programme Platform, and the Web-Portal of Electronic Services of the Pension Fund [39].

The Prozorro public procurement system has become a global benchmark of transparency. Built on the principle of *"everyone sees everything"*, its central database is administered by the state, while private providers manage access interfaces. In 2024, the average number of participants per tender reached 2.38, reflecting business confidence in the system [40]. Until 2020, Prozorro has saved the state budget approximately USD 6 billion [41]. In February 2024 alone, competitive tenders generated savings of 3 billion UAH [42].

The Prozorro system generates vast datasets, which authorities use for strategic sourcing and identifying corruption risks. Its business intelligence instruments, BI Prozorro [43], enable monitoring of prices for critical goods and help prevent price inflation.

For the management of public finances, Ukraine employs several platforms: the Open Data Portal [44], the synergy of the Open Budget portal (citizen-oriented access to public finance data, E-data) [45], the E-data platform [46], and Spending, a unified web portal for tracking public expenditures [47].

A key innovation of the recovery period is the DREAM ecosystem (Digital Restoration Ecosystem for Accountable Management), which functions as a "single window" for managing the full life cycle of reconstruction projects [48]. Each restoration object (school, bridge, hospital) has a digital profile containing all relevant information—from damage assessments to tender results and completion reports. The system automatically analyzes projects for risks (e.g., abnormally low or high prices, questionable contractor reputation) and alerts donors and oversight bodies [49]. Citizens can monitor construction progress through open data access, thereby enhancing the social accountability of contractors and local authorities. DREAM effectively transforms reconstruction into a transparent investment product comprehensible to international partners.

In December 2023, the government introduced reforms in the tax and customs systems, shifting the philosophy of interaction with taxpayers from fiscal pressure to voluntary compliance through simplified procedures [50]. New GovTech instruments were implemented to increase fiscal efficiency without raising tax rates, including E-Audit and the SAF-T standard audit file, which automate inspections of large taxpayers and reduce corruption risks. The eExcise tool combats the shadow market of excisable goods (alcohol, tobacco), allowing citizens to scan product codes via Diia to verify legality.

Customs play a critical role in budget revenues and supply chain security. Ukraine is actively implementing the New Computerised Transit System (NCTS)—a joint transit framework with the EU ("customs visa-free regime") [51]. Real-time data exchange with EU customs prevents manipulation of customs values. The AEO (Authorised Economic Operator) program offers simplifications for compliant businesses, thereby facilitating faster border crossings.

The National Bank of Ukraine (NBU) demonstrated exceptional institutional capacity during wartime, ensuring uninterrupted payments and banking stability. Its Financial Sector Development Strategy to 2025 emphasizes technological innovation in supervision and regulation [52]. The NBU introduced SupTech (Supervisory Technology) to enhance credit oversight through the automated collection of loan-by-loan data. Machine learning models and graph analytics detect related parties, capital outflow schemes, and early signs of asset quality deterioration before they become systemic problems. RegTech (Regulatory Technology) helps market participants comply with regulatory requirements. The NBU encourages banks and non-bank institutions to use open APIs for automatic reporting, reducing operational costs and freeing resources for lending [53]. The introduction of BankID and remote KYC verification enabled banks to continue serving clients displaced by war.

The financial system remains a prime target for hostile cyberattacks. The NBU established the CSIRT-NBU Cybersecurity Centre, coordinating protection across the banking sector. Harmonization of Ukrainian legislation with the EU's Digital Operational Resilience Act (DORA) sets standards for cyber hygiene and operational resilience, ensuring the continuity of electronic payments even under blackouts and cyberattacks [54].

Ukraine's path toward EU integration is the central vector of reform. The Ukraine Facility, amounting to €50 billion for 2024–2027, is structured in accordance with the principles of NextGenerationEU. Similar to the EU's Recovery and Resilience Facility (RRF), funds are allocated not merely on promises but on concrete achievements – Milestones and Targets (M&Ts) [55]. Digital systems provide a verified audit trail, with DREAM offering geo-tagged photo reports, completion acts, and payment orders that are accessible to EU auditors in real-time [56].

4. Vision of smart macroeconomic policy design for Ukraine

To transform Ukraine's digital achievements into a comprehensive *Smart Macroeconomic Policy Design*, the country must advance from routine automation toward intelligent economic modelling. Drawing on the principles of EU Smart Governance, five strategic development vectors can be identified:

- *Deployment of Nowcasting Procedures* (Real-Time Data Infrastructure) Expanding Smart Decision Making through the application of Big Data requires real-time integration of economic indicators. Currently, GDP, inflation, and other macroeconomic data are collected with delays based on monthly, quarterly, or annual reports. Ukraine needs to implement a *Nowcasting* system, integrating real-time data from P2P transactions, cash registers, electricity consumption, and customs flows. This would allow the government to monitor the economy "as of yesterday" rather than "as of last month," enabling immediate responses to shocks;
- *Initiation of a Digital Twin of the Economy*, which is the highest level of Smart Governance. AI enables complex scenario simulations rather than linear forecasts. Developing a national AI-driven model, jointly moderated by the Ministry of Economy and the National Bank of Ukraine, would enable stress-testing of fiscal, monetary, and external policies prior to implementation, while modelling the transmission effects across the economy;
- *Institutionalisation of Digital Evidence-Based Policy Making*. Policy justification based on data must become a methodological requirement rather than an optional practice. Legal provisions should mandate that macroeconomic decisions (budgetary, tax, or regulatory changes) be accompanied by digital *Impact Assessments* generated from verified datasets. This would prevent decisions unsupported by economic calculations, in line with recommendations from the EU Joint Research Centre (JRC);
- *Unification and Integration of G2G Data Exchange for Macro-Analysis.* Expanding Smart Administration through the *Once Only Principle* requires overcoming fragmented databases across the Ministry of Finance, Ministry of Economy, NBU, and State Statistics Service. Establishing a unified Data Lake with anonymized datasets accessible to analysts across institutions would enable cross-sectoral research and coordinated macroeconomic analysis;
- *Feedback and Smart Democracy*. Incorporating e-participation tools – such as crowdsourcing, sentiment analysis of social media, and online petitions – would involve businesses and experts in discussions about macroeconomic scenarios. This participatory approach would allow Ukraine to transition from the stage of *"state as a service"* to *"state as an intelligent platform"*, ensuring more effective resource management for macroeconomic stabilization and recovery.

5. Conclusion

Digitalisation in Ukraine remains a resilient process, but its intensity largely depends on macroeconomic and financial stability, as well as the availability of investment in digital infrastructure. The digital economy's resilience indicates long-

term recovery potential, which stakeholders can realise by sustaining investment support and developing infrastructure.

In defining the vectors for building a national concept of *Smart Macroeconomic Policy Design* within the context of European integration, it is essential to consider the four foundational pillars underpinning the EU model of Smart Governance:

- Smart Decision Making – the justification of economic decisions through intelligent data-driven approaches;
- Evidence-Based Policy Making – the timely collection and application of reliable data;
- Smart Administration (E-Government) – the provision of public services and inter-agency data collaboration;
- Smart Democracy / E-Participation – ensuring public involvement in policymaking.

Today, Ukraine presents to the world a unique case of employing smart governance as an instrument of survival and recovery during full-scale war. The integration of platforms such as Diia, Prozorro, and DREAM, reinforced by digital tools for tax, customs, and monetary management, has created a robust digital framework for macroeconomic stabilization.

The further development of Ukraine's "digital state" must serve as the foundation for implementing macroeconomic stabilisation measures and rebuilding the economy from the consequences of war. At the same time, they must account for risks related to cybersecurity and the ethics of digital governance. Large-scale implementation of smart governance entails not only opportunities but also systemic risks that require careful management. In the digital economy, cybersecurity becomes a matter of macroeconomic stability: attacks on energy grids, banking systems, or property registries could paralyze the economy more swiftly than physical bombardments. Likewise, the leakage of personal data from state registries could undermine trust in the entire "State in a Smartphone" system. Therefore, the deployment of advanced technologies for encryption and secure data storage is imperative in shaping Ukraine's smart macroeconomic policy design.

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