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## DIGITAL TRANSFORMATION IN THE LOGIC OF THE GREEN ECONOMY: THE UAE’S EXPERIENCE IN BUILDING A SUSTAINABLE POST-OIL GROWTH MODEL

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**Abstract.** *This article examines how the United Arab Emirates leverages digital transformation within the logic of the green economy to build a sustainable post-oil growth model. Conceptually, it treats the green economy as an institutional–technological development paradigm in which growth is achieved through resource efficiency, risk reduction, and credible governance incentives, and argues that digitalization functions as an enabling layer that strengthens measurement, optimization, and enforcement capacity. Methodologically, the study applies qualitative institutional economic analysis to official statistical materials and analytical reports, using structural, comparative, and trend-based interpretation to trace the diffusion of digitalization across sectors and its sustainability implications. The findings indicate that UAE strategies and initiatives in artificial intelligence, smart government, and smart-city development support non-oil diversification while enhancing monitoring, transparency, and administrative efficiency, thereby improving the predictability of green investment and the operationalization of sustainability targets. At the same time, persistent constraints—including limited domestic R&D depth, dependence on imported knowledge, skills mismatches, and risks related to data governance, cybersecurity, energy demand of digital infrastructure, and e-waste—may weaken the long-run sustainability dividend of digital modernization. The article concludes that digital transformation can be an effective instrument for green-economy objectives when aligned with institutional quality, capability building, and robust data and regulatory frameworks.*

**Keywords:** *Green economy, digital transformation, institutional quality, economic diversification, smart government, smart cities, resource efficiency, sustainability.*

## YASHIL IQTISODIYOT MANTIG’IDA RAQAMLI TRANSFORMATSIYA: BAANING NEFTDAN KEYINGI BARQAROR O’SISH MODELINI QURISH TAJRIBASI

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***Annotatsiya.** Ushbu maqolada Birlashgan Arab Amirliklari neftdan keyingi barqaror o'sish modelini yaratish uchun yashil iqtisodiyot mantig'i doirasida raqamli transformatsiyadan qanday foydalanishi ko'rib chiqiladi. Kontseptual jihatdan, u yashil iqtisodiyotni o'sishga resurslar samaradorligi, xavflarni kamaytirish va ishonchli boshqaruv rag'batlari orqali erishiladigan institutsional-texnologik rivojlanish paradigmasi sifatida ko'rib chiqadi va raqamlashtirish o'lchash, optimallashtirish va ijro etish salohiyatini kuchaytiradigan qulay qatlam vazifasini bajarishi ta'kidlanadi. Metodologik jihatdan, tadqiqot rasmiy statistik materiallar va analitik hisobotlarga sifatli institutsional iqtisodiy tahlilni qo'llaydi, raqamlashtirishning tarmoqlar bo'ylab tarqalishini va uning barqarorlikka ta'sirini kuzatish uchun strukturaviy, qiyosiy va trendga asoslangan talqindan foydalanadi. Tadqiqot natijalari shuni ko'rsatadiki, BAAning sun'iy intellekt, aqlli hukumat va aqlli shaharlarni rivojlantirish sohasidagi strategiyalari va tashabbuslari neft bo'lmagan diversifikatsiyani qo'llab-quvvatlaydi, shu bilan birga monitoring, shaffoflik va ma'muriy samaradorlikni oshiradi, shu bilan yashil investitsiyalarning bashorat qilinishini va barqarorlik maqsadlarini amalga oshirishni yaxshilaydi. Shu bilan birga, doimiy cheklovlar, jumladan, cheklangan ichki ilmiy-tadqiqot va ishlanmalar chuqurligi, import qilingan bilimlarga bog'liqlik, ko'nikmalarning nomuvofiqligi va ma'lumotlarni boshqarish, kiberxavfsizlik, raqamli infratuzilmaning energiya talabi va elektron chiqindilar bilan bog'liq xavflar raqamli modernizatsiyaning uzoq muddatli barqarorlik dividendini zaiflashtirishi mumkin. Maqolada raqamli transformatsiya institutsional sifat, imkoniyatlarni rivojlantirish va mustahkam ma'lumotlar va tartibga solish tizimlari bilan uyg'unlashganda yashil iqtisodiyot maqsadlari uchun samarali vosita bo'lishi mumkin degan xulosaga kelish mumkin.*

*Kalit soʻzlar:* Yashil iqtisodiyot, raqamli transformatsiya, institutsional sifat, iqtisodiy diversifikatsiya, aqlli hukumat, aqlli shaharlar, resurslar samaradorligi, barqarorlik.

## **ЦИФРОВАЯ ТРАНСФОРМАЦИЯ В ЛОГИКЕ ЗЕЛЕННОЙ ЭКОНОМИКИ: ОПЫТ ОАЭ В СОЗДАНИИ УСТОЙЧИВОЙ МОДЕЛИ РОСТА ПОСЛЕ НЕФТЯНОЙ ЭКОНОМИКИ**

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*Аннотация.* В данной статье рассматривается, как Объединенные Арабские Эмираты используют цифровую трансформацию в рамках логики зеленой экономики для построения устойчивой модели роста после нефтяной эпохи. Концептуально зеленая экономика рассматривается как институционально-технологическая парадигма развития, в которой рост достигается за счет эффективности использования ресурсов, снижения рисков и надежных стимулов управления, и утверждается, что цифровизация функционирует как вспомогательный слой, укрепляющий возможности измерения, оптимизации и контроля. В методологическом плане в исследовании применяется качественный институционально-экономический анализ официальных статистических материалов и аналитических отчетов, используя структурную, сравнительную и трендовую интерпретацию для отслеживания распространения цифровизации в различных секторах и ее последствий для устойчивого развития. Результаты показывают, что стратегии и инициативы ОАЭ в области искусственного интеллекта, «умного правительства» и развития «умных городов» поддерживают диверсификацию экономики, не связанной с нефтью, одновременно повышая мониторинг, прозрачность и эффективность управления, тем самым улучшая предсказуемость «зеленых» инвестиций и операционализацию целей устойчивого развития. В то же время сохраняющиеся ограничения, включая ограниченную глубину внутренних исследований и разработок, зависимость от импортных знаний, несоответствие навыков и риски, связанные с управлением данными, кибербезопасностью,

*энергопотреблением цифровой инфраструктуры и электронными отходами, могут ослабить долгосрочные дивиденды от цифровой модернизации в области устойчивого развития. В заключение статьи говорится, что цифровая трансформация может быть эффективным инструментом для достижения целей «зеленой» экономики при условии согласования с качеством институтов, наращиванием потенциала и надежными рамками данных и регулирования.*

**Ключевые слова:** «зеленая» экономика, цифровая трансформация, качество институтов, диверсификация экономики, «умное правительство», «умные города», ресурсоэффективность, устойчивое развитие.

## INTRODUCTION

Over the past several decades, the economic development of the United Arab Emirates has been largely shaped by hydrocarbon revenues. Oil wealth enabled rapid modernization, high income levels, and large-scale infrastructure development. However, reliance on natural resources exposed the economy to volatility in global energy markets and raised concerns regarding long-term sustainability. These structural vulnerabilities encouraged the UAE to pursue a strategic shift toward economic diversification.

Within the logic of this study, the green economy is understood as a development model in which economic growth is grounded in higher resource efficiency and technological modernization rather than in expanding the extraction and consumption of natural resources. Its core objective is to reduce environmental risks and prevent the degradation of natural capital while maintaining sustainable growth rates and quality of life. In practical terms, this implies a gradual decoupling of GDP dynamics from trends in material and energy intensity, as well as from emissions levels and other forms of pollution. At the same time, a transition to a green economy is unattainable without high-quality institutions. Effective rules, incentives, and enforcement mechanisms ensure policy predictability, build trust among businesses and society, and create conditions under which investment in clean technologies becomes economically rational.

Digital transformation is a key enabler of this shift because it provides the green economy with high-quality data, credible monitoring, and the ability to optimize decisions in real time. Digital platforms, sensor networks, and the Internet of Things make it possible to track energy use, emissions, and resource flows with far greater precision, turning sustainability goals from broad commitments into measurable performance indicators. Advanced analytics and AI can then optimize production, logistics, and urban infrastructure, cutting waste and improving energy efficiency without undermining growth. In parallel, digital public services and smart governance can strengthen institutional capacity by increasing transparency, simplifying compliance, and aligning incentives, thereby reducing transaction costs and lowering uncertainty for green investment.

This paper contributes to the literature on the UAE’s digital economy by situating digitalization explicitly within the logic of the green economy rather than treating it as a stand-alone modernization agenda. It argues that data infrastructures, smart governance, and technology-driven efficiency gains are not only engines of non-oil growth but also mechanisms that support sustainable diversification by enabling measurement, optimization, and enforcement. In doing so, the study clarifies how digital transformation can underpin a resilient post-oil development model grounded in institutional quality and observable sustainability outcomes. [1]

## **THEORETICAL FRAMEWORK**

The analytical core of the green economy approach rests on three interrelated ideas.

First, green growth requires resource efficiency. Improvements in productivity must increasingly arise from using less energy, water, and raw materials per unit of output. Second, it requires risk reduction and resilience by lowering exposure to environmental and climate-related shocks and by strengthening adaptive capacity. Third, it depends on institutional quality and incentives—regulatory coherence, monitoring capacity, and credible enforcement—because without them sustainability targets remain aspirational rather than operational.

In this framework, sustainability outcomes are achieved through a combination of (i) technological change (clean energy, low-carbon solutions, circular models), (ii) market incentives (pricing, standards, procurement, finance), and (iii) governance capacity to measure performance and enforce rules. This makes the green economy inherently institutional. The effectiveness of green policies depends not only on declared strategies but also on the ability of the state and markets to coordinate behavior under transparent and credible rules.

Digitalization supports the green economy through four main channels.

1) Measurement and monitoring (MRV capacity). Data infrastructures, IoT sensors, and digital reporting systems improve the measurability of resource use and emissions and strengthen monitoring, reporting, and verification (MRV).

2) Optimization and efficiency. AI and analytics enable real-time optimization of energy systems, logistics chains, and urban infrastructure, reducing losses and increasing energy and resource efficiency.

3) Platformization and new coordination mechanisms. Digital platforms reduce transaction costs and can improve coordination among firms, consumers, and government agencies, supporting new service models with lower material intensity.

4) Digital governance and enforcement. E-government, digital identity, interoperable registries, and process automation reduce administrative frictions and can increase transparency and compliance, thereby strengthening policy credibility.

The transition toward a knowledge-based economy represents a central element of the UAE’s long-term development strategy. A knowledge economy is commonly understood as an economic system in which growth is driven by the creation, dissemination, and application of knowledge rather than by the accumulation of physical

capital alone. This transformation is closely associated with digitalization, which enables knowledge-intensive activities across multiple sectors.

The analytical framework of the knowledge economy is traditionally structured around four interdependent pillars: human capital, innovation, information and communication technologies (ICT), and institutional and economic incentives. Together, these pillars explain how digitalization can translate into sustainable economic development. [2]

## **METHODOLOGY**

The research is structured within the framework of institutional economic analysis, focusing on the examination of digital transformation processes at the macroeconomic level. The study adopts a qualitative–analytical research design grounded in the systematic interpretation of institutional statistical materials and analytical reports.

The empirical foundation of the study is based on officially documented institutional datasets and analytically verified statistical materials. Institutional reports constitute the primary data source due to their methodological consistency, standardized data collection procedures, and macroeconomic coverage.

The methodological toolkit integrates structural analysis (sectoral reconfiguration under digitalization), comparative analysis (between traditional and digitally enabled sectors), and trend analysis (temporal dynamics of diffusion).

In addition to macroeconomic and sectoral shifts, the analysis adopts a sustainability lens by tracing (where data permit) institutional and policy mechanisms that link digitalization to resource efficiency and governance capacity (monitoring, transparency, and compliance). Limitations arise from the uneven availability of unified environmental indicators across sectors and the lag between technological deployment and its reflection in official statistics.

## **RESULTS AND DISCUSSION**

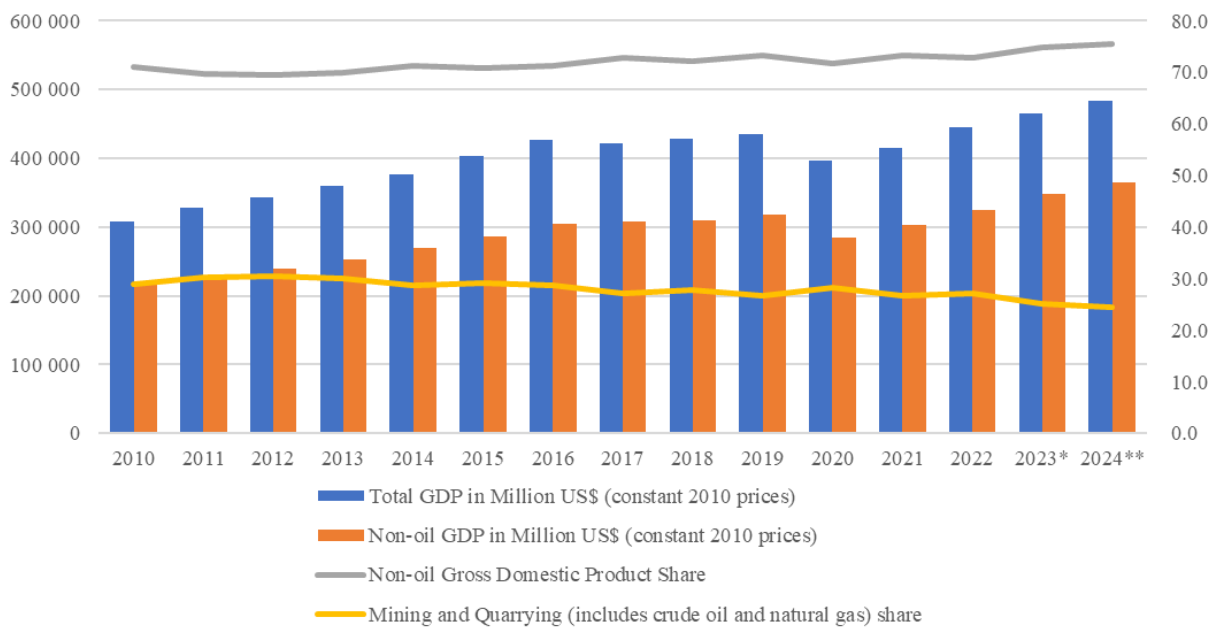
The United Arab Emirates has transformed over fifty years from a nomadic and pearl fishing economy to a wealthy nation reliant on substantial oil resources. Oil remains a critical income source and historically enabled rapid modernization. However, a concentrated export and fiscal structure increases exposure to commodity price volatility and external shocks, creating long-term sustainability risks.

The global financial crisis of 2008–2009 catalyzed the UAE’s diversification efforts and strengthened the policy rationale for restructuring away from oil dependence. In 2010, the UAE launched Vision 2021, supported by a broader set of initiatives focused on innovation, institutional modernization, and the expansion of non-oil sectors. These strategies created the institutional and infrastructural preconditions for large-scale digital adoption and the gradual integration of sustainability objectives into modernization agendas.

From 2010 to 2024, the UAE’s diversification strategy generated sustained structural shifts, reflected in the growing weight of the non-oil sector within the national

economy. According to data from the Federal Competitiveness and Statistics Centre and the Ministry of Economy, non-oil GDP increased from 218,636 million USD in 2010 to an estimated 365,427 million USD in 2024 (constant 2010 prices), representing cumulative growth of approximately 67% over the period.

The contribution of non-oil activities to total GDP also expanded steadily. The non-oil share rose from about 71% in 2010 to approximately 75.5% in 2024, while the share of mining and quarrying, including crude oil and natural gas, declined from roughly 29% to 24.5% (figure 1). This shift illustrates the gradual rebalancing of the UAE’s economic structure away from hydrocarbon dependence toward diversified productive sectors.



**Fig.1. Dynamics of total and non-oil GDP of the UAE [3]**

Although overall GDP and non-oil GDP followed broadly parallel upward trajectories, temporary slowdowns are observable around 2015, 2018, and most notably in 2020, reflecting the global economic disruption associated with the COVID-19 pandemic. The subsequent recovery phase indicates the resilience of non-oil sectors within the broader diversification framework.

External trade dynamics complement domestic diversification trends. Non-oil foreign trade reached record levels in 2022, growing by 19% year-on-year and by 50% compared to 2020 levels. Non-oil exports constituted approximately 20% of total foreign trade. [4]

Digitalization became a core pillar of the UAE’s economic strategy, positioning the digital economy as a driver of productivity and non-oil expansion. Yet within the logic of the green economy, its role is broader: digital systems also strengthen the state’s capacity to measure and steer sustainability outcomes through monitoring, optimization, and enforcement.

Key initiatives included the UAE Strategy for Artificial Intelligence (2017), the National AI Strategy 2031, and the Strategy for the Fourth Industrial Revolution. The

country’s parallel movement toward digital and environmental modernization is reflected in Smart City programs and projects such as Masdar City, which combine digital technologies (AI, IoT, blockchain) with clean-technology applications in infrastructure and services. [5]

To operationalize the “green logic” of digitalization, four mechanisms are central.

- Resource efficiency via optimization: data-driven management of energy, mobility, and infrastructure can reduce system losses.
- Faster policy execution: digital public services and automated workflows can shorten permitting and compliance processes for sustainable projects.
- Transparency and accountability: digital registries and service platforms reduce information asymmetries and can increase trust.
- Investment predictability: stronger governance and data availability reduce uncertainty and support the rationality of long-term sustainable investment.

Smart Government in the UAE represents an advanced phase of e-government characterized by integration of ICT into public administration. Unlike earlier e-government models focused mainly on online service provision, the Smart Government framework emphasizes data-driven governance, institutional efficiency, and citizen-centric service delivery. [6]

Within the green economy logic, Smart Government matters for three reasons.

- Measurement and coordination: digital registries and interoperable systems improve the state’s ability to coordinate complex cross-sector policies.
- Lower transaction and compliance costs: process automation and digital services reduce administrative burdens and can improve compliance.
- Transparency and trust: predictable, data-driven service delivery strengthens institutional credibility—an essential condition for sustained green investment.

The SmartGov model describes smart applications as principal channels for public service delivery, enabling remote access, secure payments, and structured procedures. Empirical findings point to high levels of public acceptance, where perceived usefulness, service quality, and trust influence adoption. [7]

From a sustainability perspective, adoption and trust function as an enabling condition. If digital platforms are not trusted, they cannot serve as credible channels for reporting, compliance, or incentive delivery.

Smart city development in the UAE is a strategic component of the transition toward a digital and sustainability-oriented economy. Smart urban systems can be interpreted as platforms that integrate data, governance, and infrastructure in order to improve resource efficiency and quality of life.

Dubai’s Smart Dubai initiative and Abu Dhabi’s development model (including Masdar City) provide illustrative cases where digital technologies are deployed alongside sustainability-oriented planning. [8]

Four domains are particularly relevant for “green” outcomes:

1. Energy: smart grids, metering, and analytics support demand management and energy efficiency.

2. Mobility and logistics: smart traffic management, route optimization, and integrated mobility platforms reduce congestion and fuel waste.

3. Water and waste: sensor-based monitoring and predictive maintenance reduce losses in utilities and improve collection and processing systems.

4. Buildings and infrastructure: smart building management and digital twins can improve operational efficiency and reduce resource intensity.

Digital transformation influences productivity through improved efficiency, flexibility, and personalization of production processes. In the context of the green economy, these efficiency gains are important because they can contribute to resource productivity (using fewer inputs per unit of output) and can support the long-term decoupling of growth from material intensity.

Digitalization transforms job content and skill requirements. A sustainability-oriented post-oil model increases demand not only for digital skills but also for hybrid competencies at the intersection of digital technologies, energy, and environmental management.

Digital infrastructure and regulatory predictability can attract investment to technology-intensive sectors. When combined with credible sustainability frameworks and data transparency, these conditions also improve the attractiveness of sustainability-oriented investment.

Digital tools lower market-entry costs and can support SMEs in adopting efficiency-enhancing solutions. For green diversification, the key issue is whether this ecosystem evolves toward higher-value innovation and locally embedded capabilities rather than remaining primarily adoption-driven. [9]

## **CONSTRAINTS AND STRUCTURAL CHALLENGES**

Key constraints remain relevant for both digital and green transitions.

- Innovation gap: limited depth of domestic R&D reduces endogenous green-tech innovation and the ability to move beyond technology adoption.

- Dependence on imported knowledge: reliance on external technologies can slow local learning and capability accumulation.

- Weak commercialization: limited technology transfer reduces returns to research and constrains the scaling of sustainability solutions.

- Skills mismatch: shortages of advanced and hybrid skills constrain both digital upgrading and sustainability-oriented transformation.

- Cybersecurity, data governance, and digital externalities: inadequate governance frameworks weaken trust and raise risks for data-driven sustainability policy; digitalization itself creates sustainability trade-offs, including data-center energy demand and electronic waste, requiring regulatory responses. [10]

## **CONCLUSION**

The UAE’s economic transformation illustrates how digital transformation can operate within the logic of the green economy to support a sustainable post-oil growth model. The central result is not simply the expansion of non-oil sectors but the

emergence of an enabling institutional–technological architecture that strengthens measurability, optimization capacity, and policy execution.

A sustainability-oriented post-oil growth model in the UAE can be summarized through six interdependent components: (1) non-oil sectoral diversification, (2) advanced digital infrastructure, (3) digital governance capacity, (4) innovation policy and human capital development, (5) smart-city and infrastructure modernization as a resource-efficiency platform, and (6) credible incentives and financing mechanisms supported by transparent data.

Empirical evidence suggests significant progress in digital infrastructure and institutional modernization, including Smart Government and smart-city initiatives, which can improve efficiency and governance capacity. However, structural constraints remain: limited endogenous innovation, dependence on imported knowledge, skills mismatches, and governance risks related to cybersecurity and data quality. Addressing these challenges is essential for deepening sustainable diversification and for ensuring that digital systems strengthen—rather than undermine—long-term sustainability through rising energy demand and e-waste.

In summary, the UAE case indicates that digital transformation can be a practical instrument for green-economy objectives when it strengthens institutions, improves measurement and transparency, and supports efficiency-based modernization. For resource-rich economies seeking resilient development pathways, the key policy implication is that a sustainable post-oil transition requires not only technology adoption but also capability building, credible incentives, and adaptive governance that aligns digital modernization with measurable sustainability outcomes.

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