THE "BURN-TO-EARN" INDEX

THE GLOBAL DIGITAL ECONOMY'S ECONOMIC AND ENVIRONMENTAL IMPACT AND TRADE-OFFS

Bhaskar Chakravorti, Ravi Shankar Chaturvedi, Christina Filipovic, and Abidemi Adisa

Digital Planet
July 2025

Acknowledgments

The authors wish to express their heartfelt appreciation to the many colleagues, collaborators, and supporters who made this work possible. The project was greatly strengthened by the wisdom, perspectives, and thoughtful review of numerous knowledgeable contributors. Although the final views, analyses, visualizations, and any shortcomings presented here are entirely the authors' responsibility, they have been immeasurably improved through the generous input of many.

We are especially grateful to Yean Cheong of SGTech for her unwavering support, strategic guidance, and valuable insights throughout the course of this project. We also thank members of her team—Melissa Cheong, Sukaa Latch, Low Rui Yin, Blanche Lim, Gwyneth Tan, Victoria Tan and Goh Wee Ling—for their thoughtful feedback and enthusiastic engagement.

We are proud to acknowledge our exceptional research team, comprised of talented students and alumni from The Fletcher School at Tufts University and other Tufts programs. Their intellectual curiosity, analytical rigor, and dedication have significantly enriched this research. In particular, we recognize the following student analysts for their outstanding contributions: Muhammed Anwar, Uddyalok Chakraborty, Benjamin Chishi, Gigi Copeland, Alison Guo, Tvisha Gupta, Veeradittya Podder, Francisco Salazar, Molly Sotangkur and Queena Yuan.

We are deeply thankful to our brilliant design team at Sunny Side Up—Upender Amuda, Kedar Deshpande, Anindita Dhar, Mohammed Jahangir, Sonal Kannan, Anand Krishnan, Shamanth GN, Roshan Madhavan, Rajaiah Manne, Vishnu Parikibandla, Poonam Rao, Neeraj Sharma, Rohit J. Varma, Yuvaraj SM, and Yesh Yerneni—for bringing our research findings to life through compelling visualizations.

Finally, we must recognize our behind-the-scenes colleagues, whose consistent encouragement and countless thoughtful gestures have created the supportive environment that enables our team to flourish in examining the global digital economy. We are grateful to Dean Maribel Blanco, Ann Cullen, Lupita Ervin, Dean Kelly Sims Gallagher, Xue Niu, Maria Pereira, Greg Simpson, Ariane Theis, Gwen Verkuilen-Chevalier, and Lori Zimmerman for creating this vibrant and supportive space.

Authors

Dr. BHASKAR CHAKRAVORTI

The Dean of Global Business at The Fletcher School at Tufts University, Bhaskar Chakravorti, is also the founding Executive Director of Fletcher's Institute for Business in the Global Context (IBGC) and Chair of Digital Planet. He has experience in academia, strategy consulting, and high-tech R&D, formerly on the faculties of Harvard and the University of Illinois, as a partner at McKinsey and Monitor, and as a game theorist at Bellcore (formerly Bell Labs). Chakravorti's book The Slow Pace of Fast Change, was rated one of the year's best business books. His most recent book co-edited with Joel Trachtman is Defeating Disinformation. He has been published widely in peer-reviewed academic journals, such as The New York Times, The Wall Street Journal, Financial Times, Harvard Business Review, Foreign Affairs, Foreign Policy, Forbes, and The Indian Express, among others.

RAVI SHANKAR CHATURVEDI

Ravi Shankar Chaturvedi is the author of several widely cited and influential articles in business and international affairs publications, he advises country governments, multilateral agencies, and blue-chip companies worldwide on inclusive digital transformation. Chaturvedi has extensive experience in emerging markets, strategy and business management, and the payments industry. He serves on the World Economic Forum's Council on Digital Trust and has served as a member of the Advisory Group for the Estonian Government's e-Residency program.

CHRISTINA FILIPOVIC

Christina Filipovic is the Associate Director and Head of Research at the Digital Planet research program at Fletcher's Institute for Business in the Global Context (IBGC). In addition to her work on Burn-to-Earn Index, she led the Ease of Doing Digital Business and Digital Trust research initiatives. Before her work with Digital Planet, she worked in government affairs and advocacy.

ABIDEMI ADISA

Abidemi Adisa is a Senior Research Analyst at the Digital Planet research program at Fletcher's Institute for Business in the Global Context (IBGC). In addition to her work on Burn-to-Earn Index, she has also led key projects like Getting Real About AI for the Bottom-of the Pyramid: Improving the Economic Outcomes of Smallholder Farmers in Africa also known as AI for Agriculture. Prior to joining Digital Planet, Abidemi earned her Ph.D. in Agricultural and Applied Economics from Texas Tech University.

Contents

Acknowledgments **2**
Authors **3**
Executive Summary **5**
The Digital Economy's Dual Impact: Growth and Environmental Consequences.......... 5
Addressing a Critical Knowledge Gap: Study Scope and Differentiations.......... 5
The Burn-to-Earn Index: A New Performance Metric 6
Digital Economy Framework 6
Decision Implications for Governments and Businesses.......... 9
Critical Questions Addressed 9
Key Findings.......... 10
The Economic Impact of the Digital Economy **21**
Methodology 22
Quantifying the size of the digital economy 26
The Environmental Impact of the Digital Economy **45**
Measuring Emissions 46
The Relationship between the Digital Economy and Emissions 50
The Trade-off between the Economic and Environmental Impact of the Digital Economy **58**
Countries and Companies Can Leverage These Insights to Pursue Multiple Pathways.......... 59
Burn-to-Earn by Income Group.......... 62
Comparisons Across Regions 72
Recommendations 76
Conclusion **78**
Appendix **79**
Country Selection (125 Economies) 85
Glossary **86**
Endnotes **89**
About **92**
Digital Planet 92
SGTech 92

Executive Summary

The Digital Economy's Dual Impact: Growth and Environmental Consequences

The global digital economy stands at an inflection point. The COVID-19 pandemic accelerated digitalization at an extraordinary rate, compressing years of transformation into months as organizations worldwide adapted to lockdowns and remote operations. This surge built upon already robust digital growth, with digitalization overtaking the previous paradigm of "uberization" to become the defining Socioeconomic and Political force of our era. Now, artificial intelligence is catalyzing yet another wave of acceleration, with demand increasingly driven by requirements for reliability and trustworthiness in data systems. Yet this digital revolution carries a profound paradox: while digital economies grow at three times the rate of global GDP, they simultaneously generate escalating environmental pressures through surging energy consumption, carbon emissions, and electronic waste. As we approach 2030—the critical deadline for achieving 45% emissions reductions under the Paris Agreement—we face this dual challenge in the context of widening rifts across digital access, adoption, and sustainability commitments. The mounting pressure on corporations and governments to deliver deeper emissions cuts while maintaining competitive digital growth represents one of the most complex strategic challenges of our time. This paradox demands immediate, evidence-based action from policymakers and business leaders who must navigate between digital transformation imperatives and environmental responsibilities.

Addressing a Critical Knowledge Gap: Study Scope and Differentiations

Despite the digital economy's transformative impact, no comprehensive framework has existed to measure both its economic value and environmental footprint across countries. This study fills that void by analyzing 125 economies—representing over 90% of global GDP—using a standardized, revenue-based methodology that enables meaningful cross-country comparisons and evidence-based decision-making.

Our approach represents a significant advancement over existing studies, such as those from Forrester,[1] the Consultancy,[2] and the OECD,[3] which typically examine only a limited number (14-44) of predominantly high-income countries and rely on limited or restrictive data. By establishing a universally standardized measurement framework, we provide the foundation for coordinated international action on digital sustainability.

Our methodology directly measures revenues from core components of the digital economy using a consistent approach across all 125 economies. This enables meaningful comparisons across income groups, regions, and stages of digital development. The use of standardized indicators allows for benchmarking and policy analysis that is not constrained by country-specific statistical frameworks.

Although the OECD has introduced the Digital Supply and Use Tables (Digital SUTs) to provide a standardized framework, their implementation remains a work in progress in most countries.[4] The Digital SUTs approach includes three dimensions: the nature of transactions, the types of goods and services produced, and the emergence of new digital industries. While promising, the framework depends heavily on detailed national accounts data that many countries are still in the process of compiling.

In summary, the Burn-to-Earn methodology fills a critical gap by delivering a globally harmonized, revenue-based measure of the digital economy that supports comparative analysis and evidence-based decision-making at national, regional, and global levels.

The Burn-to-Earn Index: A New Performance Metric

We introduce the Burn-to-Earn Index, a pioneering metric that calculates CO_2 equivalent emissions generated per digital economy dollar produced. This index enables direct comparison of how efficiently different economies convert digital activity into economic value while managing their environmental footprint. Leading performers demonstrate that robust digital growth and environmental stewardship are not mutually exclusive, offering a roadmap for others to follow.

Digital Economy Framework

Our analysis defines the digital economy through three core components:

1. **Value-added Services and Solutions:** IT services, software, fintech, public cloud, cybersecurity, IoT, and robotics.
2. **Digital Platforms:** E-commerce, digital media, advertising, digital health, and other service platforms.
3. **Hardware and Enabling Infrastructure:** Communications, data centers, devices, semiconductors, and digital public infrastructure.

Measuring the Value of the Digital Economy

A consistent and comprehensive framework is essential to facilitate a comparative analysis of digital economy's contributions across countries. This study defines the digital economy as a system comprising of:

Figure 1

Measuring the Value of the Digital Economy

Value-added Services and Solutions
IT Services, Software, Fintech, Public Cloud, Cybersecurity, Internet of Things, Robotics

Digital Platforms
E-commerce; Digital Media and Advertising: Music, E-Publishing, Video Games, Video Streaming, etc.
Digital Health: Fitness and Well-being, Treatment and Care, etc.
Other Service Platforms: Dating, Event Tickets, Education, Gambling, etc.

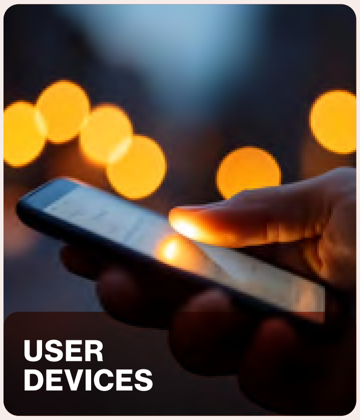
Hardware and Enabling Infrastructure
Communications, Data Centers, Devices, Semiconductors, DPI*

Measuring Emissions from the Digital Economy

Figure 2

Sources of emissions from the digital economy

Three primary sources of carbon dioxide emissions from the digital economy



Within each of the above three sources, there are two main emissions types

Operational emissions attributed to the use of digital services

+

Embodied emissions attributed to the creation of infrastructure

=

Total Emissions

Source: System Segments and GHG Footprint Allocations[5]

Decision Implications for Governments and Businesses

- Which digital activities enhance productivity and economic growth? How can they be catalyzed? How do these vary across different economies?
- Should companies and countries invest in green data center technologies, establish the next set of expansions of their digital supply chains in regions with a greener energy mix or invest in more efficient computing architectures? Should countries explore nuclear energy as a way out, as the growth of data centers is inevitable given the growing needs of AI?
- Are there changes in user behavior that can be encouraged by raising awareness of the economic-environmental trade-offs?
- Can companies and countries establish a differentiated brand equity and competitive advantage by taking action to get to a better balance on the trade-offs?
- Can governments and businesses reach better agreements on emissions limits or how much energy to consume or where to locate their digital supply chains with such information on hand and make decisions with an understanding of the trade-offs and other factors in mind? These could include cost, regulations, ability to move data across borders, reliability of the infrastructure, proximity to users, etc.
- If there are constraints in one country, because of limits placed on emissions or data protection laws, costs or other considerations, where else can a company locate parts of its digital supply chain (e.g., the next tranche of data centers)?

Critical Questions Addressed

This study enables evidence-based decision-making by answering:

- What are the specific trade-offs between digital economic growth and environmental impact?
- Which countries excel at managing these trade-offs, and what can others learn?
- How does digital maturity relate to both economic gains and emissions reduction?
- What concrete actions can stakeholders take to optimize the balance between digital growth and sustainability?

Key Findings

1. Explosive Growth

The digital economy has consistently outpaced overall GDP growth across multiple countries and income groups, underscoring its role as a powerful engine of economic expansion. Globally, between 2018 and 2023, it has expanded at a pace significantly faster than the broader economy—three times faster. This trend holds even in countries facing economic challenges; for instance, economies like Myanmar, which experienced a decline in GDP growth, still saw positive growth in their digital economies. This resilience demonstrates the digital sector's growing importance as a stabilizing and forward-driving component of national economies.

2. Platform Dominance

Digital platforms represent the largest aggregate contributor to the global digital economy, with e-commerce leading value creation. Key sectors within digital platforms include e-commerce, digital health, digital advertising, digital media, and e-services. China, the United States, and other major economies dominate the list of 25 countries where digital platforms are the most significant driver of digital economic activity, underscoring their central role in shaping global digital value chains.

3. Geographic Variations

While digital platforms contributed the most to the overall global digital economy—dominating in 25 economies including the United States and China—value-added services emerged as the leading contributor in 77 economies, highlighting their widespread impact. In contrast, hardware and enabling infrastructure are the primary drivers of the digital economy in 23 countries. Singapore is among these, with its digital economy heavily influenced by a strong semiconductor market, which underscores the importance of advanced manufacturing and infrastructure in shaping digital value in certain regions.

4. Sector Dynamics

Fintech emerges as the fastest-growing sector in the digital economy, driven by increased digital financial inclusion, widespread adoption of mobile payments, and ongoing innovation across both advanced and emerging economies. E-services also recorded strong growth, leading among digital platforms, followed by digital health and digital advertising—highlighting growing demand for digital service delivery, health technology, and online engagement.

Other notable performers in value-added services include public cloud services, the Internet of Things, and robotics, reflecting steady investment in enterprise solutions and digital infrastructure. In contrast, hardware and enabling infrastructure sectors experienced flat or negative growth, with minimal gains in data centers and declines in other areas, signaling a shift in momentum toward software-driven and service-based digital value creation.

5. Evolution Correlation

Digital economy value per internet user strongly correlates with a country's stage of digital evolution, with wealthier and more digitally mature economies generating significantly more value per user than emerging digital economies. High-income countries typically lead in both digital advancement and economic returns per internet user, supported by advanced infrastructure, robust innovation capacity, and well-established digital ecosystems. In contrast, low-income and lower-middle-income countries lag behind due to persistent challenges such as inadequate infrastructure, limited affordability, and poor connectivity, which hinder both digital adoption and value generation.

6. Digital Divide

The gap in digital productivity between high- and low-income countries continues to widen, posing a significant threat to inclusive growth. In 2023, adjusted values of digital economy size per internet user reveal substantial disparities across countries. This concentration of digital value in wealthier nations reflects their advanced infrastructure, higher disposable incomes, and mature digital services. In contrast, lower-income countries fall at the lower end of the rankings. These gaps highlight the persistent challenges of limited digital infrastructure, low purchasing power, and barriers in digital literacy and access, underscoring the urgent need for targeted efforts to bridge the digital divide.

7. Environmental Performance Variance

Countries show wide variation in how efficiently they grow their digital economies while managing emissions, as measured by the Burn-to-Earn Index. High-income economies generally achieve lower emissions per dollar of digital output due to advanced infrastructure and strong reliance on renewable energy. In contrast, some digitally advanced nations still produce emissions near or above the global average, highlighting the environmental trade-offs of fossil fuel dependence. Upper-middle-income countries display a broad spectrum—some balance digital productivity with cleaner energy use, while others face high carbon intensity tied to outdated infrastructure and energy grids.

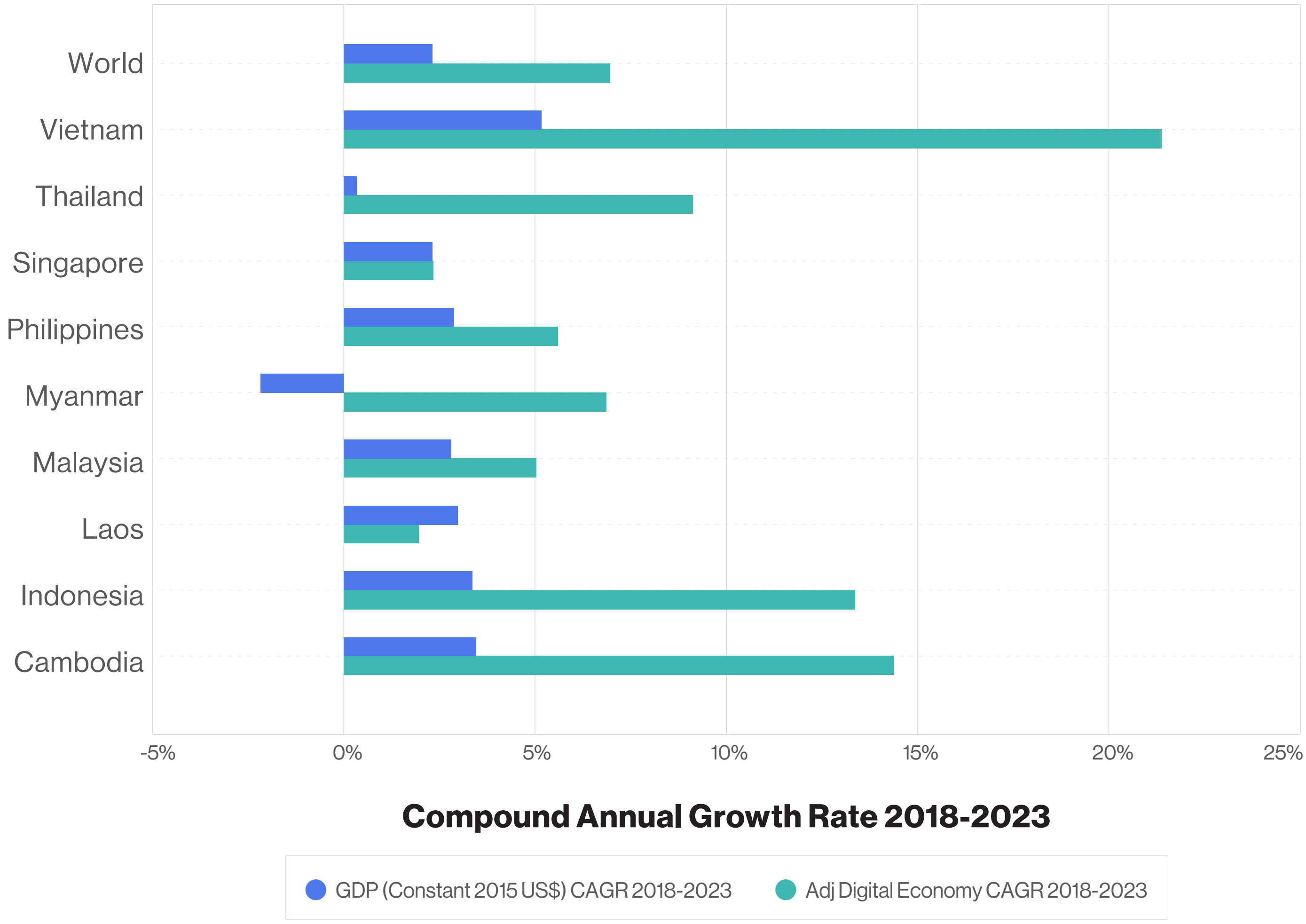
Lower-middle- and low-income countries tend to have higher emissions per dollar of digital output, often due to limited infrastructure, fossil fuel dependency, and lower digital productivity. Nonetheless, a few economies within these groups show promising progress, benefiting from renewable energy adoption or moderate digital activity. The index underscores the growing sustainability divide in the digital economy, emphasizing the urgent need for cleaner energy investments and digital infrastructure improvements, particularly in less developed regions, to support both economic growth and environmental responsibility.

Our analysis reveals seven critical insights that reshape understanding of the digital economy:

1. Explosive Growth

Digital economies are growing 3X faster than overall GDP globally, making digitalization a key lever for stimulating economic growth and revenues.

Figure 3
Growth in Digital Economy vs. Growth in GDP (2018-2023)

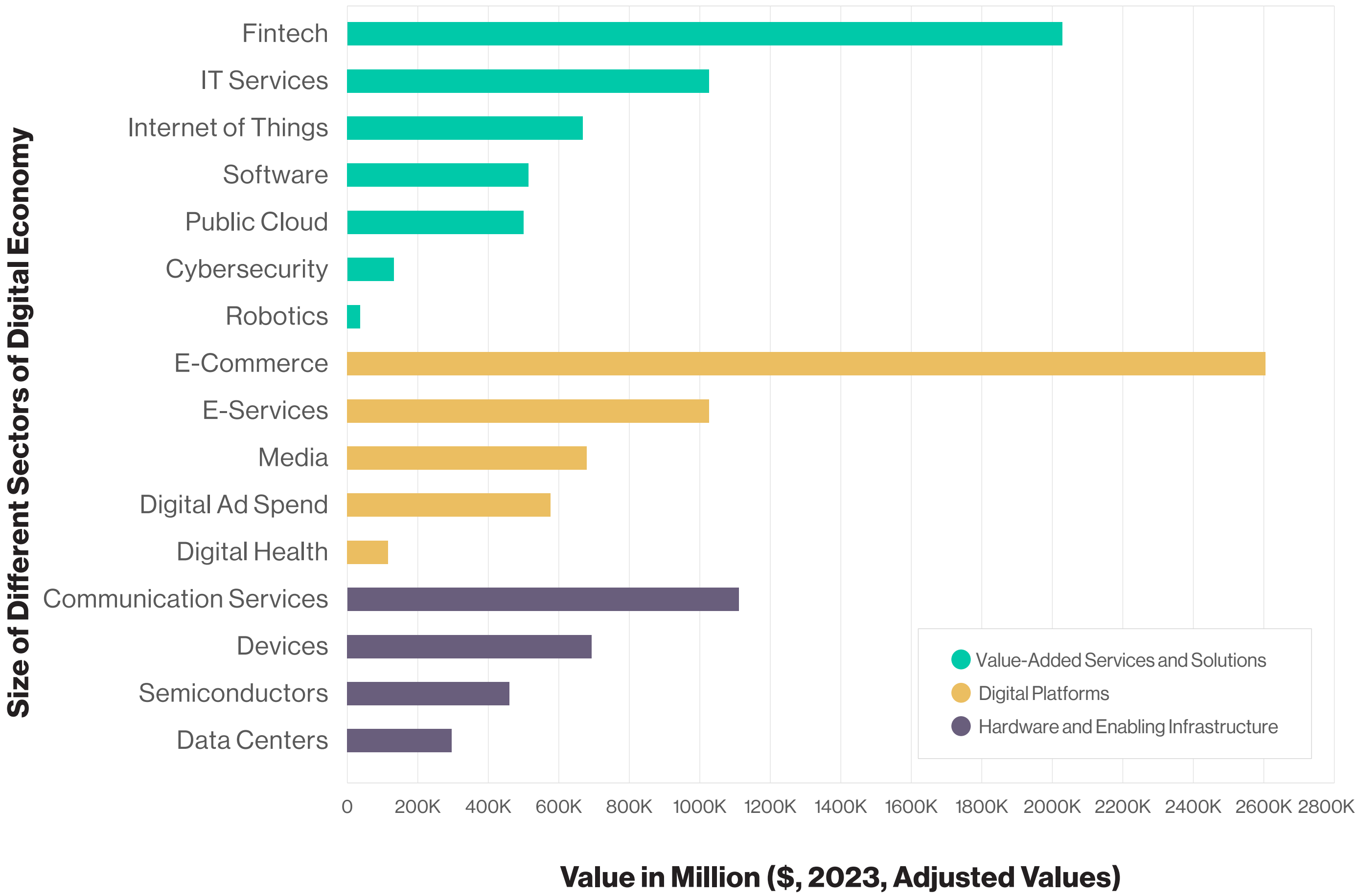


2. Platform Dominance

Digital platforms represent the largest aggregate contributor to the global digital economy, with e-commerce leading value creation.

Figure 4

Global Digital Economy Sized by Different Sectors



3. Geographic Variations

While platforms dominate in 25 economies (including the U.S. and China), value-added services lead in 77 economies.

Figure 5a

Sector Contribution to Digital Economy by Country

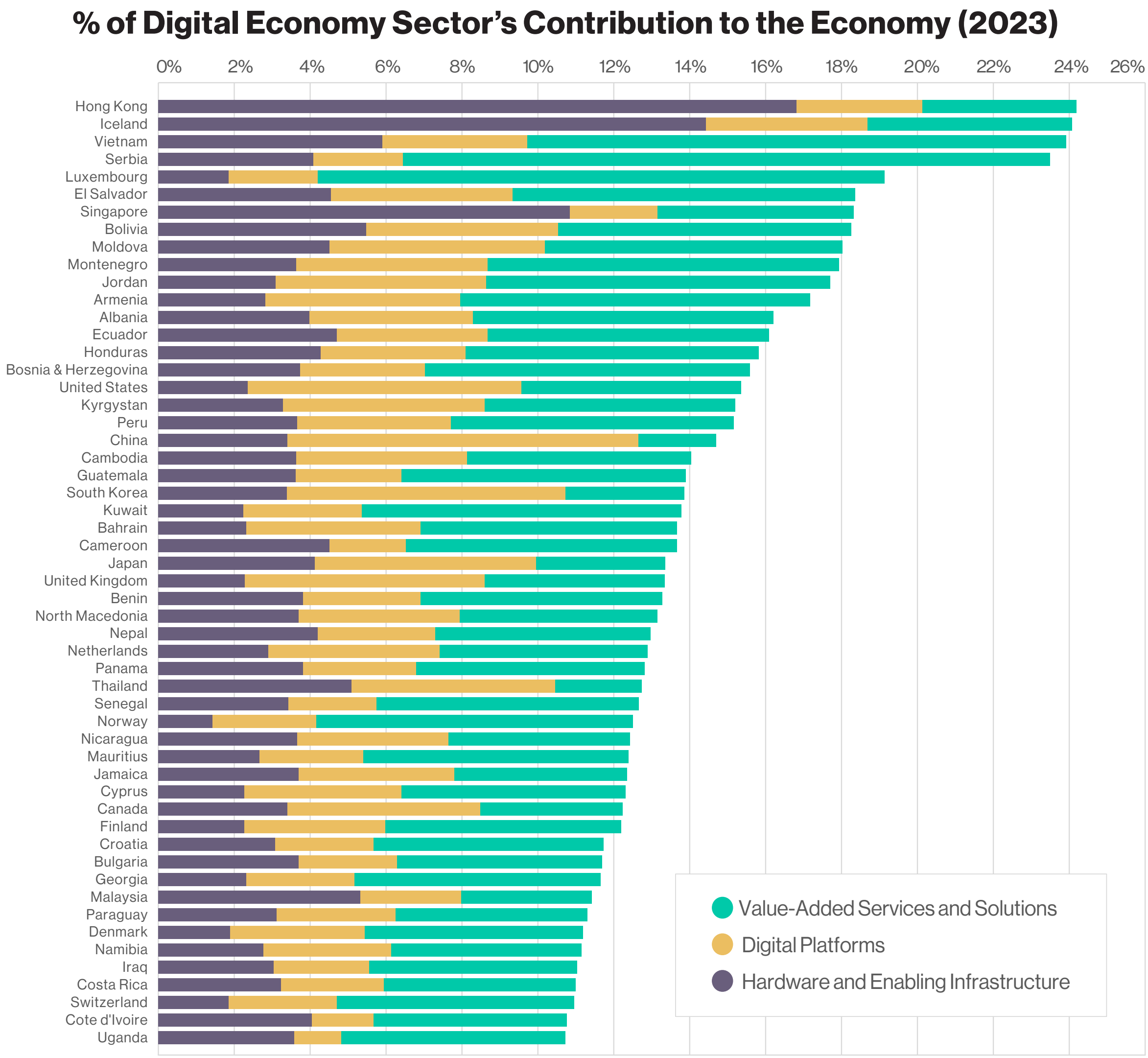
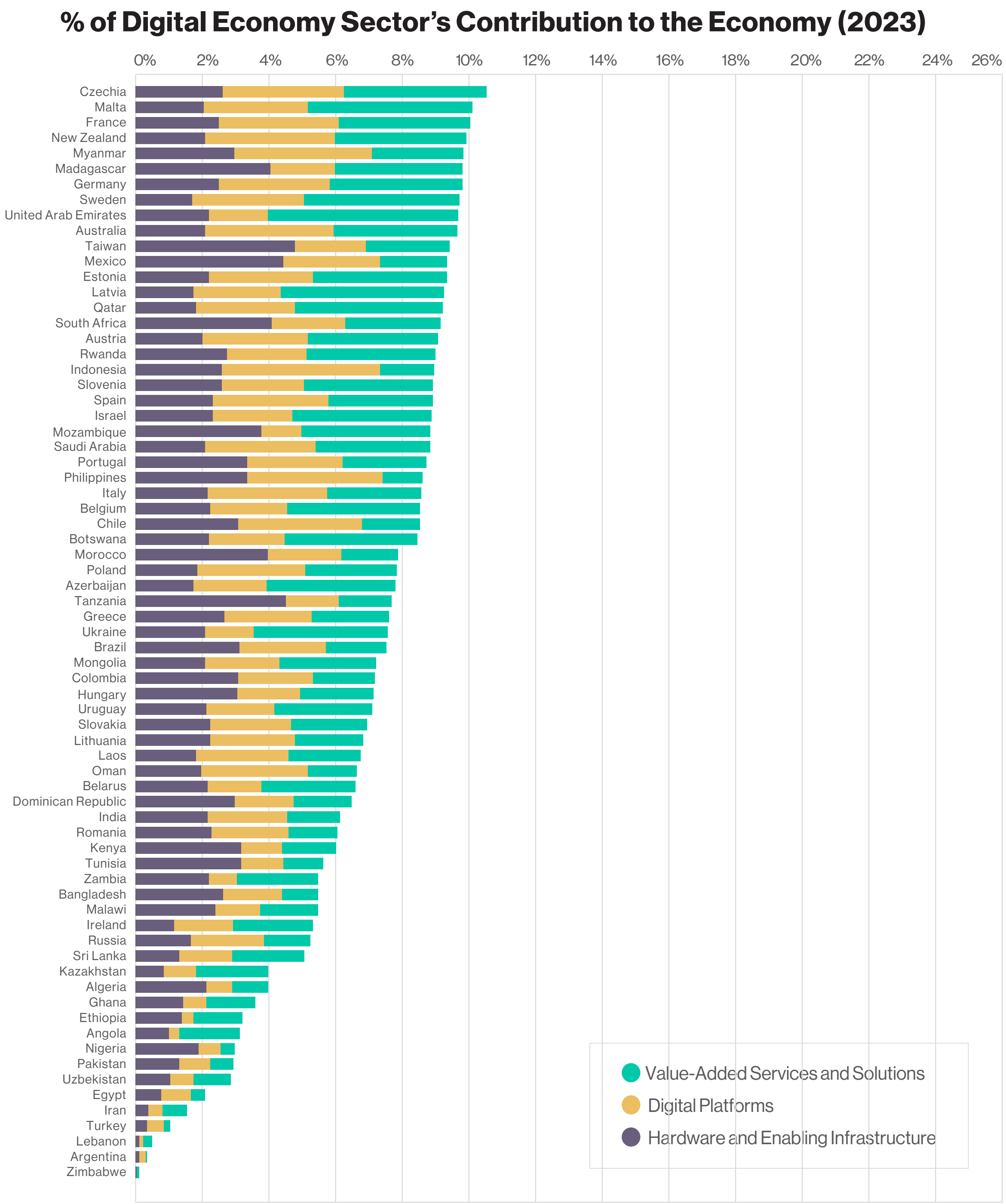


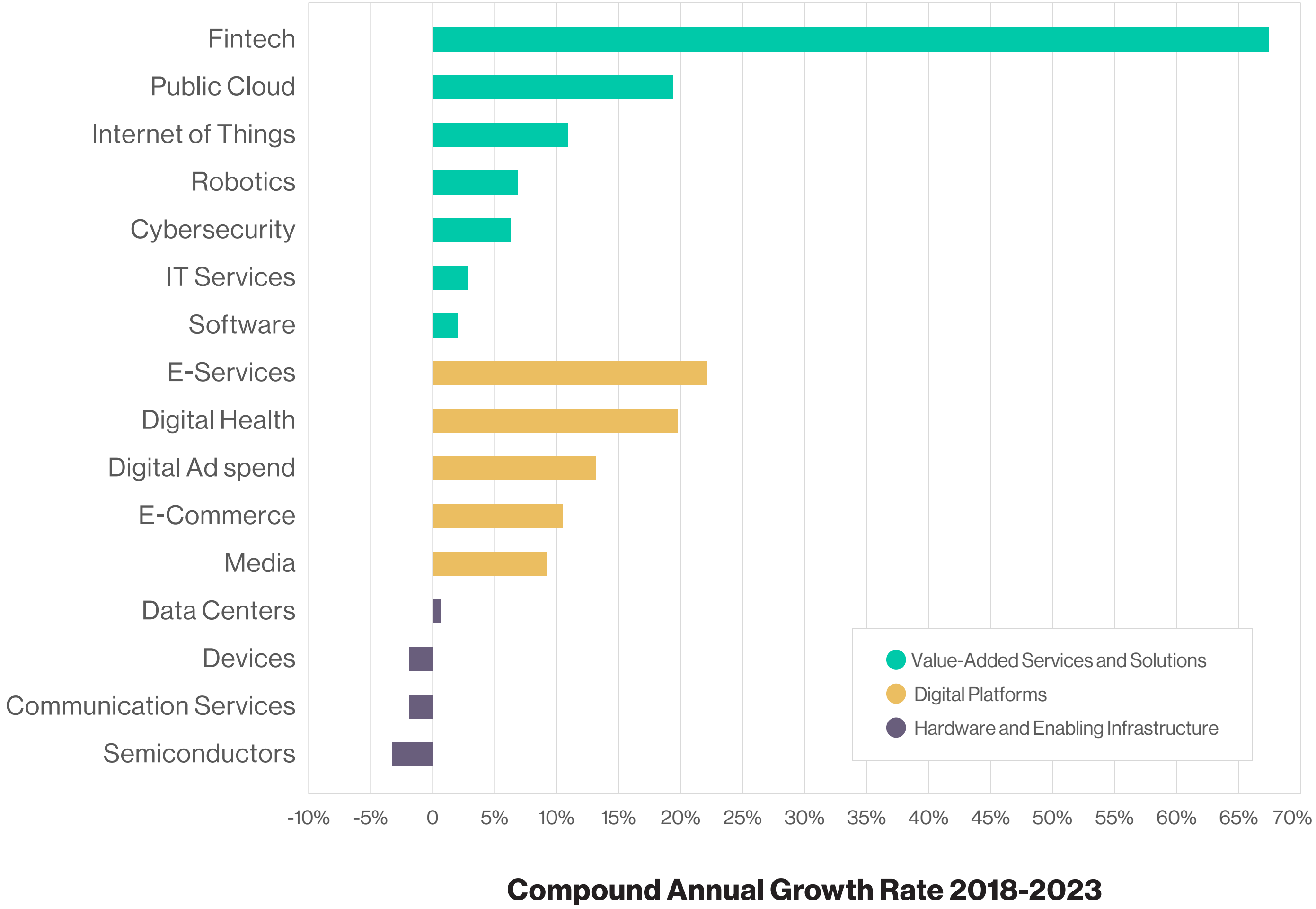
Figure 5b
Sector Contribution to Digital Economy by Country



4. Sector Dynamics

Fintech emerges as the fastest-growing sector, followed by e-services, while hardware and enabling infrastructure show decline.

Figure 6
Growth in Different Sectors of the Digital Economy (2018-2023)

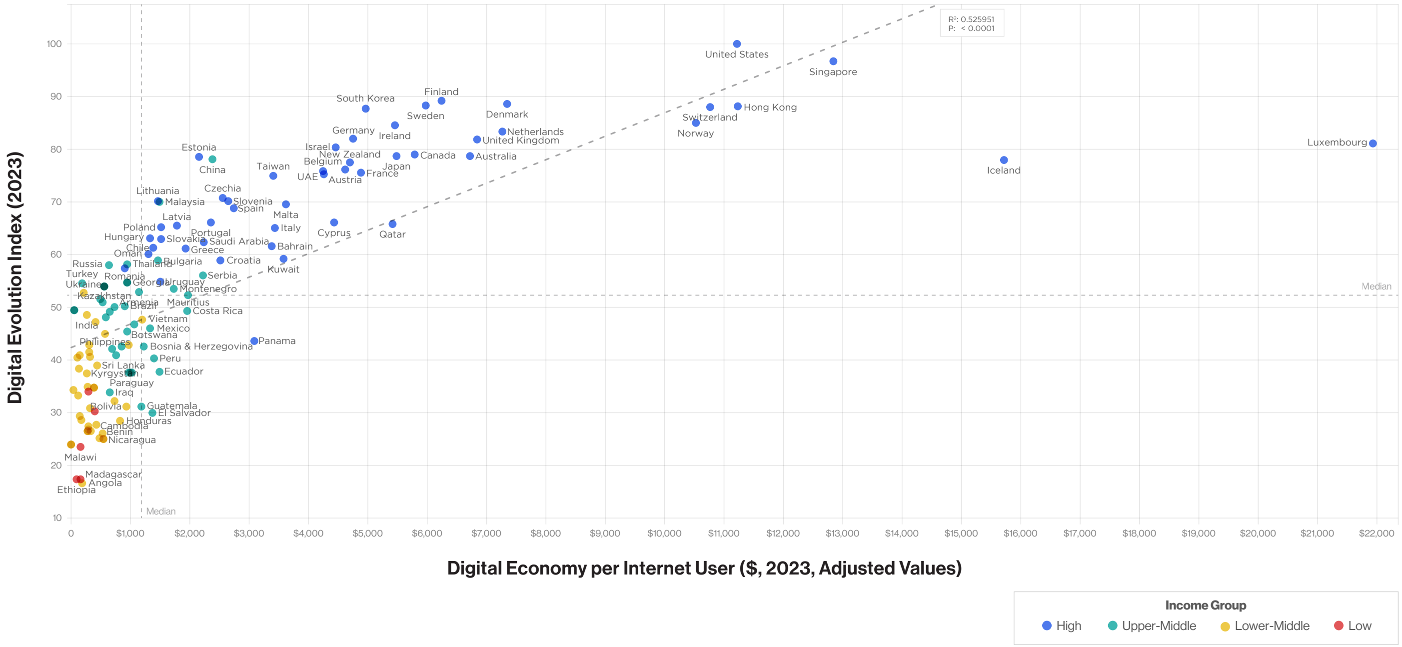


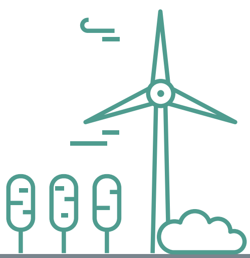
5. Evolution Correlation

Digital economy value per internet user strongly correlates with a country's overall digital evolution stage—richer, more digitally mature economies are generating more value per internet user than emerging digital economies.

Figure 7

Digital Evolution vs. Size of Digital Economy per Internet User



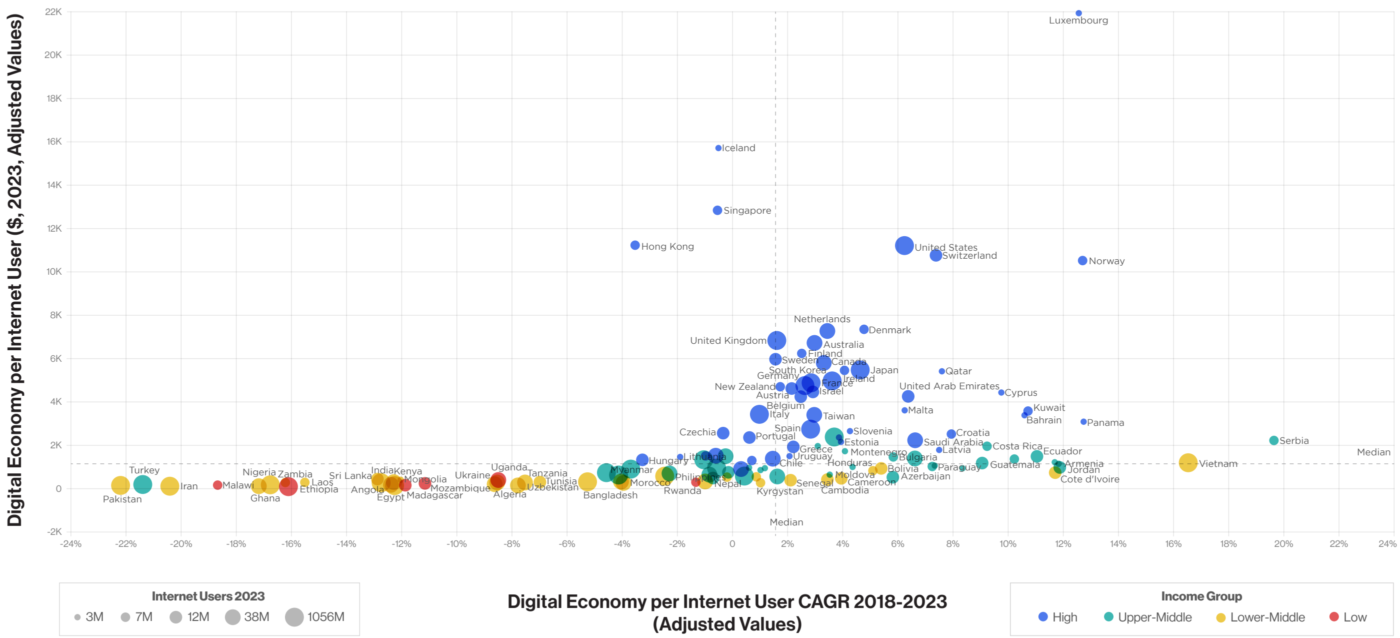


6. Digital Divide

The gap between high and low-income countries' digital productivity continues to expand, threatening inclusive growth objectives.

Figure 8

Digital Economy State vs. Momentum per Internet User (Adjusted Values)



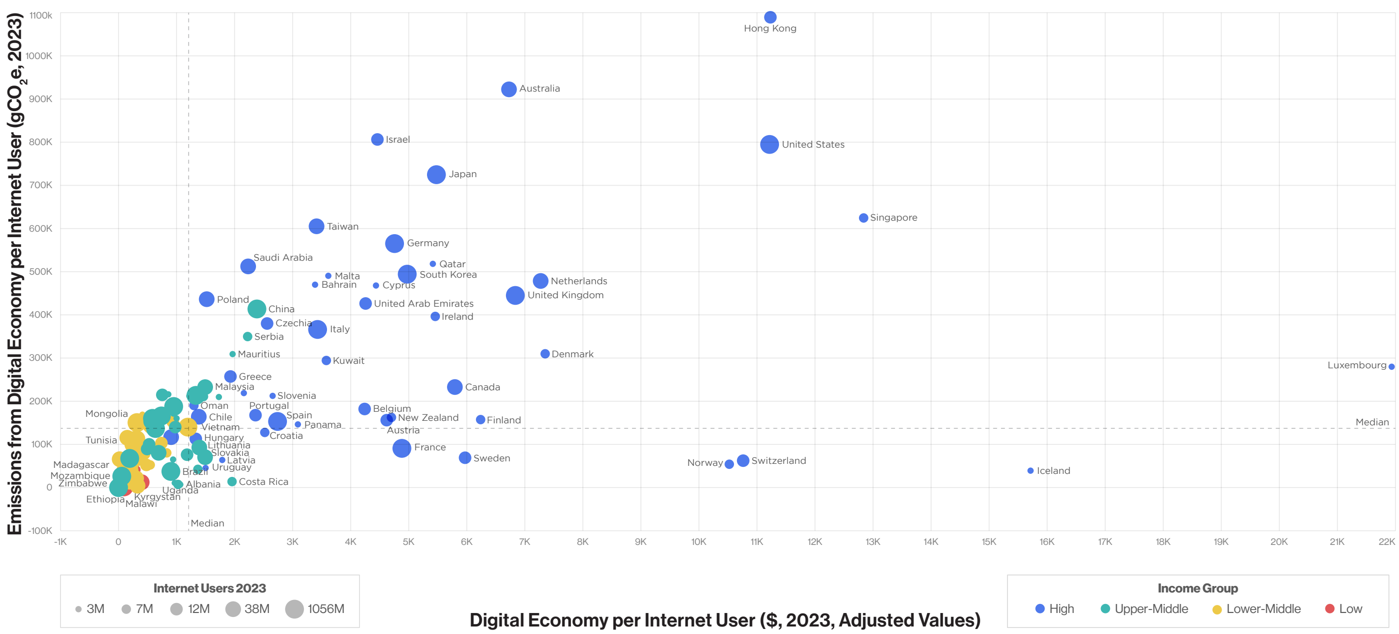
Note: This chart excludes outliers like Argentina, Lebanon and Zimbabwe.

7. Environmental Performance Variance

Countries demonstrate vastly different capabilities in managing emissions while growing their digital economies. The Burn-to-Earn Index offers a powerful way to assess this, enabling governments and companies to benchmark performance, set targets, and strategically adapt their digital and energy infrastructures.

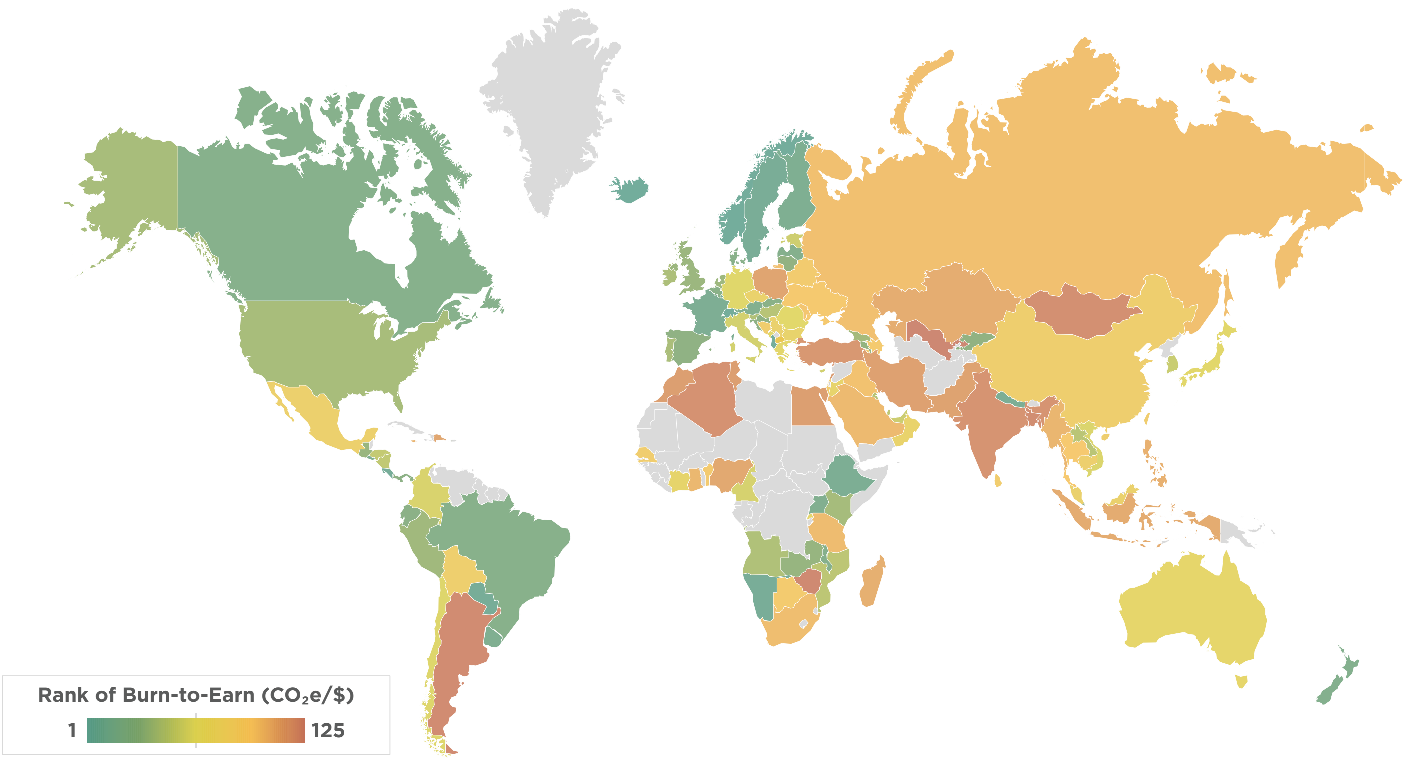
Figure 9

Digitalization Emissions and the Size of the Digital Economy per Internet User



As the digital economy continues its rapid expansion, understanding and managing the relationship between digital growth and environmental impact becomes crucial. The Burn-to-Earn Index provides a powerful tool for governments and businesses to benchmark performance, set meaningful targets, and make strategic decisions that balance economic opportunity with environmental responsibility. This study offers a comprehensive, globally comparable framework to navigate the digital economy's dual challenge of maximizing growth while minimizing environmental harm.

Figure 10
Burn-to-earn heatmap



The Economic Impact of the Digital Economy

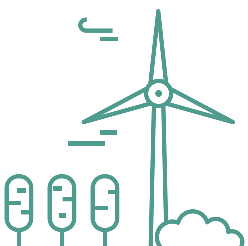
Methodology

How to Measure the Digital Economy

In the absence of a universally accepted definition, studies have measured the digital economy using various criteria, often based on data availability and other specific factors. However, many of these definitions are applicable only to a limited set of similar countries and lack relevance across diverse economies. The digital economy represents a dynamic and rapidly evolving landscape that spans multiple sectors, fueling global innovation, connectivity, and economic growth. Leveraging insights from our Digital Evolution Index[6] and Ease of Doing Digital Business[7] studies and the OECD methodology,[8] we define the digital economy as comprising hardware and enabling infrastructure, platforms facilitated by digital technologies, and supporting services and technology. At its core, the digital economy thrives on the seamless integration of hardware, enabling infrastructure, digital platforms, and value-added services and solutions. These sectors collectively revolutionize how businesses operate, individuals interact, and societies function.

Objective of the Report

This study aims to explore the economic and environmental impacts of the digital economy and examine the trade-offs between these impacts. The goal is to understand how the digital economy contributes to economic growth while analyzing its environmental effects, such as energy consumption, carbon dioxide equivalent emissions, and e-waste generation. This exploration will inform strategies to balance economic benefits with environmental sustainability. Neither of these elements is "well-measured"—there's awareness, but no universal measurement to move forward.



Mapping and Measuring the Digital Economy

Figure 11

Mapping and Measuring the Digital Economy

Value-added Services and Solutions
IT Services, Software, Fintech, Public Cloud, Cybersecurity, Internet of Things, Robotics

Digital Platforms
E-commerce; Digital Media and Advertising: Music, E-Publishing, Video Games, Video Streaming, etc.
Digital Health: Fitness and Well-being, Treatment and Care, etc.
Other Service Platforms: Dating, Event Tickets, Education, Gambling, etc.

Hardware and Enabling Infrastructure
Communications, Data Centers, Devices, Semiconductors, DPI*

Source: Statista Market Insights[9]

Hardware and Enabling Infrastructure

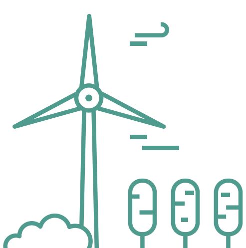
Central to the digital economy are the hardware components and enabling infrastructure that form the backbone of digital systems. This includes physical equipment such as servers, routers, and data centers, as well as the telecommunications networks, internet infrastructure, and broadband connectivity that facilitate data transmission. In essence, hardware and enabling infrastructure provide the essential groundwork upon which digital technologies and services are built, enabling seamless communication, data storage, and processing capabilities.

Digital Platforms

Digital platforms serve as virtual marketplaces, bringing together consumers, businesses, and stakeholders to exchange goods, services, and information online. These platforms encompass diverse services, including e-commerce platforms like Amazon and Alibaba, social media networks such as Facebook and X, and collaborative platforms like Airbnb and Uber. By leveraging advanced technologies such as artificial intelligence, cloud computing, and big data analytics, digital platforms streamline transactions, enhance user experiences, and foster new forms of economic activities.

Value-added Services and Solutions

In addition to facilitating transactions and interactions, the digital economy offers a wide range of value-added services and solutions that cater to diverse needs and preferences. These encompass software applications, digital content, cloud-based services, and digital marketing solutions, among others. Value-added services not only enhance productivity and efficiency but also enable businesses to harness data insights, personalize user experiences, and drive innovation. These services play a pivotal role in shaping the digital landscape and driving sustainable growth.

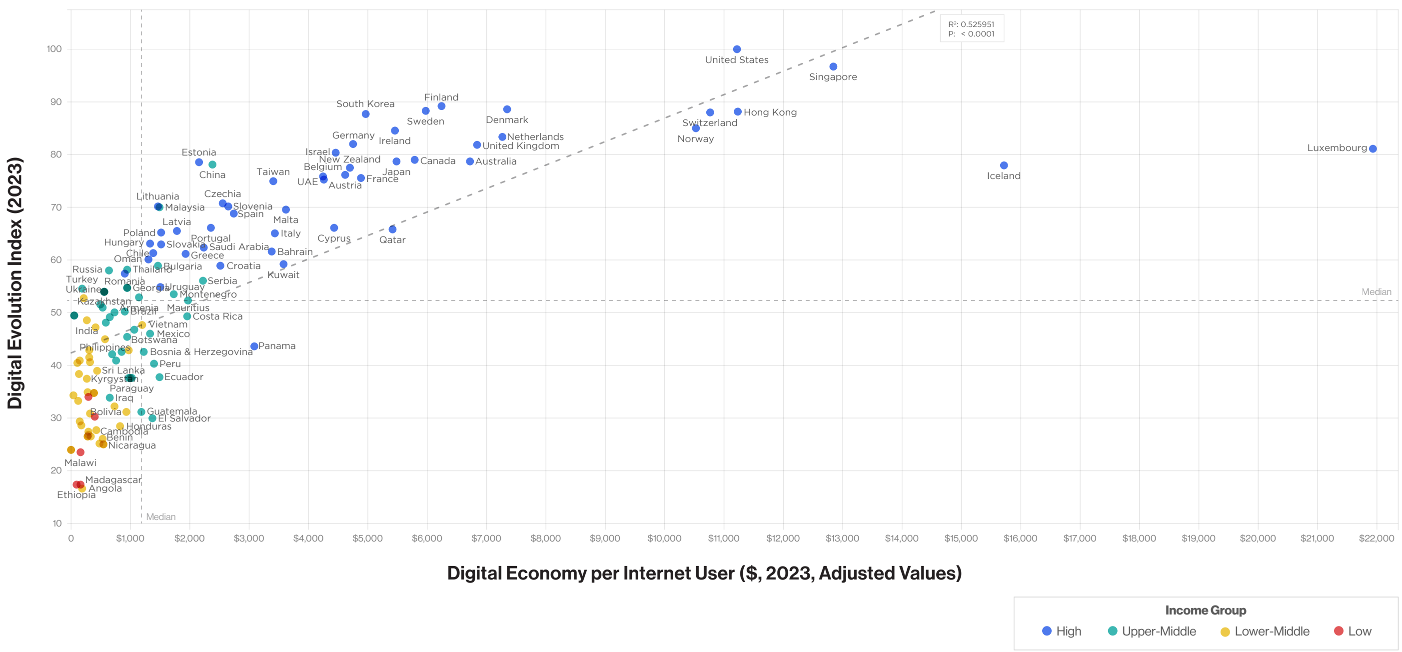


Digital Evolution vs. Size of Digital Economy per Internet User

High-income economies tend to lead in both digital evolution and economic value generated per internet user, reflecting advanced infrastructure, strong innovation, and mature digital ecosystems. In contrast, low-income and lower-middle-income countries lag behind, with limited digital development and economic returns due to challenges like poor infrastructure, affordability issues, and weak connectivity.

Figure 12

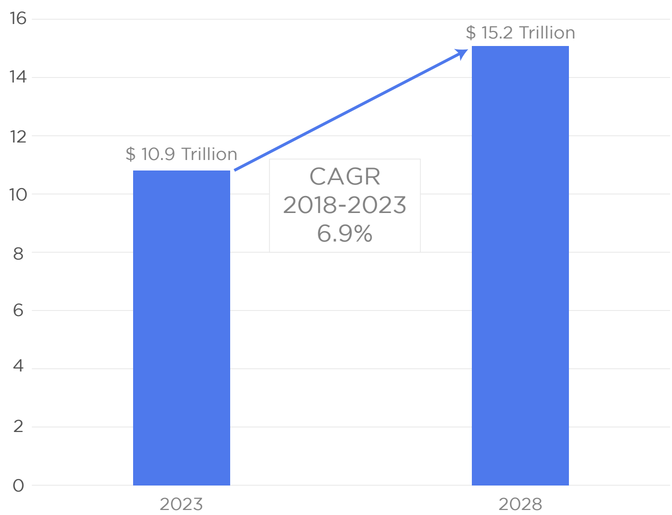
Digital Evolution vs. Size of Digital Economy per Internet User



Quantifying the size of the digital economy

The global size of the digital economy was nearly $11 trillion in 2023. If the digital economy maintains the same growth rate of 6.9% annually as is estimated from 2018 to 2023, the size of the digital economy is expected to increase to $15.2 trillion by 2028.

Figure 13
Global size of the Digital Economy



Global size of the Digital Economy

Figures 14a, 14b and 14c present the size of the digital economy in million USD (2023, adjusted values) across various economies, highlighting significant disparities in digital economic scale. The United States leads with the largest digital economy ($3.3 trillion), followed by China ($2.5 trillion) and Japan ($616 billion), reflecting their strong digital infrastructure, innovation hubs, and highly developed technology sectors. Other high-income economies, including the UK, Germany, France, and Canada, also rank highly, indicating well-established digital markets and robust economic contributions from digital industries.

Among upper-middle-income nations, China stands out significantly, while India leads lower-middle-income countries with a digital economy worth $195 billion, showcasing rapid digital adoption despite infrastructural challenges. Emerging economies such as Indonesia, Vietnam, and Mexico are also growing digital players, demonstrating strong regional growth potential.

Figure 14a
Top 25 Digital Economies

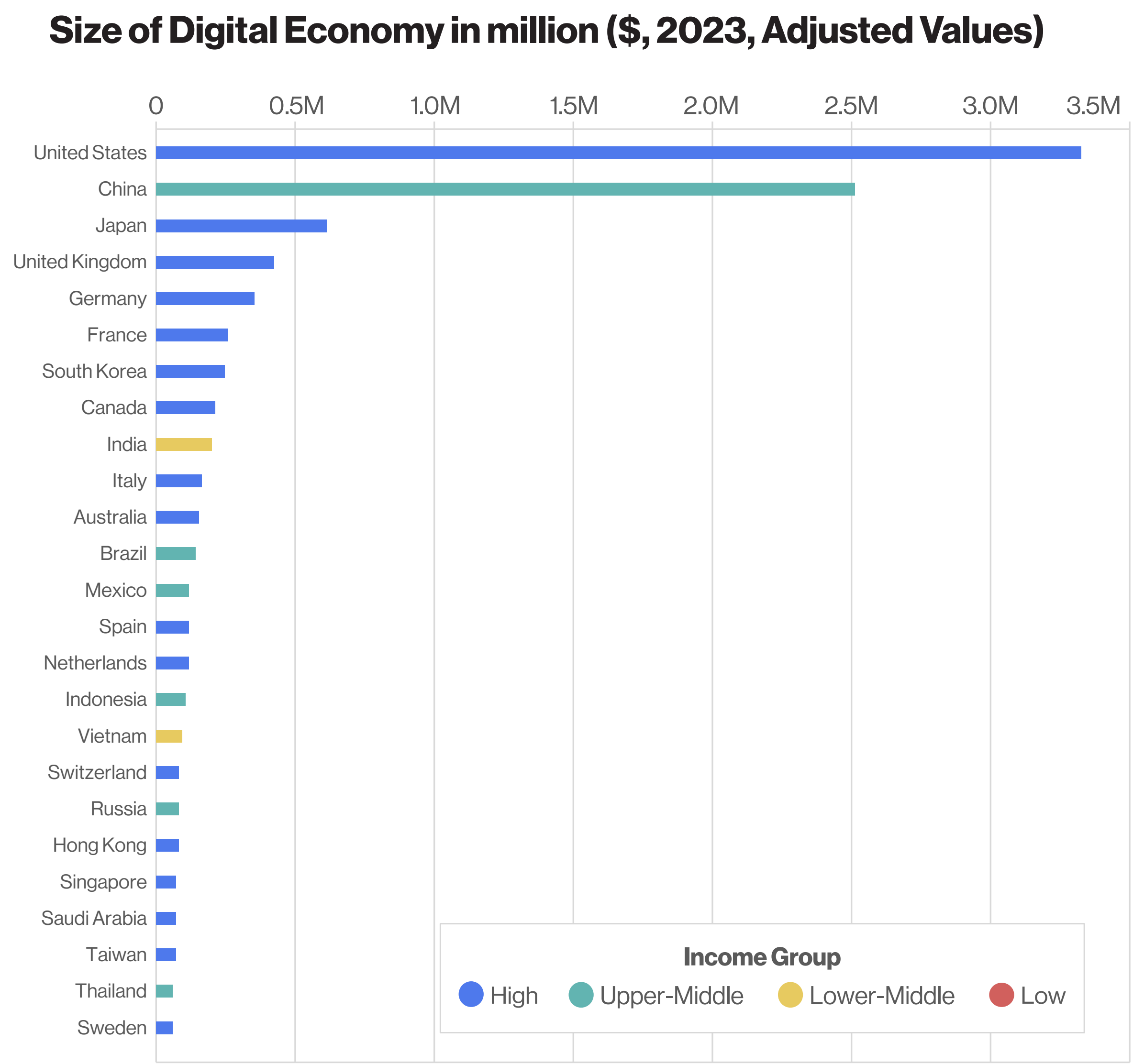


Figure 14b
Middle 50 Digital Economies (Zoomed in)

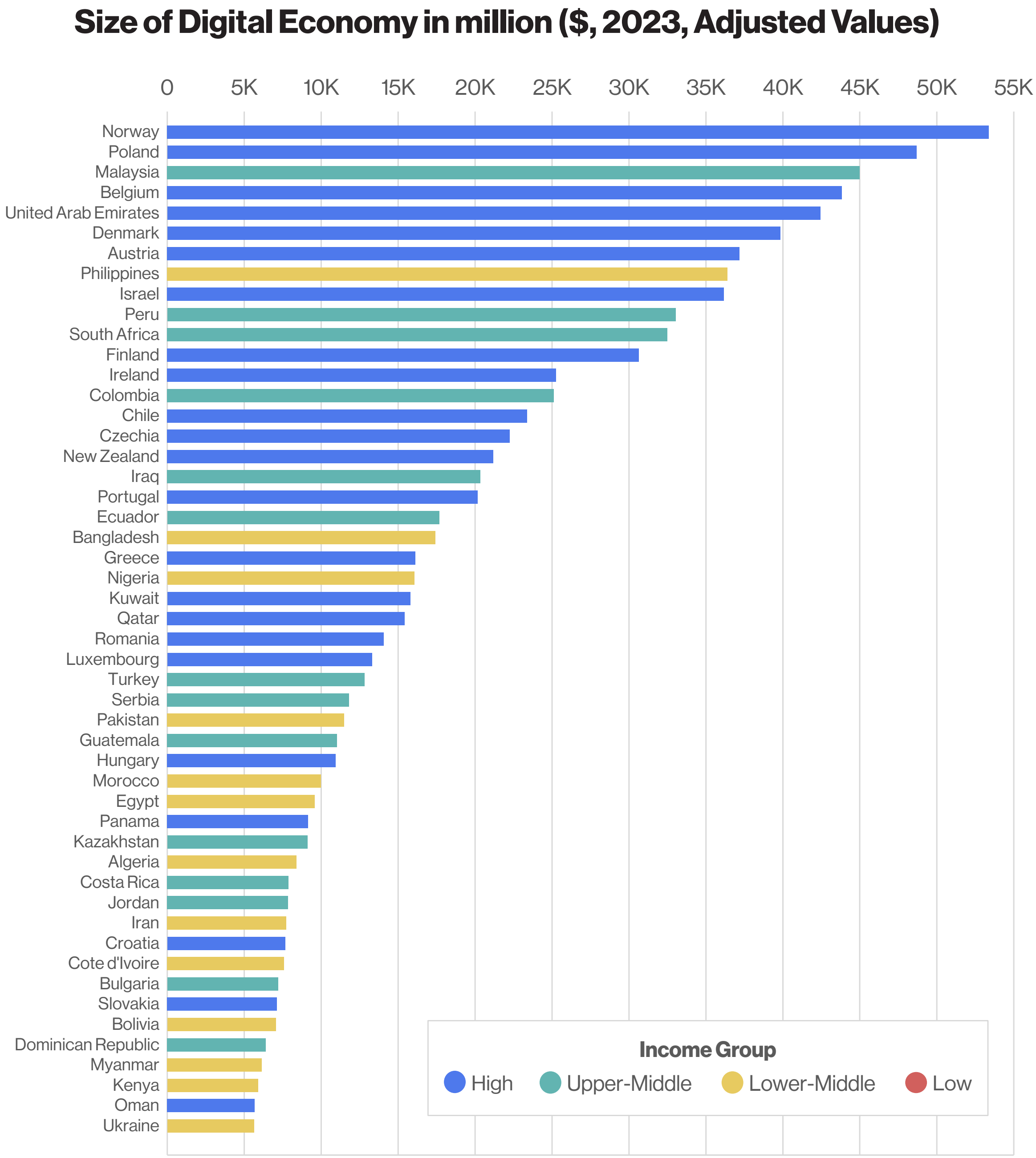
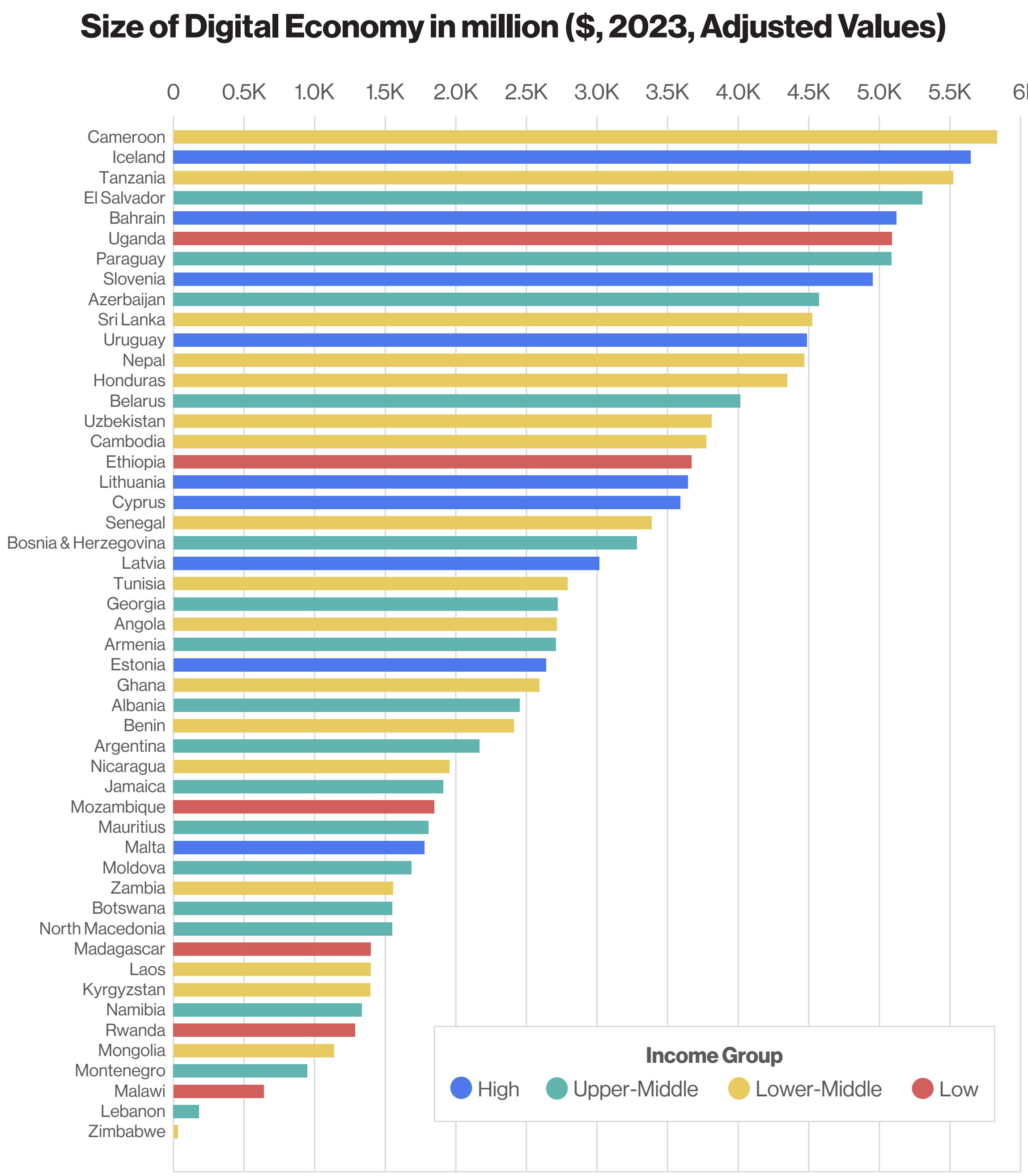


Figure 14c
Lower 50 Digital Economies (Zoomed in)



The Size of the Digital Economy per Internet User

Figures 15a and 15b illustrate the size of the digital economy per internet user in 2023 (adjusted values) across different countries, revealing substantial disparities in digital productivity. Although the United States, China, and Japan have the largest overall digital economies, Luxembourg, Iceland, and Singapore generate the most digital economy revenue per user—each exceeding $12,000. The dominance of high-income economies suggests their strong digital infrastructure, higher disposable incomes, and advanced digital services.

In contrast, lower-income economies like India, Bangladesh, and many African nations rank among the lowest of the 125 economies compared. This disparity may reflect limitations in digital infrastructure, lower purchasing power, and gaps in digital literacy and accessibility.

Note: *Normalizing based on population (i.e., internet users) facilitates more meaningful cross-country comparisons. For example, prior to normalization, India ranked 9th among 125 economies. However, after adjusting for its large internet user base, India's ranking dropped to 108th, reflecting a lower per-user digital economy performance. Similarly, China dropped from second in ranking to 37th after normalization by population.*

Figure 15a
Size of the Digital Economy per Internet User

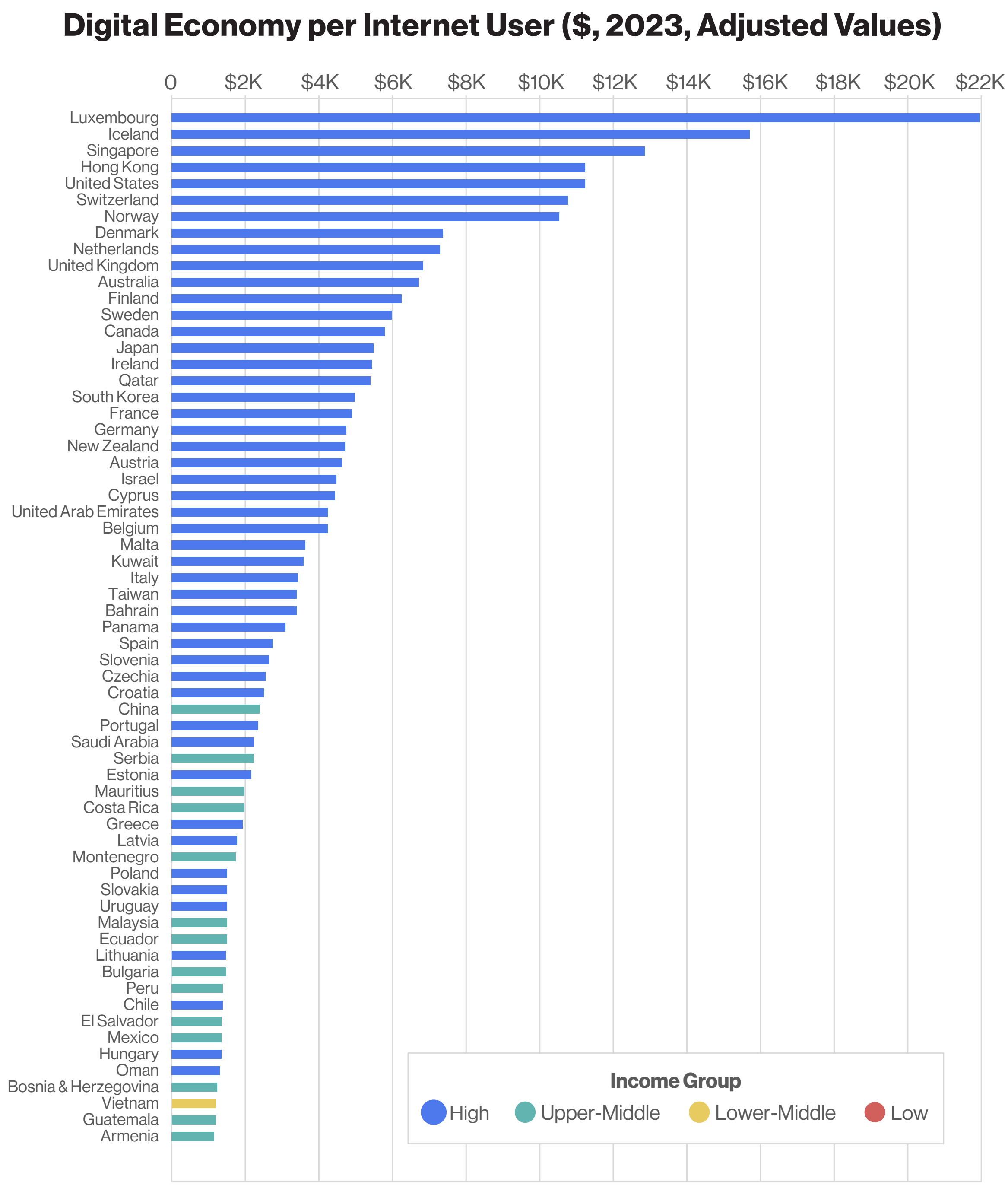
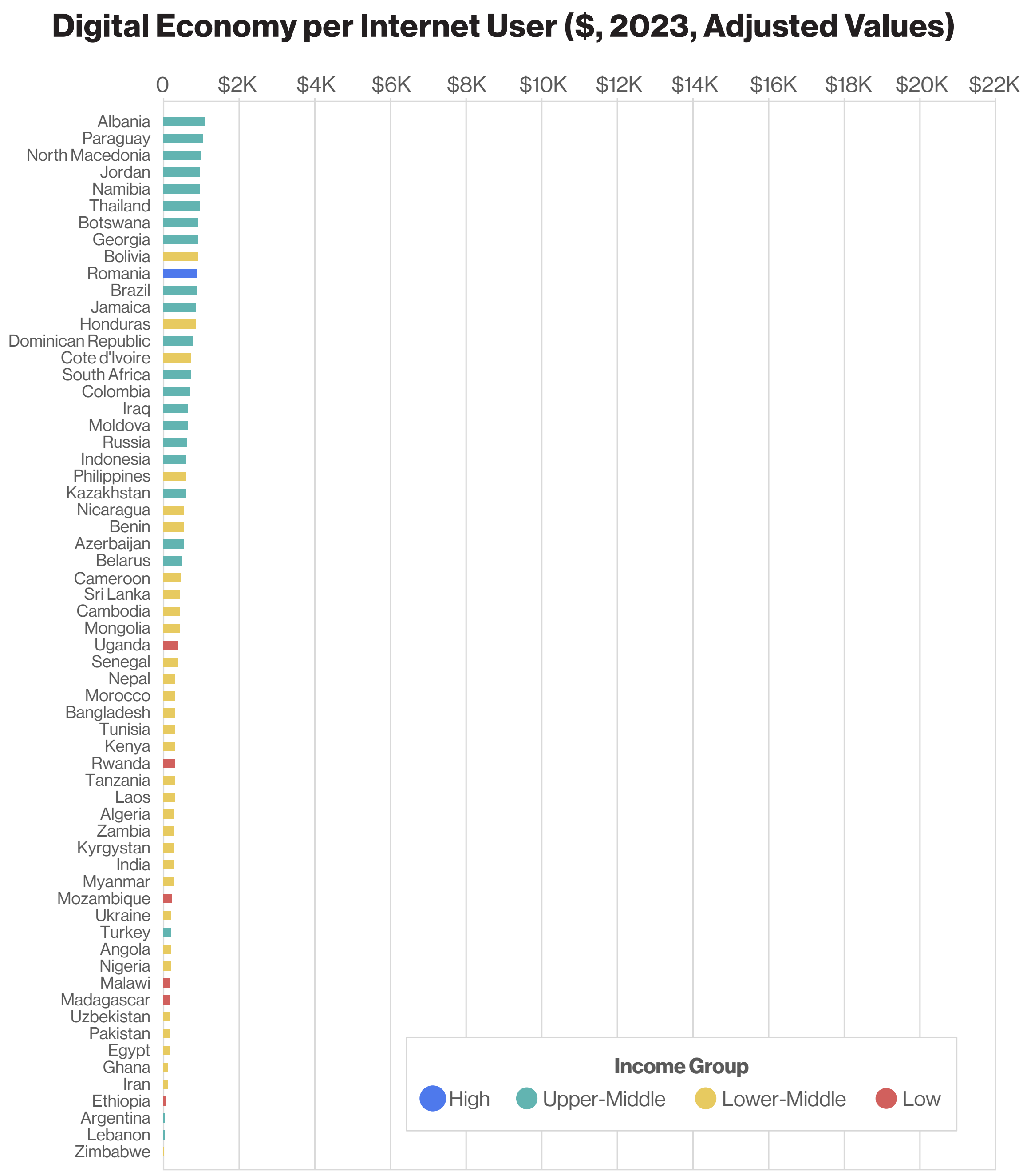


Figure 15b
Size of the Digital Economy per Internet User



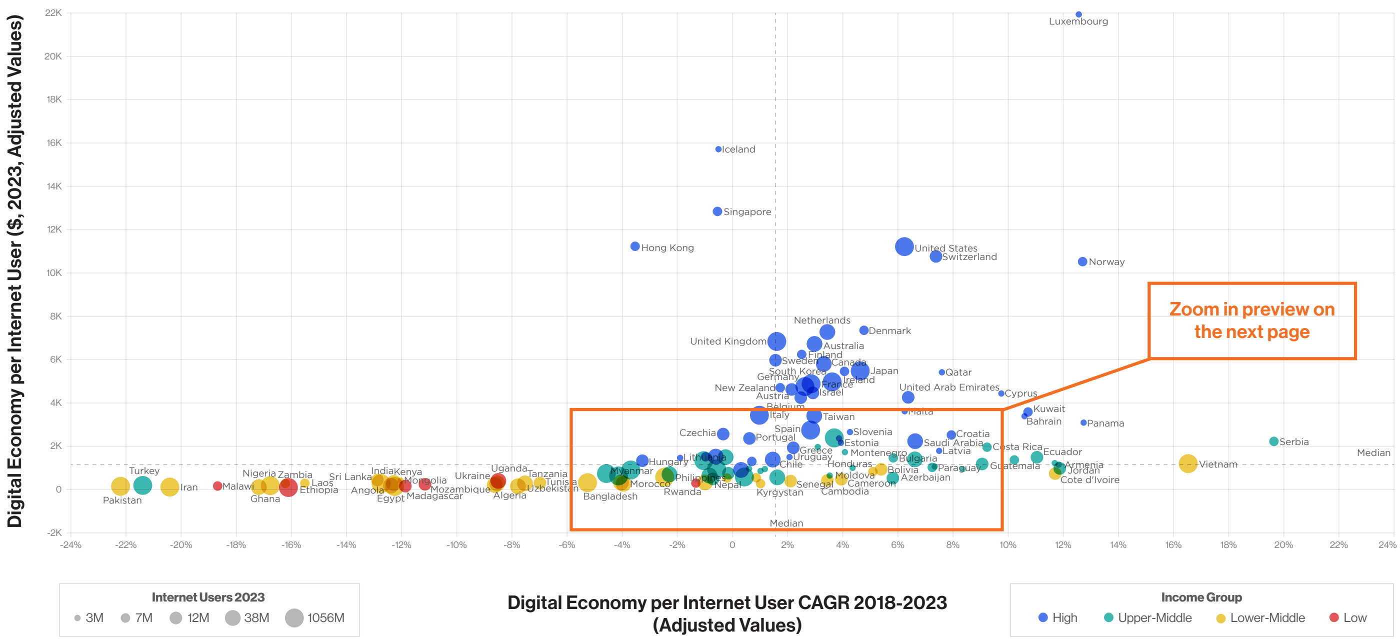
Digital Economy State vs. Momentum

Figures 16a and 16b show that richer economies extract more economic value per internet user, and high-income and upper-middle-income countries are moving faster in creating more value per user than lower-income countries.

- High-income countries like Luxembourg, Switzerland, and Norway dominate in digital revenue per user, indicating mature, high-value digital economies.
- The U.S. leads in absolute revenue generation, with moderate growth, while China maintains a strong digital economy but with slower expansion.
- Emerging economies such as Vietnam and Serbia are rapidly growing their digital economies, but still lag in digital economy revenue per user.
- Countries like India, Pakistan, and Nigeria struggle with both low digital revenue and slow or negative growth, indicating barriers to digital monetization and infrastructure development.

Figure 16a

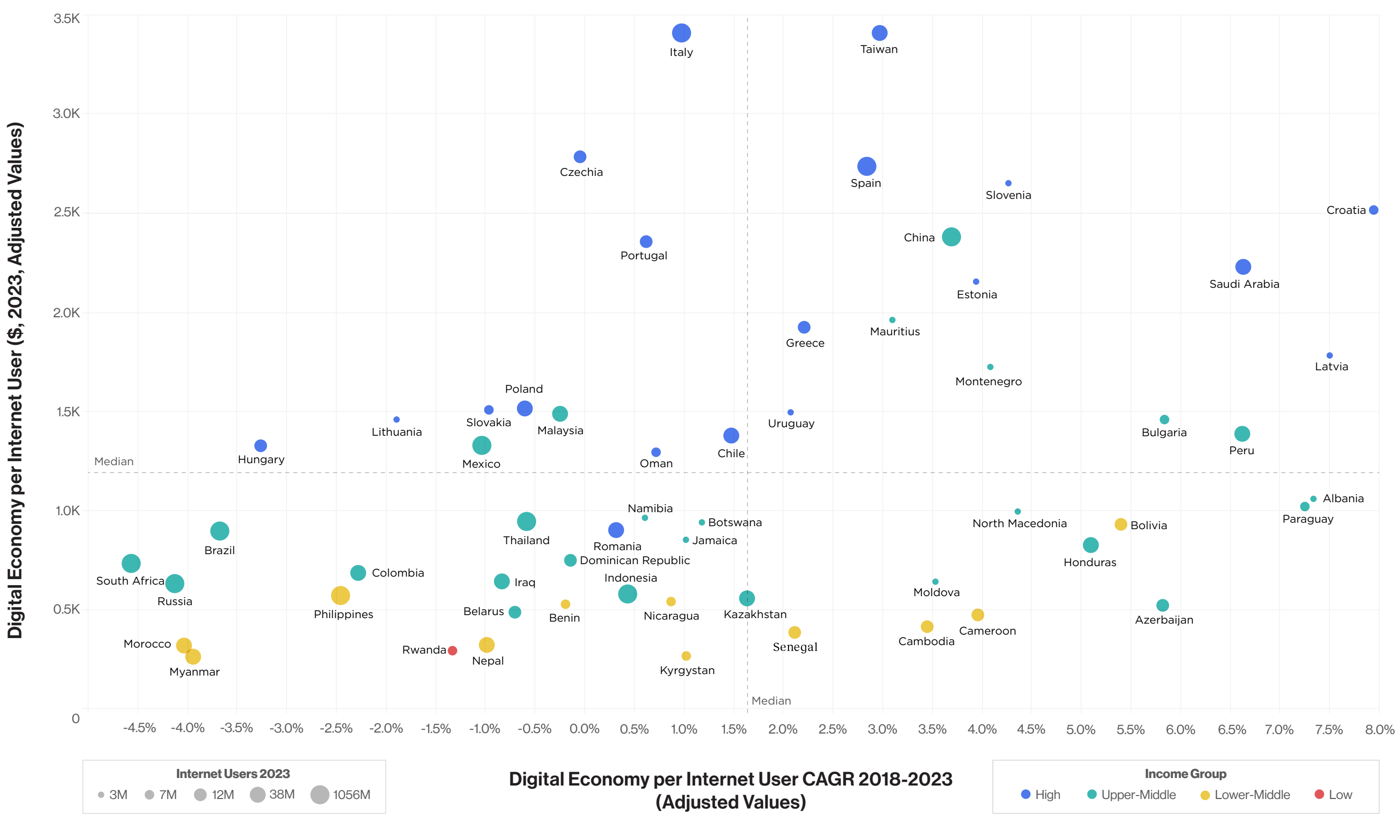
Digital Economy State vs. Momentum per Internet User (Adjusted Values)



Note: This chart excludes outliers like Argentina, Lebanon and Zimbabwe.

Figure 16b

Digital Economy State vs. Momentum per Internet User (Adjusted Values)



Growth in Digital Economy vs. Growth in GDP (2018-2023)

Figure 17 shows that the aggregate growth of the digital economy has consistently outpaced overall GDP growth across all income groups, highlighting its role as a key driver of economic expansion. At the global level, the digital economy grew at a 6.95% compound annual growth rate (CAGR) from 2018 to 2023, compared to a 2.32% GDP growth rate, showing that digital industries are expanding at three times the rate of the broader economy.

Among the different income groups, Upper-middle-income countries saw the fastest digital economy growth at 8.49% CAGR, more than 2.3X faster than their 3.68% GDP aggregate growth. This suggests that these economies are making strong investments in digital transformation, using digital platforms and services as major engines of economic growth.

High-income countries experienced an aggregate digital economy growth rate of 6.32%, compared to 1.52% GDP growth. While this represents a slightly slower rate than upper-middle-income economies, it indicates continued expansion even in more digitally mature economies, with growth driven by fintech, cloud computing, and ecommerce services.

Lower-middle-income countries exhibited an aggregate digital economy growth rate of 6.27%, 1.8X their GDP growth of 3.45%. This suggests that digital adoption is progressing, but at a more gradual pace than in higher-income economies, likely due to infrastructure challenges and limited investment in high-tech industries.

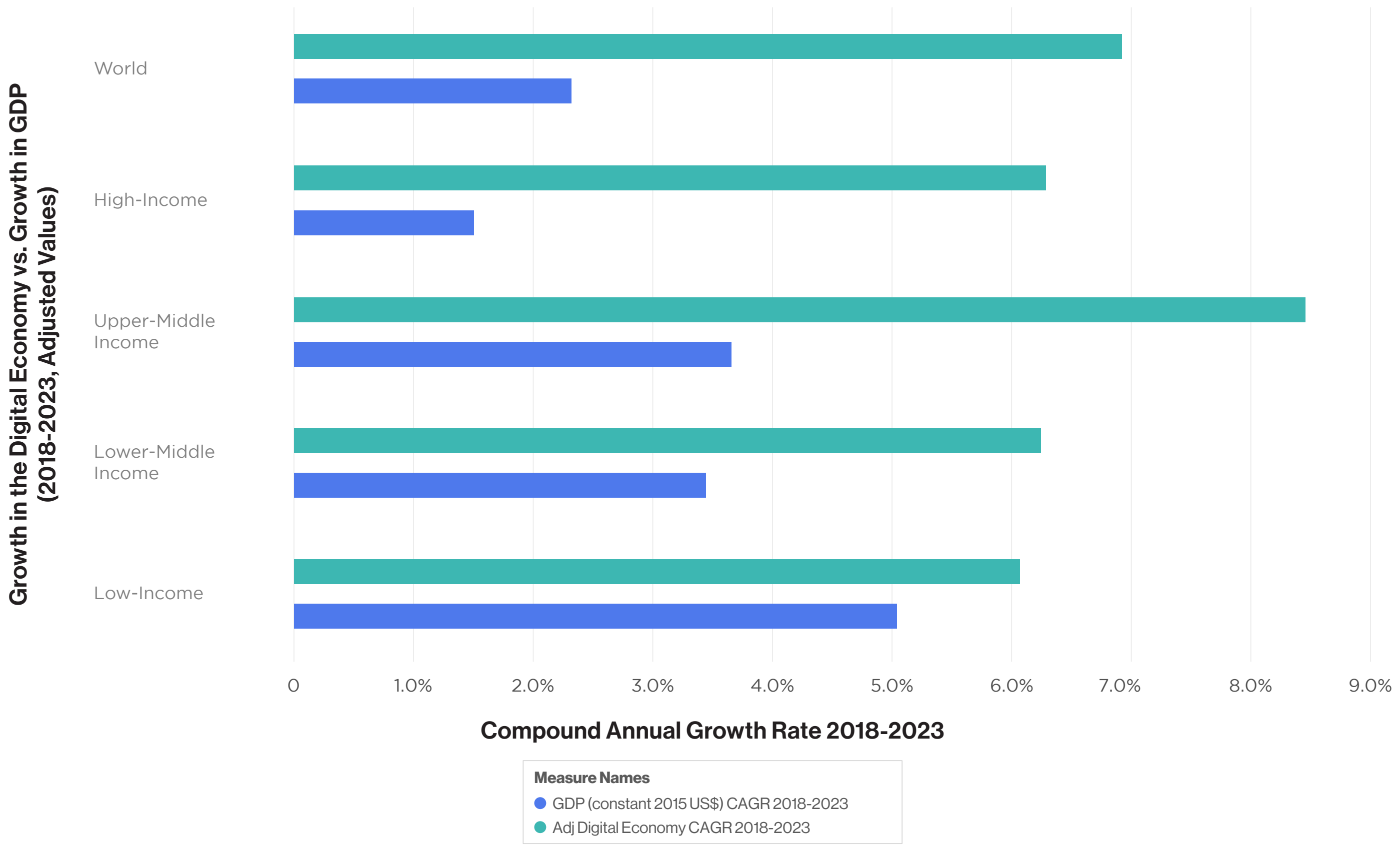
Among the different income groups, low-income countries recorded the slowest aggregate digital economy growth rate of 6.09%, eclipsing their GDP growth of 5.07%. This reflects strong momentum in digital adoption, likely fueled by mobile connectivity, fintech innovations, and the expansion of digital platforms, despite broader economic constraints.

Overall, the digital economy is a fast-growing component of national economies, both in high- and low-income contexts—albeit for different reasons.

We find that digital economies have grown at 3 times the rate of the overall economy. This has policy implications: countries would be motivated to attract and invest in a larger digital sector to grow their economies with this knowledge in hand.

Figure 17

Growth in the Digital Economy vs. Growth in GDP (2018-2023)



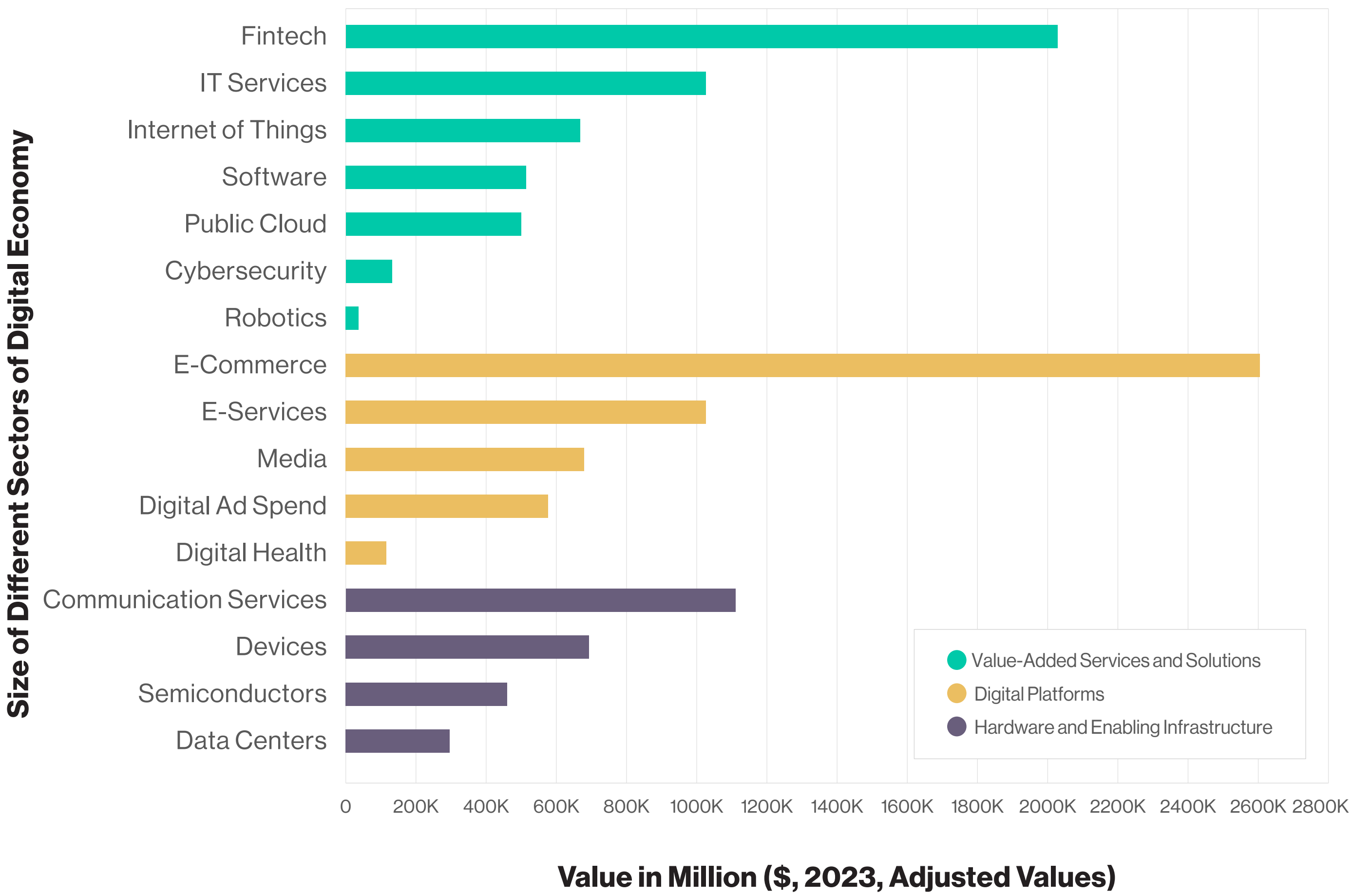
Quantifying the Digital Economy by Sector

Figure 18 illustrates the relative size of different sectors within the global digital economy, with e-commerce emerging as the largest contributor, followed closely by fintech and communication services. The dominance of e-commerce reflects the widespread shift toward digital retail and online transactions, driven by increasing internet penetration and evolving consumer behavior. Fintech, another major sector, underscores the growing reliance on digital financial services, mobile payments, and decentralized finance solutions. Communication services also hold a substantial share, highlighting the importance of digital connectivity in supporting economic activity.

Among value-added services, IT services and Internet of Things (IoT) have significant contributions, reflecting the expansion of enterprise digital solutions and connected devices. Software and public cloud also play crucial roles, emphasizing the increasing adoption of cloud computing and digital applications. Meanwhile, devices and data centers, key components of hardware and enabling infrastructure, maintain strong positions, supporting the broader digital ecosystem. While digital advertising spend and digital health contribute to the digital economy, they remain smaller in comparison to sectors like fintech and e-commerce.

When examining all 125 economies combined, the digital platforms sector group contributes substantially to the total digital economy, with e-commerce as the dominant contributor. Fintech and communication services follow in second and third place, respectively, while robotics, digital health, and cybersecurity make the smallest contributions.

Figure 18
Global Digital Economy Sized by Different Sectors



Growth in Different Sectors of the Digital Economy

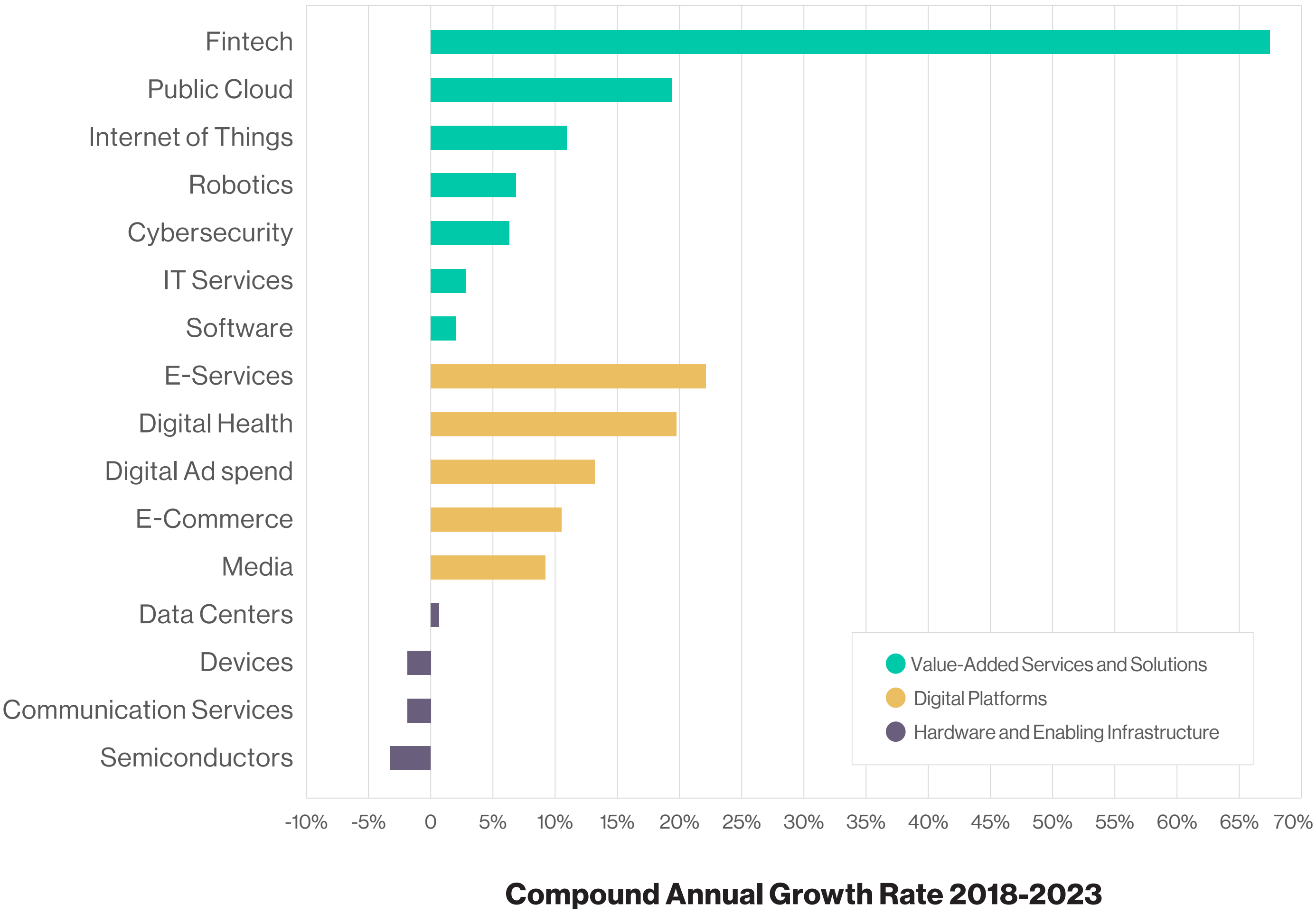
Figure 19 presents the global compound annual growth rate (CAGR) from 2018 to 2023 across different sectors of the digital economy.

The fintech sector recorded the highest growth rate at 67%, far surpassing all other sectors. This rapid expansion reflects increased digital financial inclusion, mobile payment adoption, and innovation in financial technologies across both advanced and emerging economies. Other strong performers in the value-added services category include public cloud services (20%), Internet of Things (11%), and robotics (7%), showing steady investments in digital infrastructure and enterprise solutions.

Among digital platforms, e-services led with 22% growth, followed by digital health (20%) and digital advertising (13%). This reflects rising demand for digital service delivery, health tech adoption, and online engagement across sectors.

In contrast, hardware and enabling infrastructure sectors showed negative or stagnant growth. Data centers had a slight growth (1%) while other sectors experienced a decline.

Figure 19
Growth in Different Sectors of the Digital Economy (2018-2023)



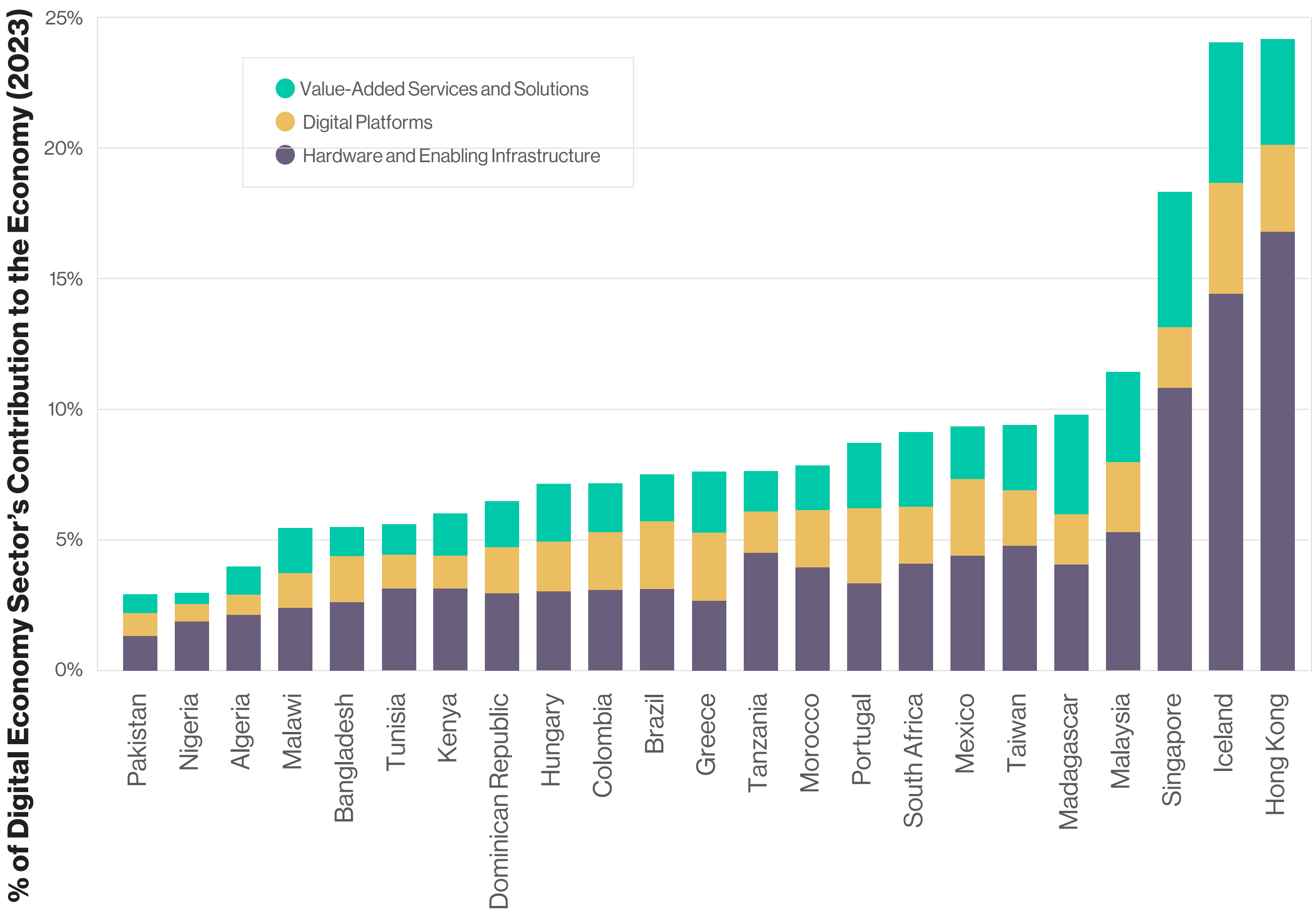
The Composition of Digital Economies Across the Globe

While digital platforms contributed the most to the overall global economy, value-added services contributed the most to 77 economies. Digital platforms are the largest contributor in 25 economies, including the United States and China. Hardware and enabling infrastructure are the major contributors in 23 economies.

Singapore is among 23 other countries where hardware and enabling infrastructure account for the lion's share of the digital economy. This is driven by their sizeable semiconductor market.

Figure 20

Digital Economy Composition: 23 Economies Led by Hardware and Enabling Infrastructure



Digital platforms contributed the most to the global digital economy. Below are the 25 economies where digital platforms are the greatest contributor. China, the US, and other major economies dominate the list.

Figure 21

Digital Economy Composition: 25 Economies Led by Digital Platforms

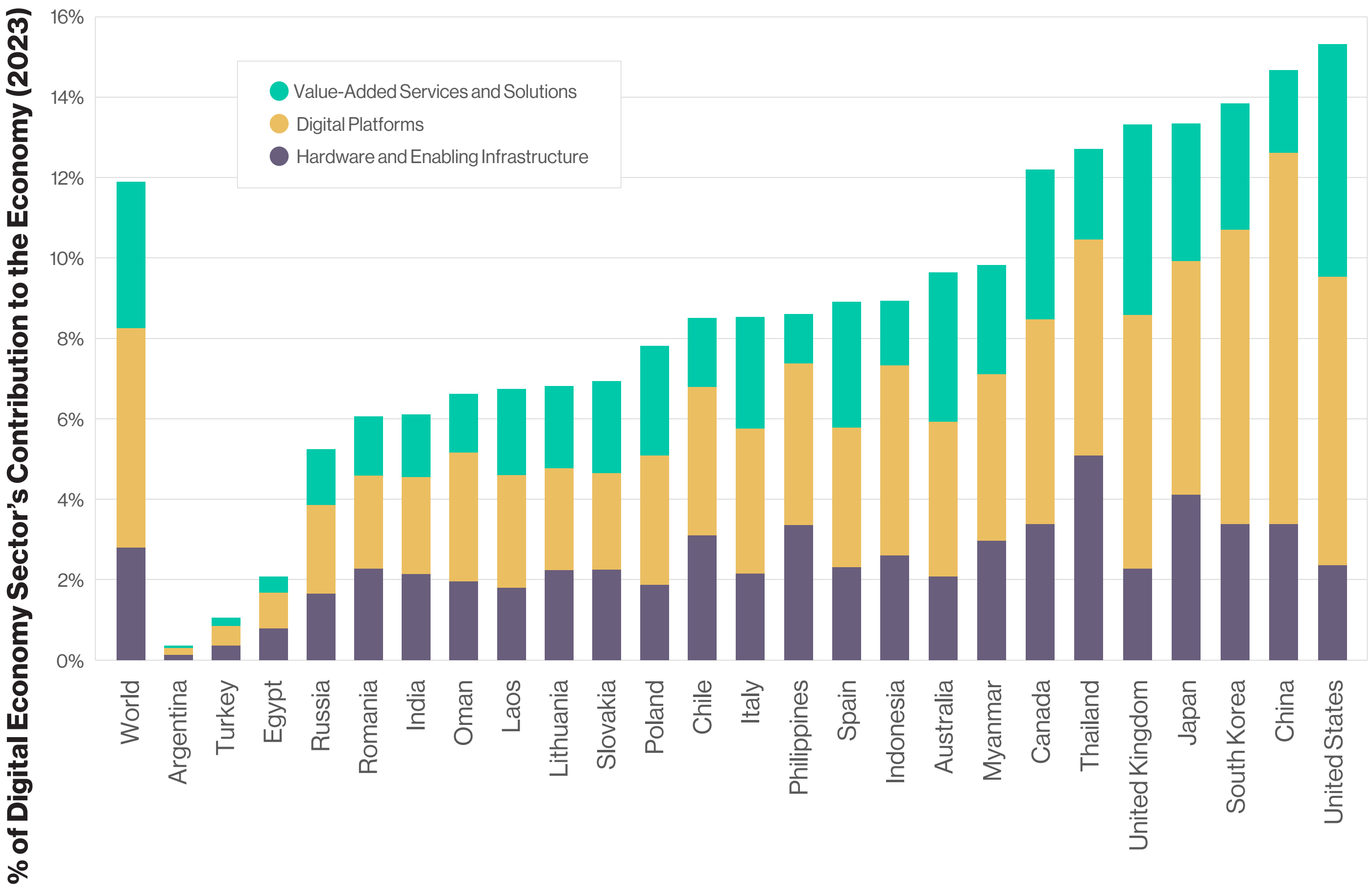


Figure 22a

Digital Economy Composition: 77 Economies Led by Value-Added Services and Solutions

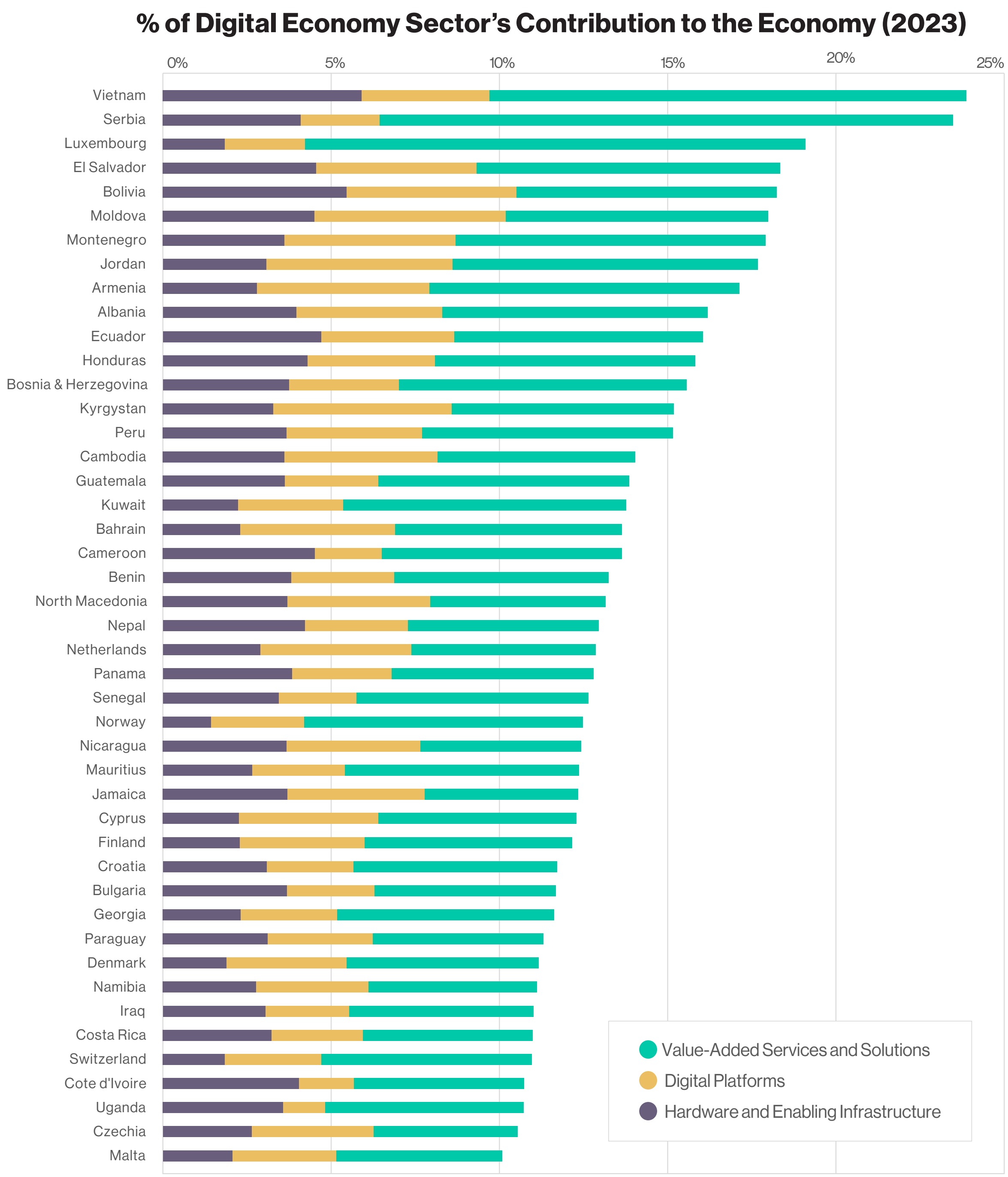
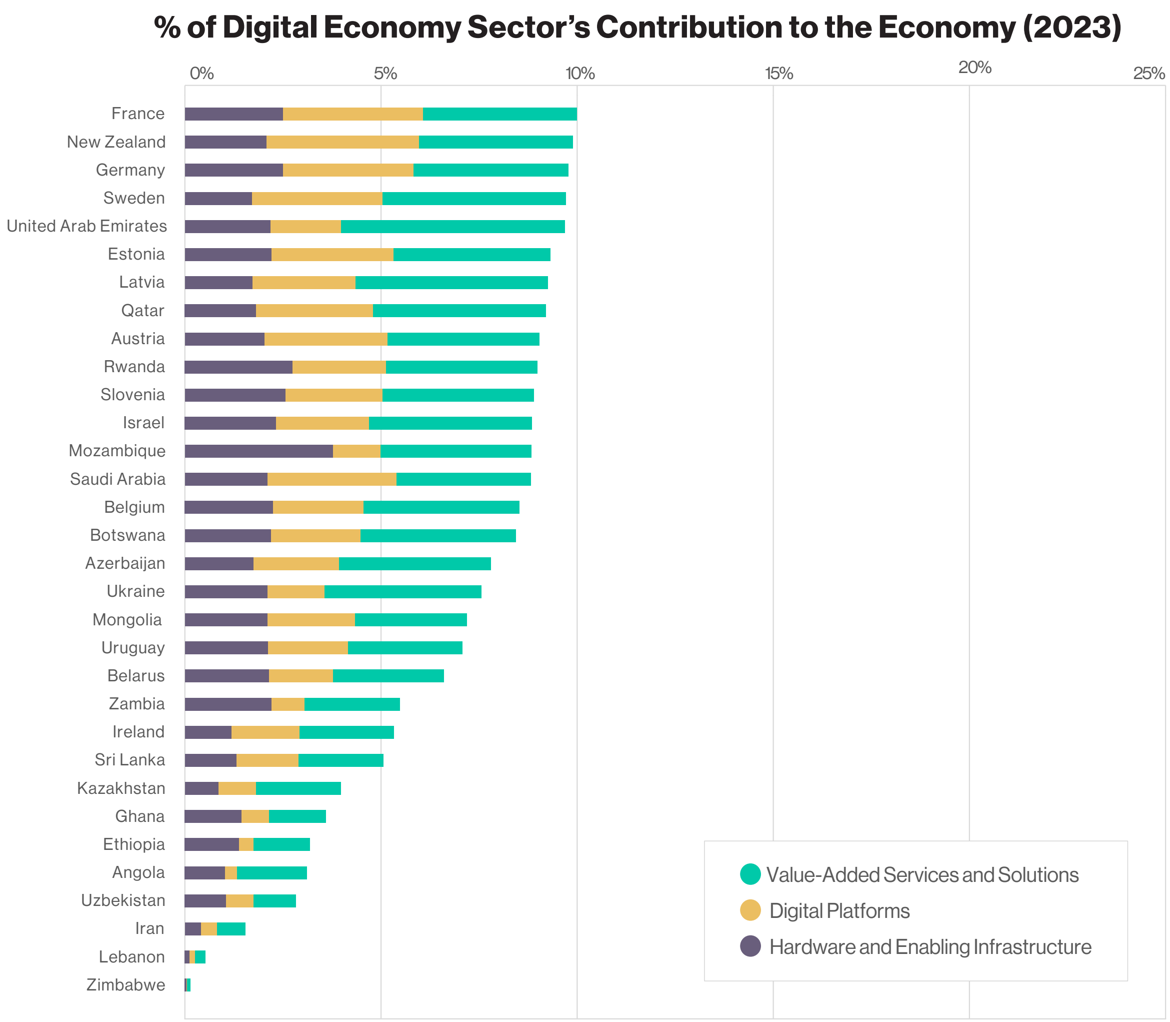


Figure 22b

Digital Economy Composition: 77 Economies Led by Value-Added Services and Solutions



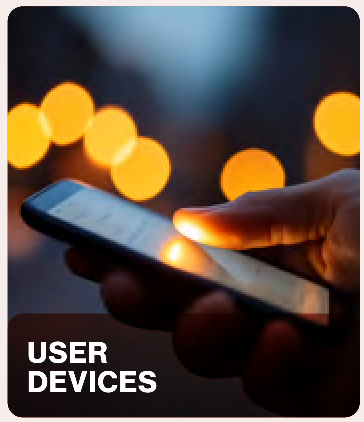
The Environmental Impact of the Digital Economy

Measuring Emissions

Figure 23

Sources of Emissions from the Digital Economy

Three primary sources of carbon dioxide emissions from the digital economy



Within each of the above three sources, there are three main types of emissions but two are of importance in this study

Operational
emissions attributed to the use of digital services

Embodied
emissions attributed to the creation of infrastructure

E-Waste
electronic waste generated from the end of life of electronic products and their components. Contributes to GHG, and other environmental concerns like pollution and resource depletion

Note: There is a possible overlap between embodied emissions and e-waste because embodied emissions include all emissions associated with the production of the device including mineral extraction.

Data Center Emissions

To estimate data center emissions by country, we used data center revenue as a proxy for demand and established an emissions range. Most energy estimates are based on 2020 data. Given the rise of generative AI and increasing data generation, demand for data centers is expected to grow significantly. To account for this, we created an energy demand range, using International Energy Agency (IEA)[10] estimates as the lower bound and factoring in data growth from 2020 to 2023[11] for the upper bound. The midpoint of this range represents our estimated global data center energy consumption in 2023. The steps and assumptions below outline the estimation process:

- **Share of internet users:** We used the share of internet users in the 125 economies—96.5% of the global total—as a proxy for estimating their share of global data center energy consumption.
- **Total Energy Use:** Global data centers consumed between 460–883 TWh. We used the midpoint of this range as total global consumption in 2023.
- **Country-Level Allocation:** We estimated each country's share of energy use based on its proportion of global data center revenue.
- **Emission Factors:** For each country, we applied the CO_2e emissions per kWh based on its national energy mix.[12]
- **Final Emissions Estimate:** We multiplied each country's energy use by its emission factor to estimate operational emissions from data centers.

Data Transmission Network Emissions

- **Data Collection:** We downloaded fixed and mobile broadband internet traffic data from ITU (International Telecommunication Union)[13]. For countries with missing data, we estimated traffic by multiplying broadband subscribers by the average traffic per subscriber in their income group.
- **Energy Intensity Calculation:** We determined network energy intensity by dividing total electricity used[14] by the 125 economies (estimated at 299 TWh) by total global internet traffic[15] (5.7315 Zettabytes).
- **Emissions Estimation:** For each economy, we calculated network sector emissions by multiplying its internet traffic by the energy intensity and the country's energy mix.

User Device Emissions

We separated user device emissions into three main types, following the approach in the UNCTAD report[16]

- ICT emissions (proportion of emissions from ICT devices such as computing devices, digital cameras, drones, etc.).
- IoT emissions (proportion of emissions from devices categorized as Internet of Things).
- Non-ICT emissions (proportions of emissions from non-ICT devices such as gaming equipment, headphones, smart remotes, televisions, etc.).
- Then, we estimated the electricity use across economies by multiplying the share of internet users in the 125 economies (96.5%) by the global electricity consumption of user devices, as reported by UNCTAD[17].
  - 345 TWh for ICT devices
  - 500 TWh for non-ICT devices
  - 75 TWh for IoT devices
- Next, we allocated the energy by economy through using each economy's share of global user device revenue (by device category) to estimate its portion of the total electricity use.
- Finally, to calculate emissions, we multiply each economy's estimated electricity use by its emission factor (energy mix) to determine operational emissions.

Finally, we estimated the total and embodied emissions across the three sectors using the distribution below:

Table 1

Emissions Distribution by Sector

	Data Centers	Networks	User Devices
Operational: Emissions attributed to the use of digital services	82%	82%	49%
Embodied: Emissions attributed to the creation of infrastructure	18%	18%	51%

Source: System Segments and GHG Footprint Allocations[18], also supported by UNCTAD report[19]

Emissions interpretation: Emissions are attributed to the countries where services are consumed. For instance, if a device is manufactured in China but sold in India, its emissions are assigned to India, as local revenue is used as a proxy for the energy demand of the device and India's energy mix is used to estimate emissions. Similarly, data center emissions are allocated based on the revenue generated within a country, reflecting demand and usage rather than the physical location of the data centers.

The Relationship between the Digital Economy and Emissions

Figures 24a and 24b show that globally, digital economy size and carbon emissions tend to increase together, as seen in countries like the United States, Hong Kong, and Australia, which have both high digital revenues and significant emissions per internet user. However, some nations, such as Luxembourg, Switzerland, and Iceland, demonstrate that a strong digital economy can exist with lower emissions, largely due to clean energy sources and productive infrastructure. The ideal scenario is for countries to expand their digital economies while minimizing emissions, which depends heavily on the cleanliness and sustainability of their energy sector.

Figure 24a

Digitalization Emissions and the Size of the Digital Economy per Internet User

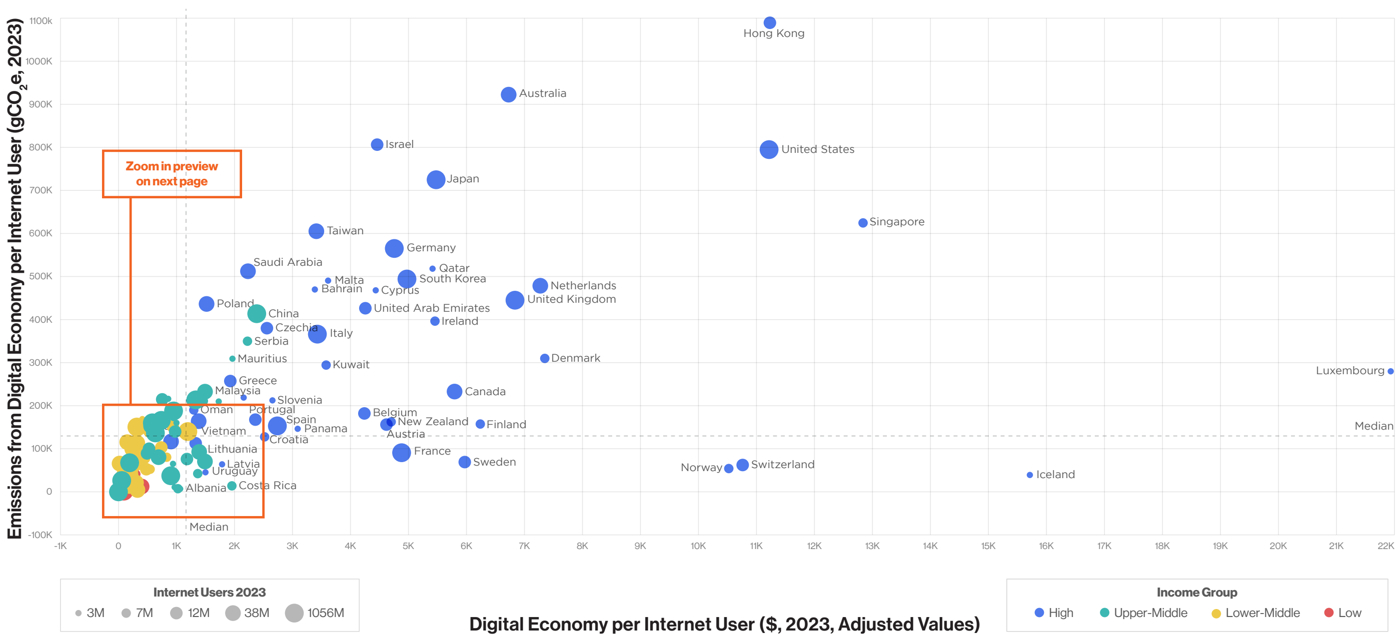
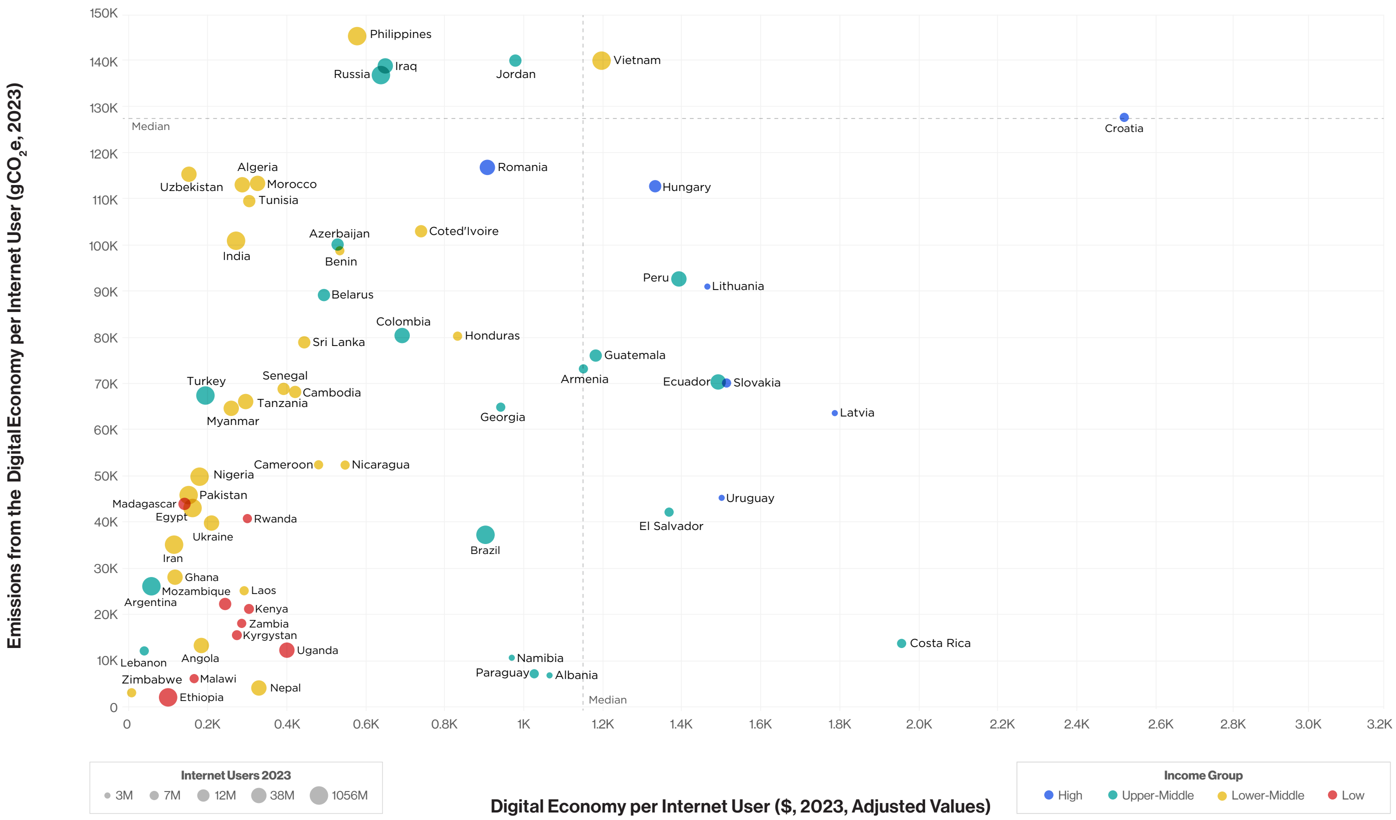


Figure 24b

Digitalization Emissions and the Size of the Digital Economy per Internet User



Data Center Emissions and the Size of the Digital Economy

Figures 25a and 25b show that globally, larger digital economies tend to generate higher data center emissions per internet user, as seen in countries like the United States, Hong Kong, and Australia, which have both high digital revenues and significant emissions from data centers. Conversely, nations such as Switzerland, Norway, and Iceland maintain strong digital economies with minimal data center emissions, highlighting the impact of clean energy and efficient infrastructure.

Figure 25a

Data Center Emissions and the Size of the Digital Economy per Internet User

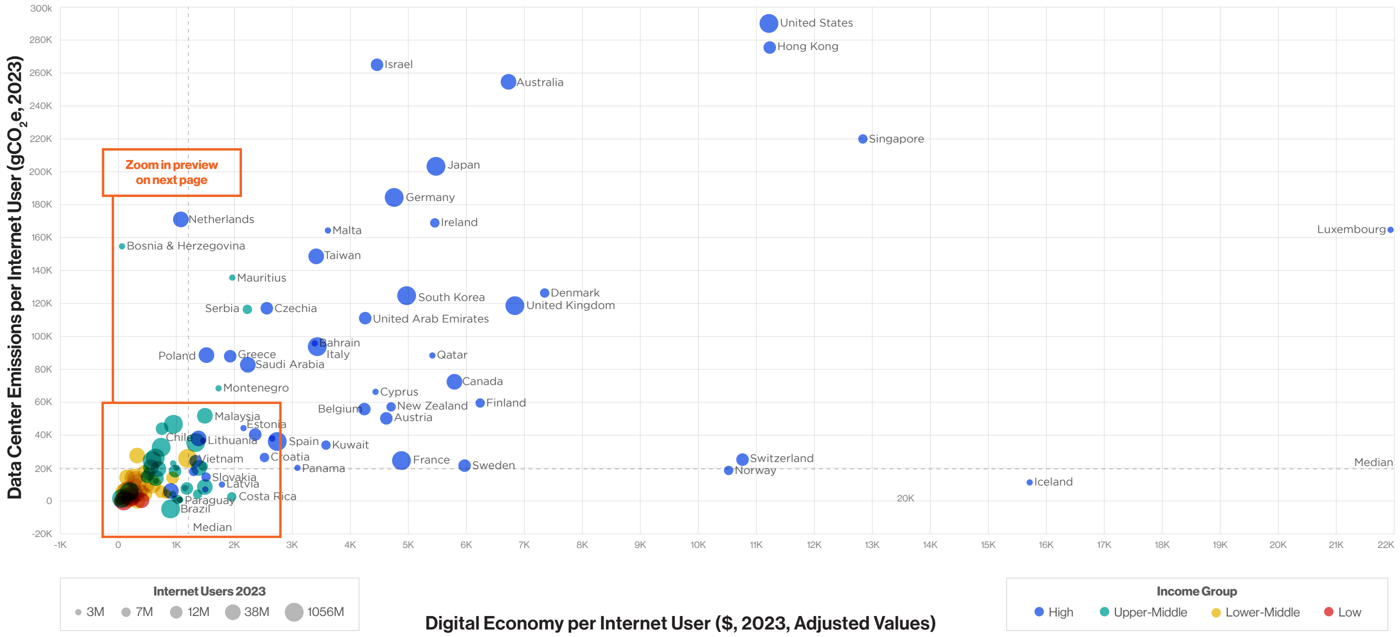
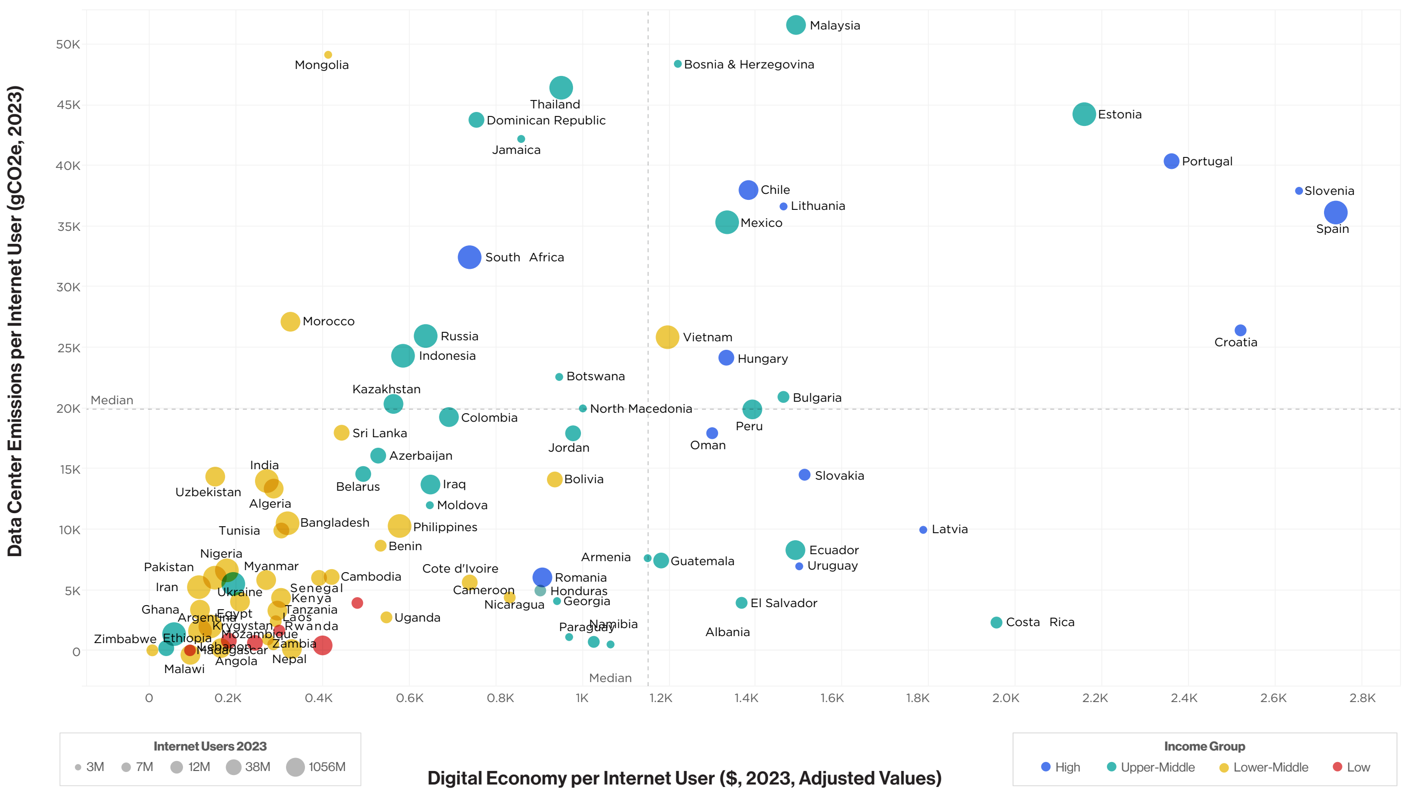
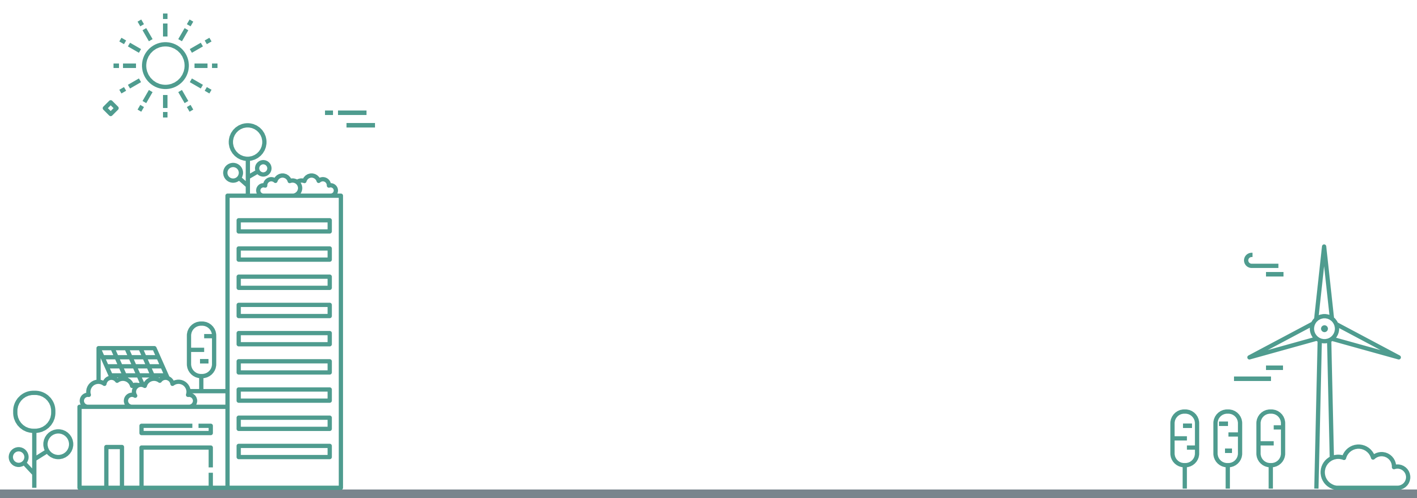


Figure 25b

Data Center Emissions and the Size of the Digital Economy per Internet User



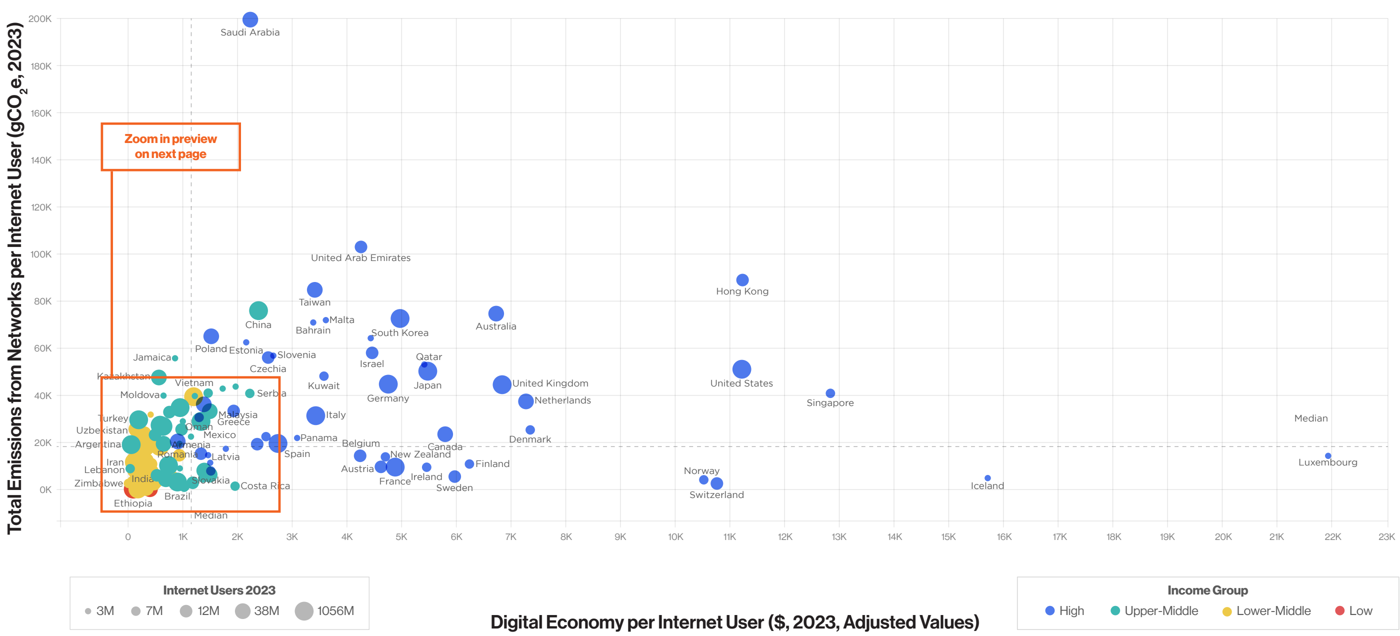


Network Emissions and the Size of the Digital Economy

As seen in figures 26a and 26b, the relationship between network emissions per internet user and the size of the digital economy follows a less consistent pattern than emissions from the overall digital economy and data centers. While higher digital economy revenue per user generally corresponds to greater network emissions, notable outliers disrupt this trend. Saudi Arabia exhibits the highest network emissions per user despite having a moderate digital economy, suggesting a less productive network infrastructure and a reliance on fossil-fuel-powered telecommunications.

Figure 26a

Network Emissions and the Size of the Digital Economy per Internet User



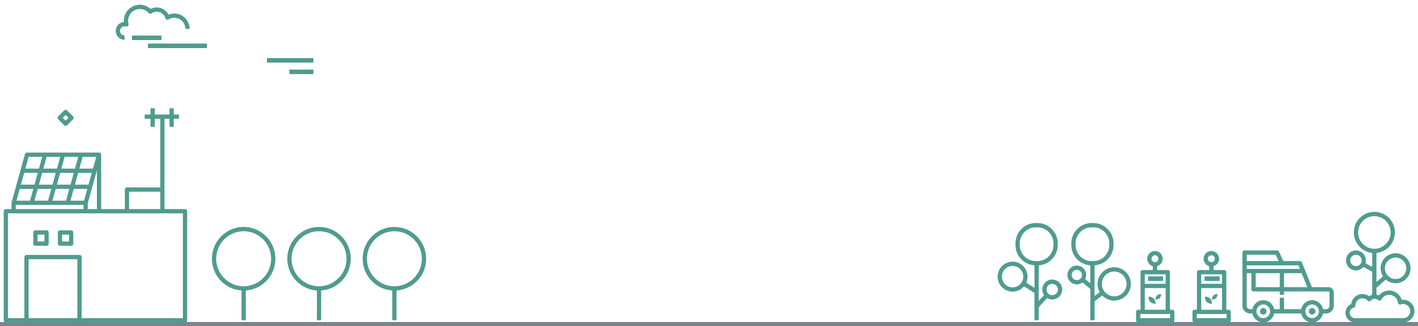
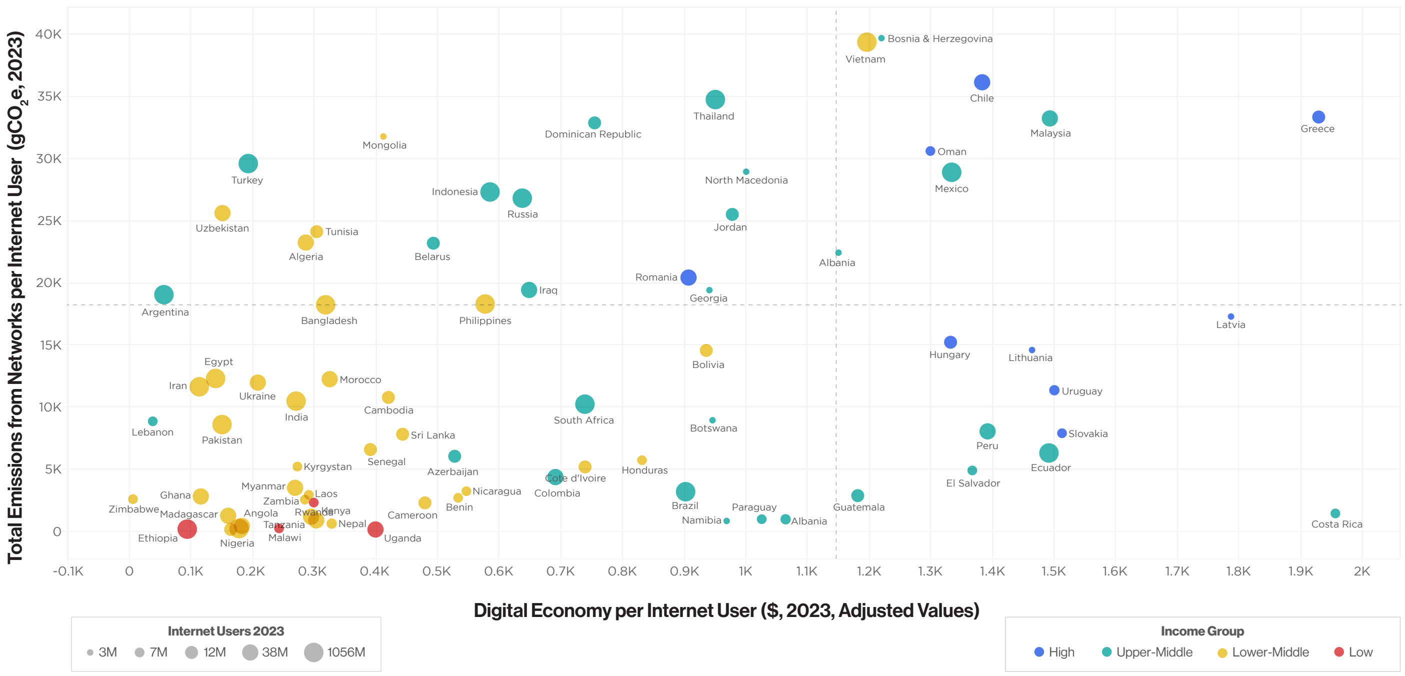


Figure 26b

Network Emissions and the Size of the Digital Economy per Internet User



User Devices Emissions and the Size of the Digital Economy

As seen in Figures 27a and 27b, the relationship between user device emissions per internet user and the size of the digital economy follows a similar pattern to other digital emissions sources, but with notable distinctions.

Hong Kong, Australia, and the United States exhibit the highest user device emissions, mirroring their strong digital economies, suggesting that greater digital consumption leads to increased emissions from personal and corporate devices. Singapore and Israel also show elevated emissions, reinforcing the trend that high-income, tech-heavy nations have greater per-user device emissions. In contrast, Luxembourg, Switzerland, Norway, and Iceland maintain high digital economy revenue with minimal user device emissions, reflecting sustainable consumption habits.

Lower-income countries, including India, Nigeria, and Iran, have the lowest device emissions per user, likely due to lower digital penetration and longer device lifecycles rather than higher energy efficiency. This suggests that while user device emissions scale with digital economy size, policies on sustainability, device longevity, and electronics recycling play a crucial role in reducing emissions in high-income nations.

Figure 27a

User Devices Emissions and the Size of the Digital Economy per Internet User

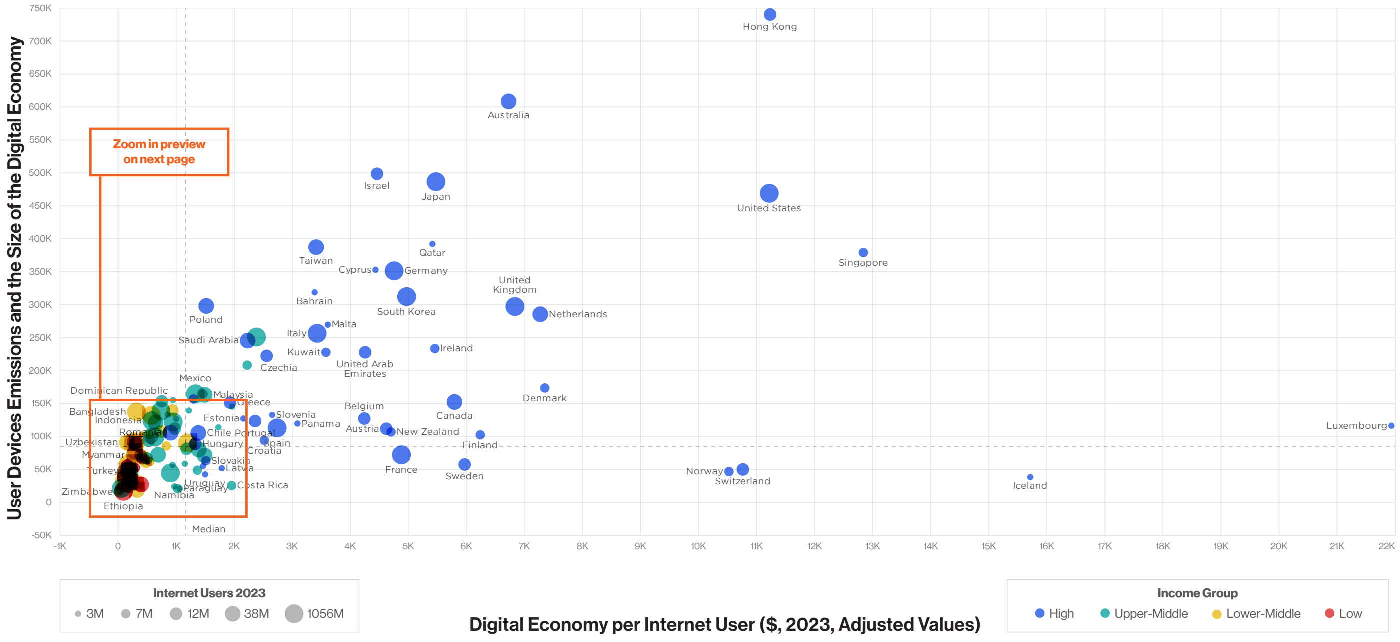
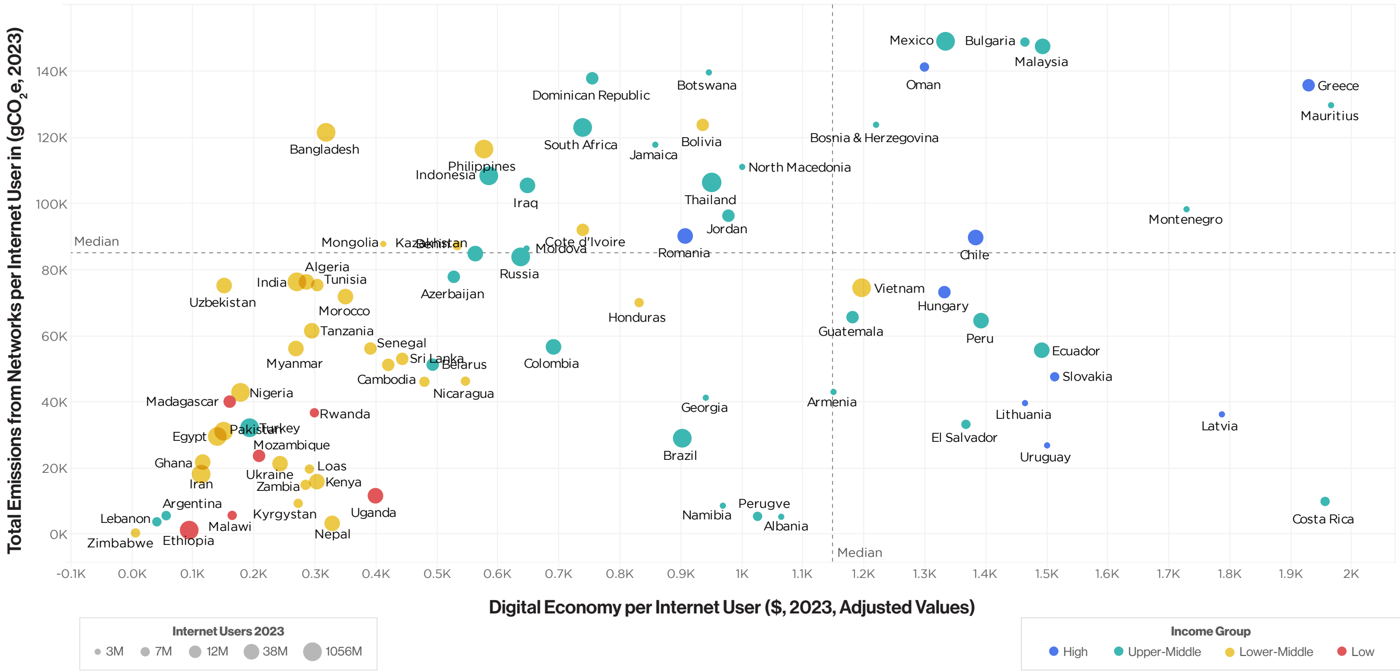


Figure 27b

User Devices Emissions and the Size of the Digital Economy per Internet User



The Trade-off between the Economic and Environmental Impact of the Digital Economy

The Burn-to-Earn Index reveals stark differences in how efficiently countries convert digital activity into economic value. By measuring grams of CO_2 equivalent emitted per dollar of digital revenue, this metric exposes critical trade-offs that shape strategic decisions.

Countries and Companies Can Leverage These Insights to Pursue Multiple Pathways:

Strategic Benchmarking and Optimization

- Analyze top performers to reverse-engineer their digital and energy mix.
- Identify specific sectors or technologies driving emissions inefficiencies.
- Reconfigure digital portfolios based on environmental performance data.

Policy and Investment Decisions

- Set emissions targets grounded in peer comparisons and best practices.
- Guide location decisions for data centers and digital infrastructure.
- Shape regulatory frameworks that encourage cleaner digital growth.

Market Positioning and Nation Branding

- Develop national identities as sustainable digital economy leaders.
- Attract foreign investment through superior environmental performance metrics.
- Influence user adoption patterns through transparency about environmental costs.
- Strengthen global competitiveness by showcasing efficient digital-environmental balance.

The Index transforms abstract sustainability goals into concrete choices: Should a country prioritize high-growth digital platforms despite their emissions intensity? Can companies justify premium pricing for environmentally efficient digital services? These trade-offs, now quantifiable, become central to strategic planning.

Tables 2a and 2b show the relative performance of economies in managing digital value creation and environmental impact:

Table 2a

Burn-to-Earn Index: Digital Economies Ranked by Emissions Generated per USD

Economy	Burn-to-Earn ($gCO_2e/\$$)	Rank	Economy	Burn-to-Earn ($gCO_2e/\$$)	Rank
Iceland	2.5	1	Armenia	63.7	33
Norway	5.1	2	Zambia	64.0	34
Switzerland	5.8	3	Guatemala	64.5	35
Albania	6.5	4	United Kingdom	65.1	36
Costa Rica	7.1	5	Netherlands	65.8	37
Paraguay	7.1	6	Peru	66.6	38
Namibia	11.1	7	Georgia	69.1	39
Sweden	11.6	8	Kenya	70.5	40
Luxembourg	12.8	9	United States	70.9	41
Nepal	12.8	10	Portugal	71.0	42
Ethiopia	17.3	11	Ireland	72.7	43
France	18.6	12	Angola	73.7	44
Finland	25.2	13	Slovenia	79.9	45
Uruguay	30.2	14	Kuwait	82.2	46
El Salvador	30.9	15	Hungary	84.7	47
Uganda	31.1	16	Laos	87.0	48
Austria	33.8	17	Mozambique	92.4	49
New Zealand	34.6	18	Qatar	95.7	50
Latvia	35.7	19	Nicaragua	96.1	51
Malawi	38.0	20	Honduras	96.7	52
Canada	40.2	21	Hong Kong	97.0	53
Brazil	41.4	22	South Korea	99.4	54
Denmark	42.2	23	United Arab Emirates	100.2	55
Belgium	42.9	24	Estonia	101.3	56
Slovakia	46.4	25	Cyprus	105.5	57
Ecuador	47.2	26	Italy	106.8	58
Panama	47.3	27	Cameroon	109.7	59
Singapore	48.6	28	Colombia	116.6	60
Croatia	50.7	29	Vietnam	117.1	61
Spain	56.0	30	Chile	118.7	62
Kyrgyzstan	57.5	31	Germany	118.8	63
Lithuania	62.2	32	Montenegro	121.4	64

Table 2b

Burn-to-Earn Index: Digital Economies Ranked by Emissions Generated per USD

Economy	Burn-to-Earn ($gCO_2e/\$$)	Rank
Romania	129.0	65
Japan	132.3	66
Greece	133.4	67
Malta	135.7	68
Rwanda	136.9	69
Australia	137.1	70
Bahrain	138.8	71
Cote d'Ivoire	139.6	72
Jordan	143.2	73
Bulgaria	144.1	74
Oman	146.4	75
Czechia	148.5	76
Malaysia	155.9	77
Serbia	157.3	78
Mauritius	157.3	79
Mexico	160.2	80
North Macedonia	160.3	81
Cambodia	162.8	82
Bolivia	163.3	83
China	173.5	84
Bosnia & Herzegovina	174.0	85
Senegal	176.6	86
Taiwan	177.4	87
Sri Lanka	178.6	88
Israel	180.8	89
Belarus	181.3	90
Botswana	181.3	91
Benin	185.6	92
Azerbaijan	190.1	93
Ukraine	192.2	94
Thailand	197.7	95

Economy	Burn-to-Earn ($gCO_2e/\$$)	Rank
Moldova	214.3	96
Iraq	214.4	97
Russia	215.0	98
South Africa	224.8	99
Tanzania	225.1	100
Saudi Arabia	229.4	101
Ghana	244.8	102
Myanmar	245.0	103
Jamaica	251.9	104
Philippines	252.1	105
Madagascar	270.6	106
Kazakhstan	272.1	107
Indonesia	274.3	108
Nigeria	281.6	109
Dominican Republic	284.9	110
Poland	287.2	111
Pakistan	307.1	112
Iran	312.6	113
Egypt	316.6	114
Lebanon	328.9	115
Morocco	349.8	116
Turkey	351.3	117
Tunisia	361.5	118
India	374.5	119
Algeria	396.3	120
Mongolia	410.7	121
Bangladesh	474.0	122
Argentina	474.2	123
Zimbabwe	617.4	124
Uzbekistan	767.4	125

Burn-to-Earn by Income Group

High-Income: Burn-to-Earn Index (gCO_2e/USD)

The Burn-to-Earn Index among high-income countries on figures 28a and 28b highlight stark differences in digital economy productivity and environmental footprint. Iceland, Norway, Switzerland, and Sweden are in the lead, producing the lowest emissions per dollar due to renewable energy reliance. Luxembourg, Finland, and France also perform well, maintaining strong digital revenues with relatively low carbon intensity. In contrast, Germany, Japan, and Italy hover near the global average, indicating moderate environmental footprint with room for improvement. At the high-emission end, the digital economies of Poland, Saudi Arabia, and Taiwan have the largest environmental footprint, with emissions significantly exceeding the global average, likely due to a high share of fossil fuel in their energy mix.

Figure 28a

High-Income: Burn-to-Earn Index (gCO_2e/USD)

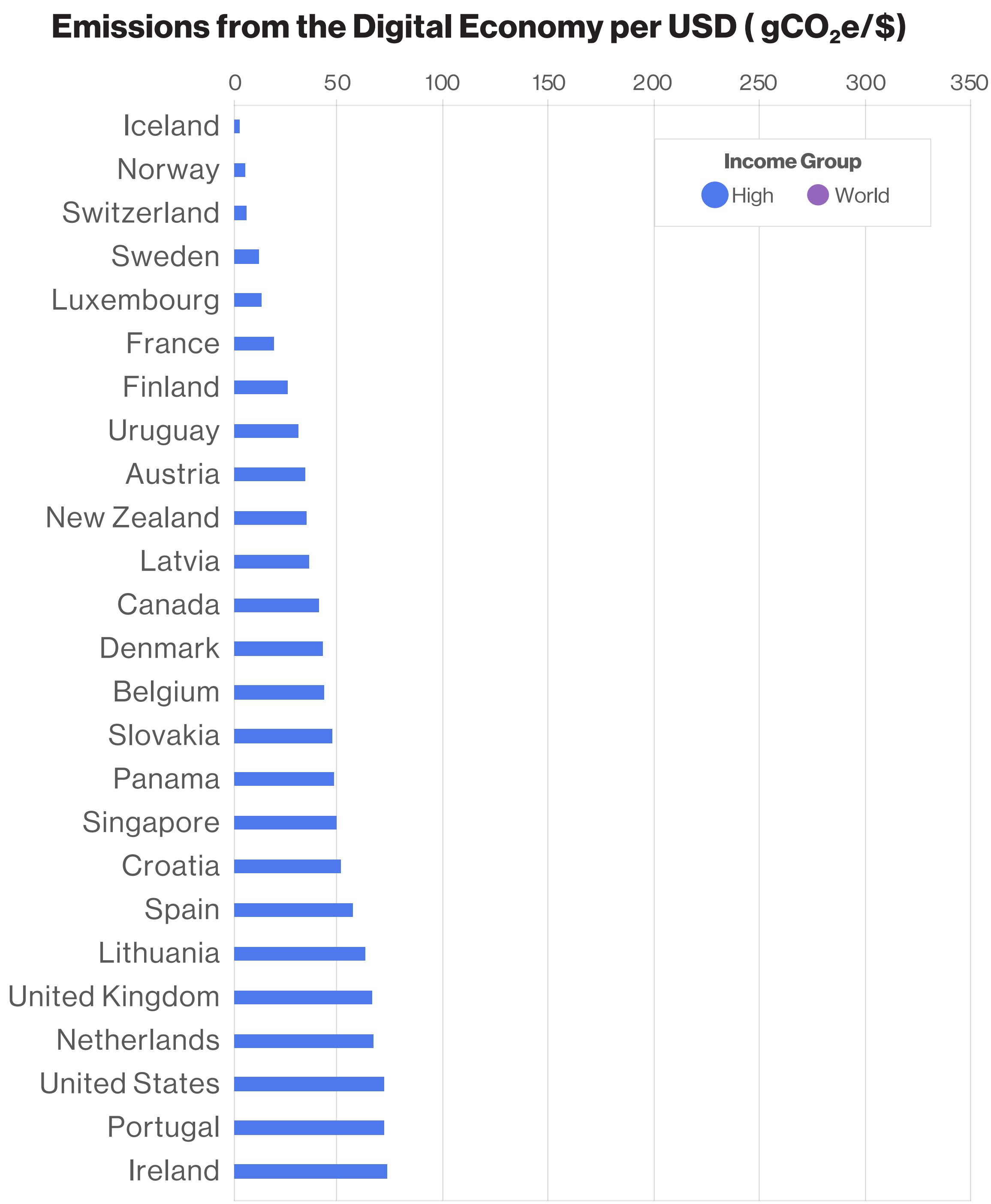
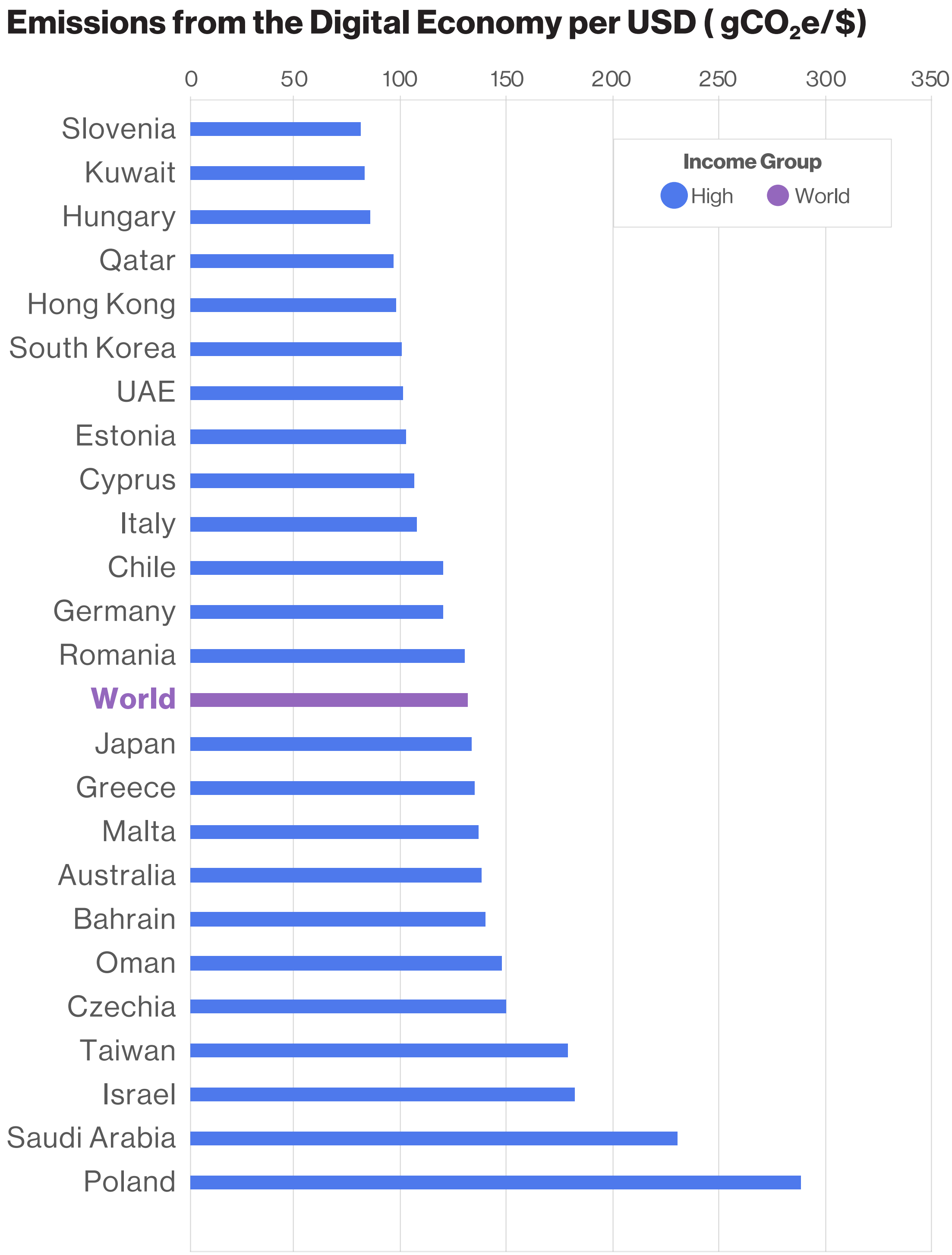


Figure 28b

High-Income: Burn-to-Earn Index (gCO_2e/USD)



Upper-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)

Figures 29a and 29b show significant differences among upper-middle-income countries in the Burn-to-Earn Index, reflecting wide variation in both the productivity and environmental impact of their digital economies. Albania, Costa Rica, Paraguay, and Namibia emerge as the digital economies with emissions per dollar significantly below the global average. These countries likely benefit from cleaner energy sources and lower digital infrastructure emissions.
In contrast, Montenegro, Jordan, and Bulgaria are positioned closer to the global average, indicating a moderate environmental footprint with room for sustainable improvements. At the high-emission end, the digital economies of Argentina, Turkey, Lebanon, and the Dominican Republic exhibit the highest burn-to-earn values, likely due to a strong reliance on fossil fuels and outdated infrastructure. The chart highlights a significant sustainability gap, where some upper-middle-income countries successfully balance digital growth with lower carbon intensity, while others remain highly dependent on carbon-heavy energy sources.

Figure 29a
Upper-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)

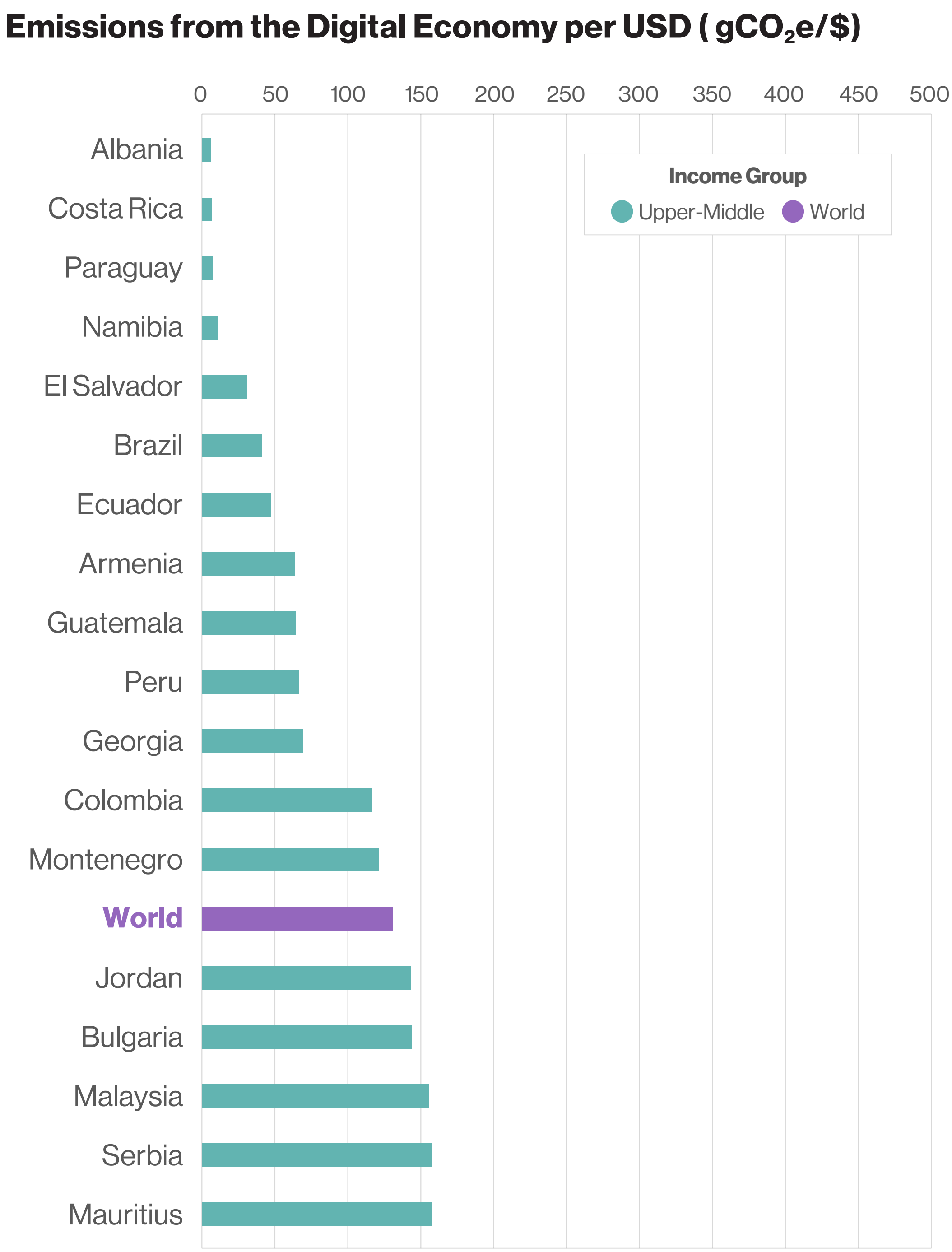
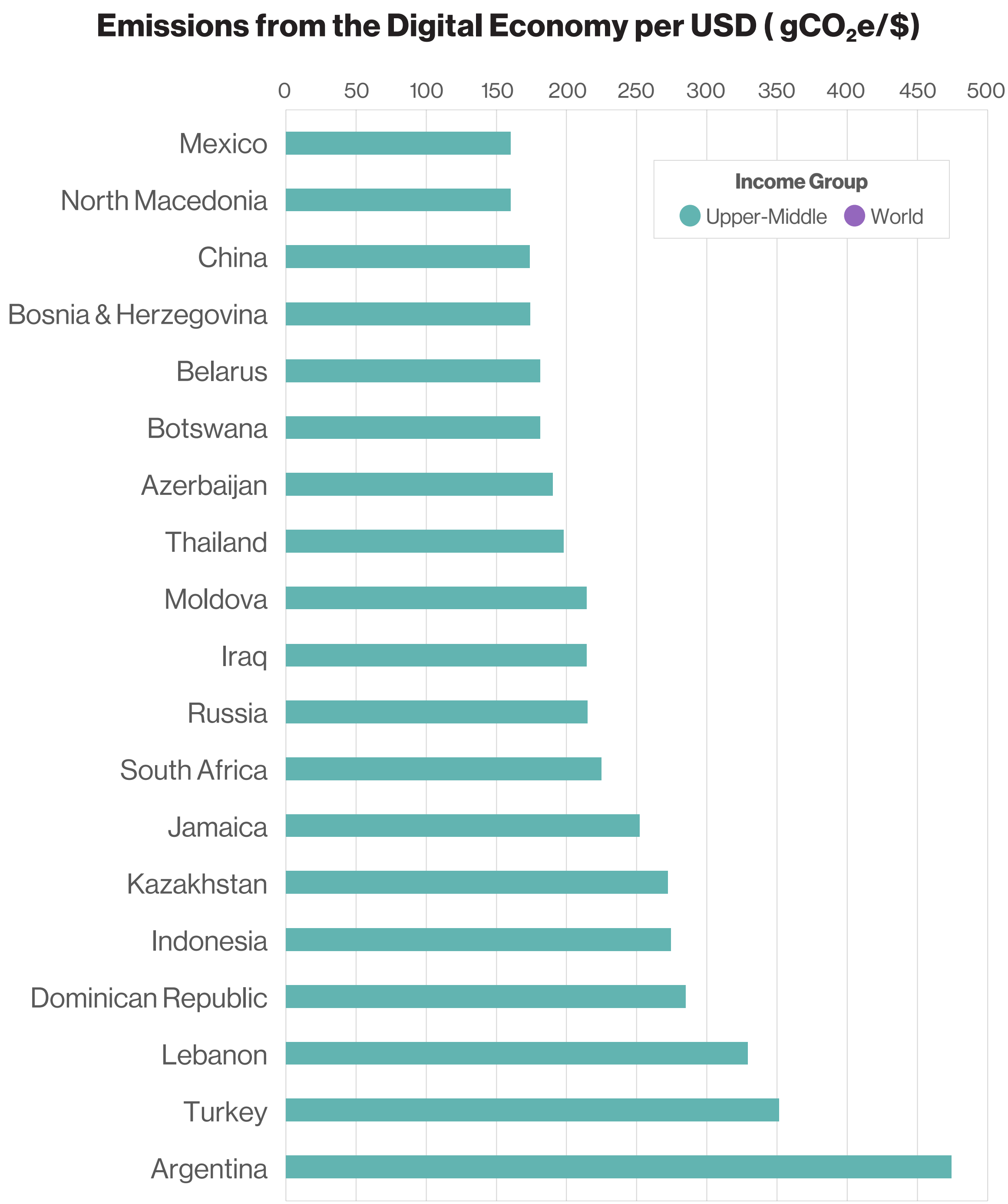


Figure 29b
Upper-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)



Lower-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)

Figures 30a and 30b show that lower-middle-income countries have a notable environmental footprint in their digital economies, as indicated by high emissions per dollar of economic output. Nepal, Kyrgyzstan, Zambia, Kenya, and Angola exhibit the lowest emissions per dollar, indicating a relatively lower environmental footprint within their income group, possibly due to a moderately productive digital economy and a mix of renewable energy sources. However, many countries in this category, such as Nigeria, Pakistan, Iran, and India, exceed the global average, reflecting higher carbon intensity in digital operations. The economies with the largest environmental footprint include Bangladesh, Zimbabwe, and Uzbekistan, with Uzbekistan ranking the worst, emitting the highest gCO_2e per dollar. These countries likely rely on fossil fuel-dominated energy grids and less productive digital infrastructure, resulting in increased environmental footprint as the digital economy grows. The stark contrast between the lowest and highest emitters highlights the urgent need for clean energy investments and productivity improvements in the digital sectors of lower-middle-income countries.

Figure 30a
Lower-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)

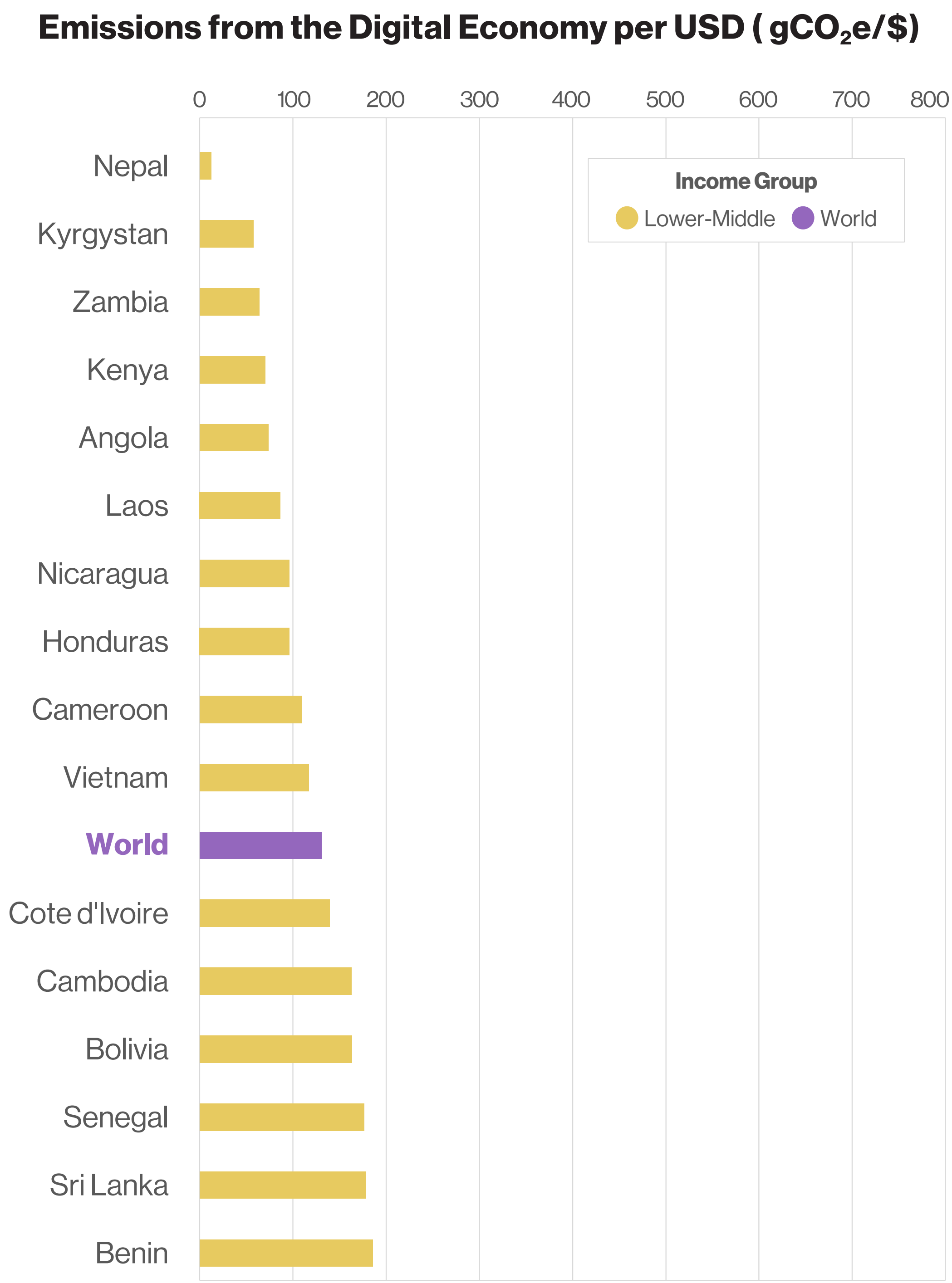
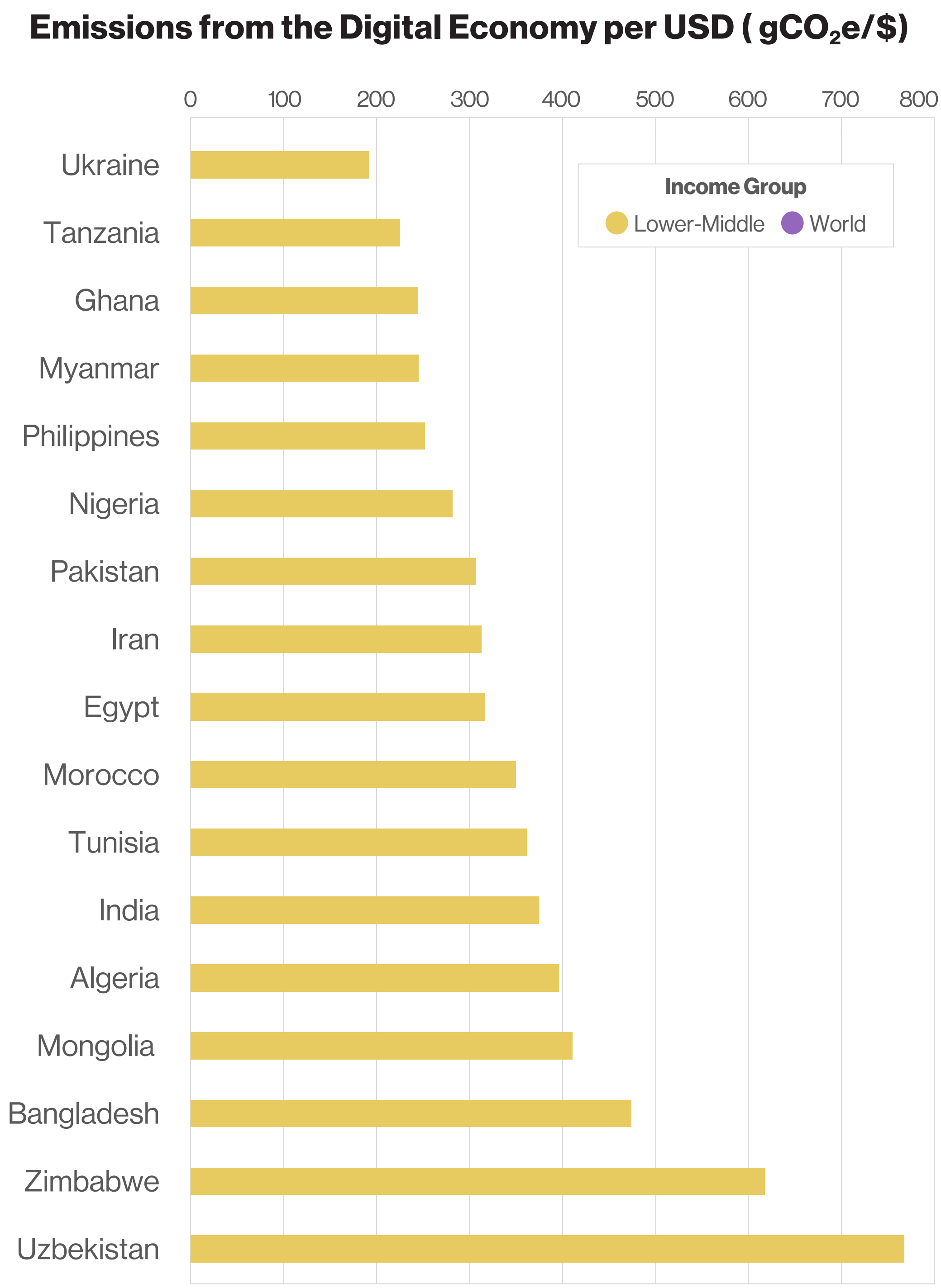


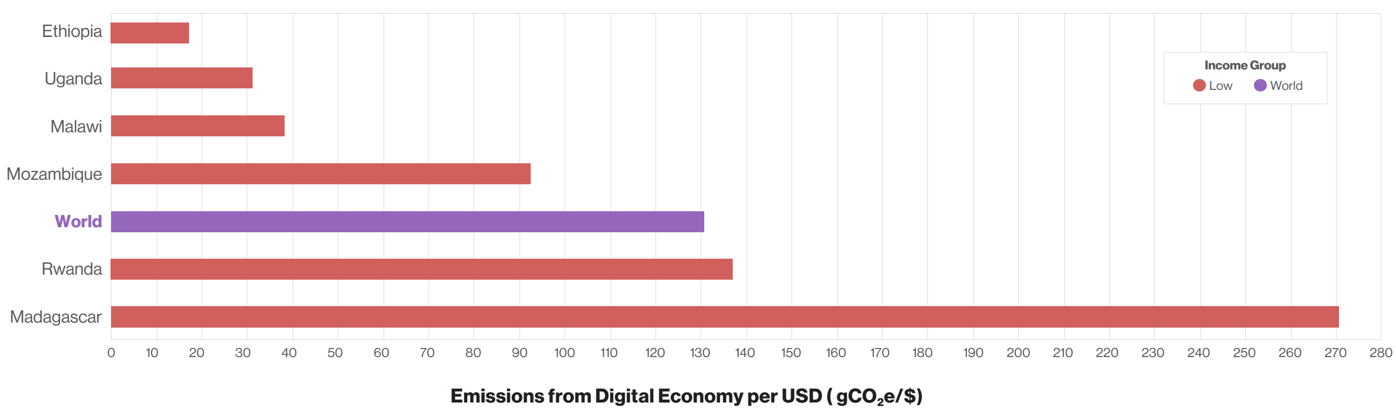
Figure 30b
Lower-Middle-Income: Burn-to-Earn Index (gCO_2e/USD)



Low-Income: Burn-to-Earn Index (gCO_2e/USD)

Figure 31 highlights substantial disparities in both the productivity and environmental impact of the digital economy among low-income countries, as shown by the Burn-to-Earn Index. Ethiopia, Uganda, and Malawi exhibit the lowest emissions per dollar, indicating relatively smaller environmental footprints in their digital economies, potentially due to lower overall digital infrastructure and reliance on renewable energy sources. Mozambique and Rwanda hover around the global average, suggesting moderate environmental footprints, likely influenced by energy access constraints and reliance on fossil fuels. Madagascar, however, has the highest burn-to-earn value among low-income countries, emitting far more CO_2e per dollar generated, indicating a high environmental footprint due to dependence on high-carbon energy sources. This trend underscores the need for clean energy investment and improved digital infrastructure in low-income nations to enhance both economic and environmental sustainability.

Figure 31
Low-Income: Burn-to-Earn Index (gCO_2e/USD)

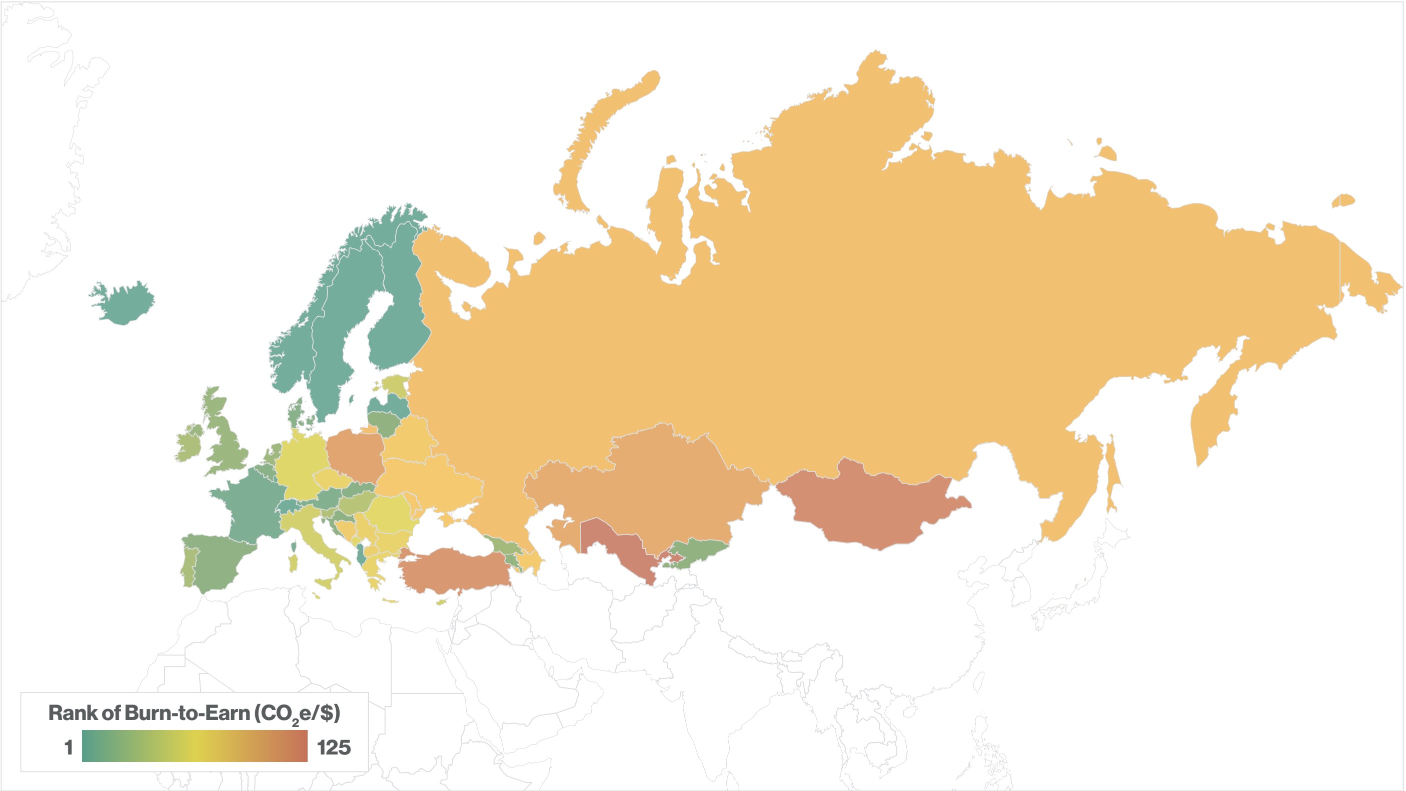


Comparisons Across Regions

Europe and Central Asia: Western vs. Eastern Europe

Figure 32 reveals a clear divide between Western and Eastern Europe in terms of digital economy emissions per dollar. Western European countries generally show lower emissions, supported by renewable energy use, productive digital infrastructure, and strong sustainability policies. In contrast, much of Eastern Europe displays higher emissions due to greater dependence on fossil fuels and less productive digital sectors, though a few Eastern European countries are narrowing this gap through better performance.

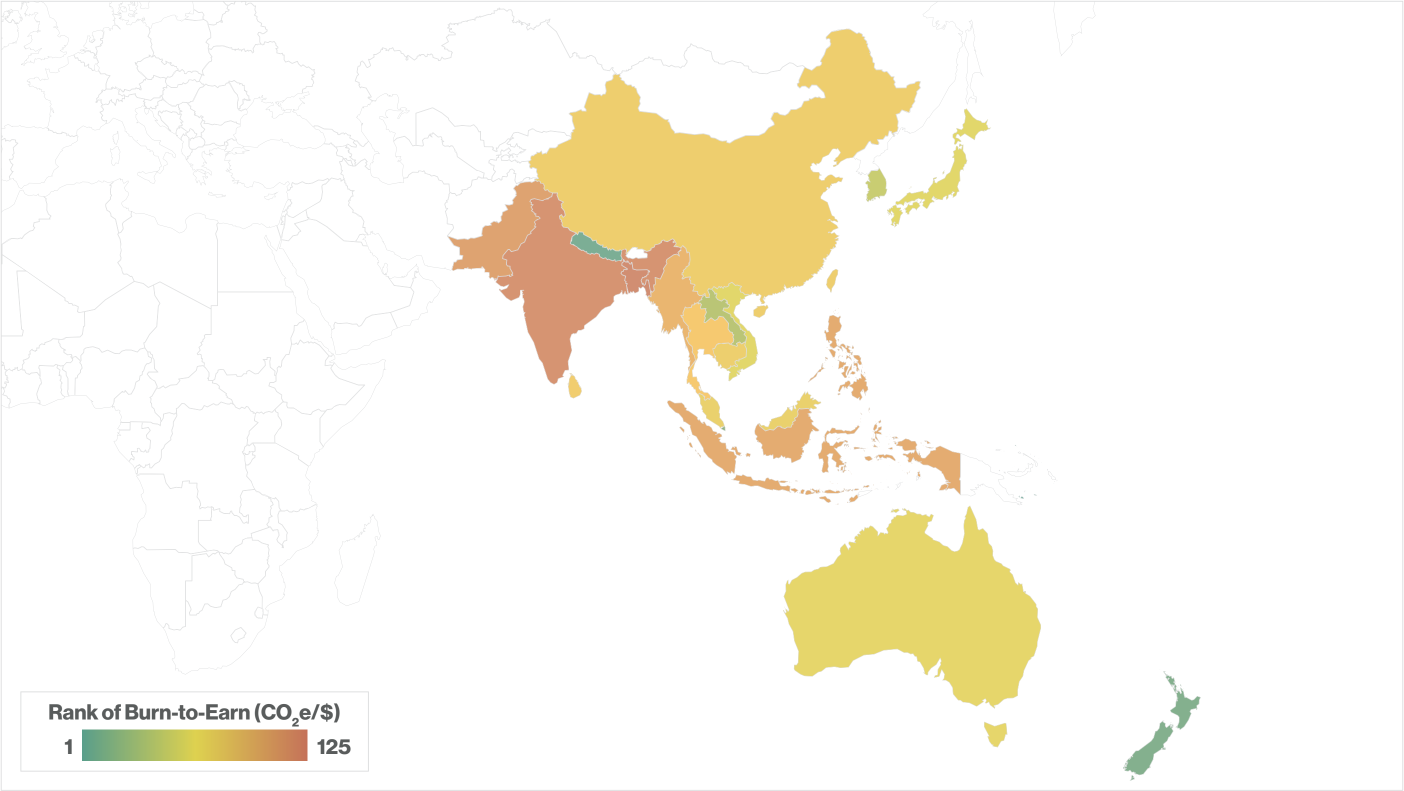
Figure 32
Europe and Central Asia: Western vs. Eastern Europe



Asia-Pacific: A Contrast Between High-Income and Developing Countries in Asia

Figure 33 highlights a stark divide in the Asia-Pacific region between high-income and developing countries in terms of digital economy emissions per dollar. Developing nations exhibit the highest emissions, pointing to high carbon intensity and lower digital productivity driven by fossil fuel reliance and underdeveloped infrastructure. In contrast, high-income countries demonstrate significantly lower emissions, reflecting more sustainable, higher-value digital economies. Upper-middle-income countries occupy the middle ground, indicating a gradual shift toward cleaner and more productive digitalization.

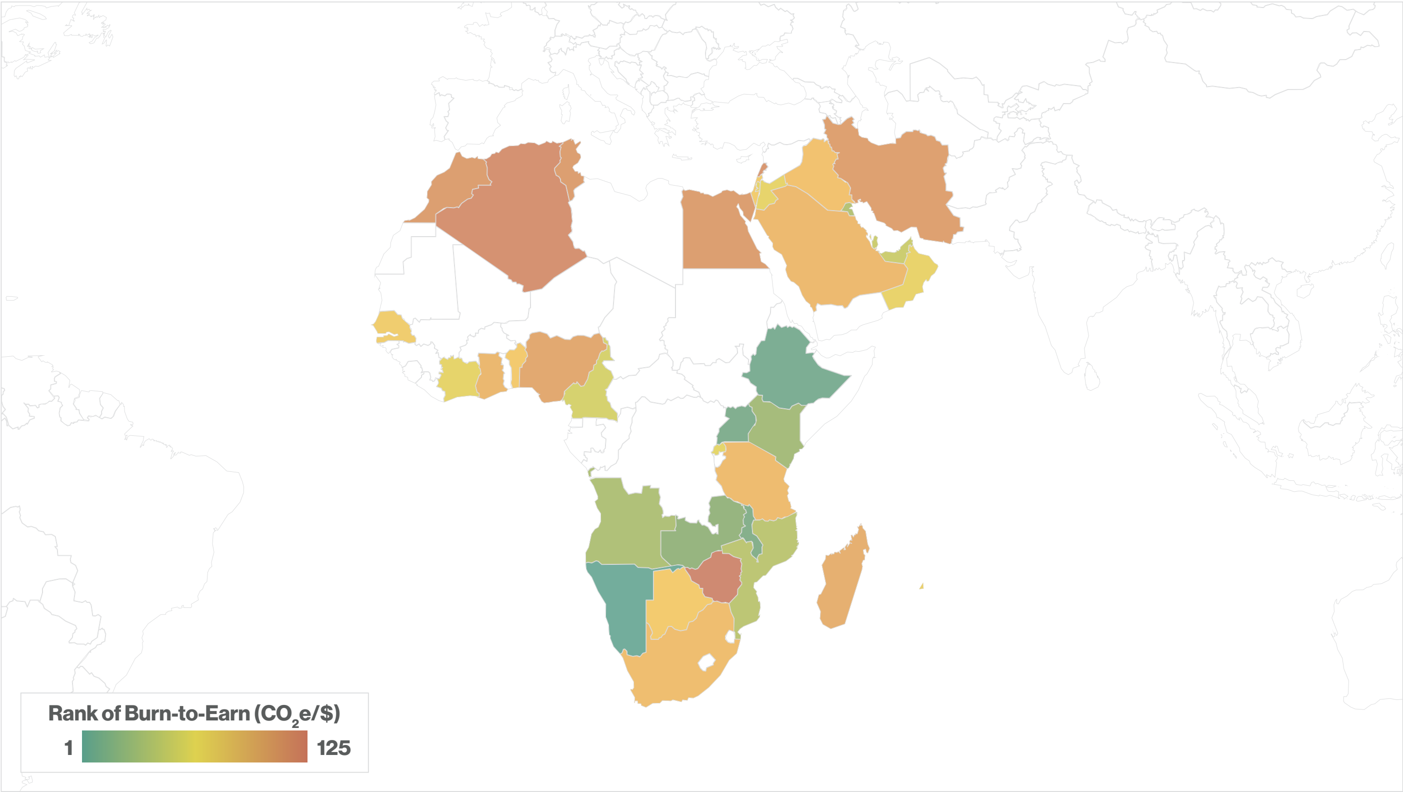
Figure 33
Asia-Pacific: A Contrast Between High-Income and Developing Countries in Asia



Middle East and Africa: A Diverse Performance Across Countries

Figure 34 shows that Africa and the Middle East have a broad spectrum of Burn-to-Earn performance, reflecting differences in digital productivity and energy reliance. Some countries like Namibia, achieve lower emissions per dollar due to greater use of renewable energy sources like hydropower.[20] Others, however, face high emissions linked to heavy fossil fuel dependence and less productive digital economies.

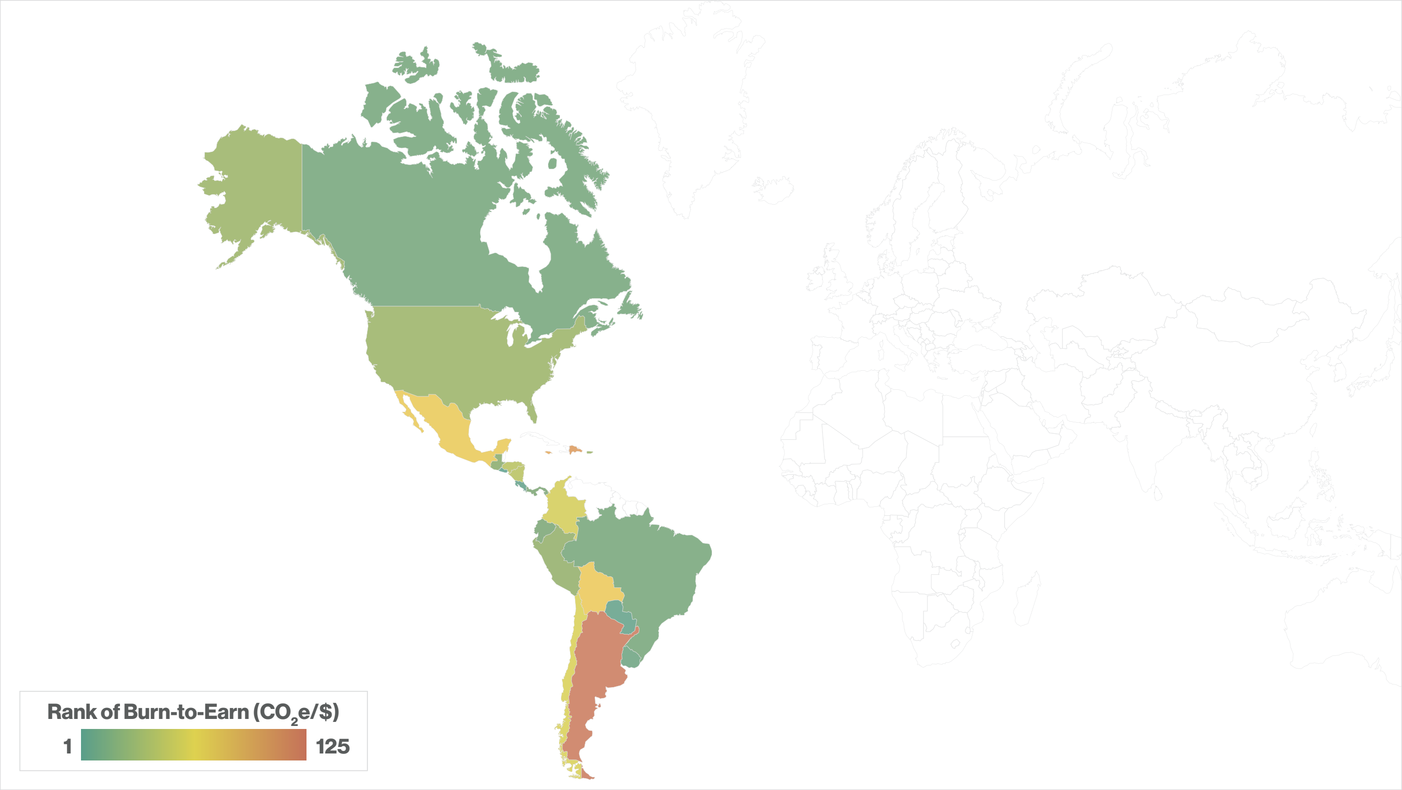
Figure 34
Middle East and Africa: A Diverse Performance Across Countries



Americas: A Regional Overview

Across regions, North America has the lowest median Burn-to-Earn, and Latin America is 3rd, after Europe. Within the Americas, Figure 35 illustrates a wide range of emissions from the digital economy, with no clear pattern across income groups. The emissions per digital dollar generated are driven by the energy sources powering digital infrastructure and the level of digital productivity. Countries that rely on cleaner energy and generate more value from their digital activities tend to have lower emissions per dollar.

Figure 35
Americas: A Regional Overview



Recommendations

1. Accelerating the Transition to Clean Energy

- Prioritizing renewable energy adoption,[21] especially by economies with high emissions per digitally generated dollar.
- Creating incentives for low-carbon power for data centers through tax incentives and subsidies for data centers and digital service providers that generate clean energy.[22]
- Facilitating regional energy collaborations, where high-emission countries can partner with neighboring cleaner-energy economies to integrate renewable sources into their energy mix.[23]

2. Improving Energy Efficiency in the Digital Economy

- Adopting energy-efficient digital infrastructure[24] by encouraging the deployment of low-energy servers, green data centers, energy-efficient networking equipment and making data center location choices in countries and regions with lower emissions per dollar.
- Optimizing AI and cloud computing for lower energy use by using advanced AI algorithms and smart cloud storage systems to reduce power consumption while increasing computing capacity.[25] Implementing AI-driven smart grids can optimize energy use in the digital sector, reducing unnecessary power consumption.
- Encouraging circular economy practices by extending device lifespans, promoting recycling, and reducing e-waste.[26]

3. Enhancing Productivity of the Digital Economy

- Lower-income economies investing in domestic software, fintech, and e-commerce industries to boost their digital economy's size.
- Investing in digital public goods/infrastructure[27] to enable access to digital platforms and applications at population-scale.
- Developing high-speed, lower-energy digital networks by expanding fiber-optic[28] networks and 5G adoption.[29]

4. Enhancing Energy Efficiency of AI

- Leveraging innovations in energy-efficient AI[30]: More efficient GPUs that can deliver 30X in performance while using 25X less energy; cutting cooling expenses in data centers; novel computing architectures, e.g. locating memory inside computing cores that cut energy dissipation by shortening data travel distances; deploying devices mimicking brain functions and using 1000X less energy; using models running on low-powered microcontrollers; minimizing energy-intensive operations by writing to memory cells; using distillation to enable more efficient use of computation without performance loss; integrating photonic accelerators, 3D chips, chip cooling techniques, with future gains from quantum and photonic computing.
- DeepSeek demonstrated savings on compute and energy resources by deploying a "mixture of experts" technique that splits the AI's neural networks into different categories, and other creative approaches without noticeable losses in performance.[31]
- Instituting training programs that develop local expertise in AI and energy conservation[32] and energy use data capture globally.

5. Strengthening International Cooperation to Build Digital Trust through Sustainable Digitalization

- Establishing and harmonizing digital carbon pricing[33] mechanisms to encourage low-carbon digital infrastructure investment.
- Creating global standards for sustainable digital growth by publishing Burn-to-Earn scores and seeking improvement, while harmonizing emission benchmarks for digital sectors.
- Facilitating technology transfer to lower-income economies.[34]

6. Enhancing Data Transparency and Measurement

- Developing standardized metrics for measuring the environmental impact[35] of the digital economy noting leverage points for governments, industry and users, setting "carbon budgets," etc.
- Requiring digital sustainability reporting by tech firms and data center operators.[36]
- Leveraging AI and data analysis for real-time emissions monitoring[37] to enable behavior changes, nudges and proactive sustainability management.

Conclusion

Managing the trade-offs between economic growth and environmental impact in the digital era requires a deliberate and coordinated approach that spans energy policy, digital infrastructure, and technological innovation. As the data and regional analyses show, countries vary widely in how efficiently they convert digital activity into economic value, with some nations achieving low emissions per digital dollar through clean energy and advanced digital infrastructure, while others remain heavily reliant on fossil fuels and less productive digital sectors.

To bridge this gap and reduce the "burn-to-earn" ratio globally, governments, businesses, and consumers must work together to adopt more sustainable digital practices. This includes investing in renewable energy sources to power data centers and digital services, designing energy-efficient infrastructure, and promoting responsible consumption of digital devices to reduce electronic waste. Emerging economies, in particular, need targeted support and investment to improve both digital access and sustainability outcomes.

Importantly, countries must also consider the carbon intensity of their digital economic growth and benchmark progress using tools like the Burn-to-Earn Index. This metric not only helps identify inefficiencies but also opens opportunities for sustainable growth, competitive differentiation, and innovation. By aligning digital expansion with environmental responsibility, and fostering global collaboration and knowledge sharing, we can ensure that the digital revolution drives inclusive prosperity while safeguarding the planet for future generations.

Data Sources

Table 3
Data Sources

Statista Market Insights	IEA (International Energy Agency)
ITU (International Telecommunication Union)	UNCTAD (UN Trade and Development)
Euromonitor	EMBER
World Bank	
FAOSTAT (Food and Agricultural Organization)	

Appendix

Table 4a

Digital Economies Ranked by Earn

Economy	Digital Economy per Internet User ($, 2023)	Rank
Luxembourg	21,936	1
Iceland	15,713	2
Singapore	12,838	3
Hong Kong	11,232	4
United States	11,218	5
Switzerland	10,762	6
Norway	10,523	7
Denmark	7,351	8
Netherlands	7,273	9
United Kingdom	6,836	10
Australia	6,727	11
Finland	6,238	12
Sweden	5,970	13
Canada	5,795	14
Japan	5,477	15
Ireland	5,457	16
Qatar	5,415	17
South Korea	4,971	18
France	4,882	19
Germany	4,756	20
New Zealand	4,702	21
Austria	4,620	22
Israel	4,460	23
Cyprus	4,435	24
United Arab Emirates	4,257	25
Belgium	4,242	26
Malta	3,614	27
Kuwait	3,580	28
Italy	3,429	29
Taiwan	3,412	30
Bahrain	3,386	31

Economy	Digital Economy per Internet User ($, 2023)	Rank
Panama	3,089	32
Spain	2,739	33
Slovenia	2,654	34
Czechia	2,560	35
Croatia	2,519	36
China	2,384	37
Portugal	2,360	38
Saudi Arabia	2,233	39
Serbia	2,224	40
Estonia	2,158	41
Mauritius	1,965	42
Costa Rica	1,955	43
Greece	1,928	44
Latvia	1,786	45
Montenegro	1,728	46
Poland	1,519	47
Slovakia	1,512	48
Uruguay	1,500	49
Malaysia	1,492	50
Ecuador	1,491	51
Lithuania	1,463	52
Bulgaria	1,463	53
Peru	1,391	54
Chile	1,382	55
El Salvador	1,366	56
Mexico	1,333	57
Hungary	1,331	58
Oman	1,299	59
Bosnia & Herzegovina	1,219	60
Vietnam	1,195	61
Guatemala	1,181	62

Table 4b

Digital Economies Ranked by Earn

Economy	Digital Economy per Internet User ($, 2023)	Rank
Armenia	1,149	63
Albania	1,064	64
Paraguay	1,025	65
North Macedonia	1,000	66
Jordan	977	67
Namibia	968	68
Thailand	950	69
Botswana	945	70
Georgia	940	71
Bolivia	935	72
Romania	906	73
Brazil	901	74
Jamaica	857	75
Honduras	831	76
Dominican Republic	754	77
Côte d'Ivoire	738	78
South Africa	738	79
Colombia	690	80
Iraq	648	81
Moldova	646	82
Russia	637	83
Indonesia	584	84
Philippines	576	85
Kazakhstan	562	86
Nicaragua	546	87
Berlin	532	88
Azerbaijan	527	89
Belarus	492	90
Cameroon	479	91
Sri Lanka	442	92
Cambodia	419	93
Mongolia	411	94

Economy	Digital Economy per Internet User ($, 2023)	Rank
Uganda	398	95
Senegal	390	96
Nepal	327	97
Morocco	324	98
Bangladesh	317	99
Tunisia	303	100
Kenya	302	101
Rwanda	298	102
Tanzania	294	103
Laos	290	104
Algeria	285	105
Zambia	284	106
Kyrgyzstan	272	107
India	270	108
Myanmar	268	109
Mozambique	242	110
Ukraine	208	111
Turkey	192	112
Angola	182	113
Nigeria	177	114
Malawi	164	115
Madagascar	159	116
Uzbekistan	150	117
Pakistan	150	118
Egypt	139	119
Ghana	115	120
Iran	113	121
Ethiopia	93	122
Argentina	55	123
Lebanon	37	124
Zimbabwe	5	125

Table 5a

Digital Economies Ranked by Burn

Economy	Emissions from DE per Internet User in gCO_2e 2023	Rank
Ethiopia	1,606	1
Zimbabwe	3,165	2
Nepal	4,196	3
Malawi	4,222	4
Albania	6,927	5
Paraguay	7,271	6
Namibia	10,741	7
Lebanon	12,217	8
Uganda	12,380	9
Angola	13,392	10
Costa Rica	13,834	11
Kyrgyzstan	15,628	12
Zambia	18,174	13
Kenya	21,304	14
Mozambique	22,373	15
Laos	25,239	16
Argentina	26,209	17
Ghana	28,174	18
Iran	35,210	19
Brazil	37,346	20
Iceland	39,122	21
Ukraine	39,889	22
Rwanda	40,856	23
El Salvador	42,250	24
Madagascar	43,143	25
Egypt	44,036	26
Uruguay	45,347	27
Pakistan	45,396	28
Nigeria	49,922	29
Nicaragua	52,436	30
Cameroon	52,497	31

Economy	Emissions from DE per Internet User in gCO_2e 2023	Rank
Norway	61,028	32
Switzerland	62,295	33
Latvia	63,681	34
Georgia	64,966	35
Myanmar	65,661	36
Tanzania	66,185	37
Turkey	67,490	38
Cambodia	68,258	39
Senegal	68,919	40
Sweden	69,077	41
Slovakia	70,199	42
Ecuador	70,425	43
Armenia	73,258	44
Guatemala	76,134	45
Sri Lanka	79,001	46
Honduras	80,337	47
Colombia	80,471	48
Belarus	89,229	49
France	90,797	50
Lithuania	91,062	51
Peru	92,718	52
Benin	98,822	53
Azerbaijan	100,164	54
India	100,981	55
Cote d'Ivoire	103,039	56
Tunisia	109,562	57
Hungary	112,781	58
Algeria	113,100	59
Morocco	113,397	60
Uzbekistan	115,372	61
Romania	116,857	62

Table 5b

Digital Economies Ranked by Burn

Economy	Emissions from DE per Internet User in gCO_2e 2023	Rank
Croatia	127,678	63
Russia	136,832	64
Moldova	138,469	65
Iraq	138,822	66
Vietnam	139,957	67
Jordan	139,969	68
Philippines	145,263	69
Panama	146,243	70
Bangladesh	150,478	71
Bolivia	152,670	72
Kazakhstan	152,975	73
Spain	153,275	74
Austria	156,115	75
Finland	157,435	76
North Macedonia	160,211	77
Indonesia	160,233	78
New Zealand	162,517	79
Chile	164,067	80
South Africa	165,893	81
Portugal	167,670	82
Mongolia	168,899	83
Botswana	171,386	84
Belgium	182,023	85
Thailand	187,780	86
Oman	190,056	87
Montenegro	209,757	88
Bulgaria	210,902	89
Slovenia	212,095	90
Bosnia & Herzegovina	212,129	91
Mexico	213,519	92
Dominican Republic	214,752	93
Jamaica	215,921	94

Economy	Emissions from DE per Internet User in gCO_2e 2023	Rank
Estonia	218,628	95
Malaysia	232,599	96
Canada	232,838	97
Greece	257,269	98
Luxembourg	279,865	99
Kuwait	294,390	100
Mauritius	309,166	101
Denmark	309,871	102
Serbia	349,815	103
Italy	366,222	104
Czechia	380,011	105
Ireland	396,457	106
China	413,698	107
United Arab Emirates	426,365	108
Poland	436,353	109
United Kingdom	444,992	110
Cyprus	467,986	111
Bahrain	469,923	112
Netherlands	478,556	113
Malta	490,481	114
South Korea	494,239	115
Saudi Arabia	512,271	116
Qatar	518,225	117
Germany	565,145	118
Taiwan	605,224	119
Singapore	624,501	120
Japan	724,775	121
United States	794,774	122
Israel	806,312	123
Australia	922,402	124
Hong Kong	1,089,360	125

Table 6a

Digital Economies Ranked by Carbon Intensity

Economy	Carbon intensity (CO_2e / KWh, 2023)	Carbon Intensity Rank
Nepal	23	1
Ethiopia	24	2
Albania	24	3
Costa Rica	25	4
Paraguay	25	5
Iceland	28	6
Switzerland	30	7
Norway	30	8
Sweden	38	9
Namibia	48	10
Malawi	55	11
France	55	12
Uganda	57	13
Finland	82	14
Brazil	96	15
Kenya	97	16
New Zealand	104	17
Zambia	111	18
Austria	112	19
Slovakia	115	20
Uruguay	116	21
El Salvador	118	22
Lithuania	119	23
Latvia	119	24
Luxembourg	122	25
Mozambique	128	26
Belgium	135	27
Denmark	150	28
Kyrgyzstan	151	29
Portugal	158	30
Canada	165	31

Economy	Carbon intensity (CO_2e / KWh, 2023)	Carbon Intensity Rank
Angola	167	32
Georgia	168	33
Spain	170	34
Ecuador	176	35
Hungary	196	36
Croatia	197	37
Slovenia	225	38
United Kingdom	228	39
Laos	232	40
Romania	243	41
Ukraine	256	42
Panama	259	43
Armenia	262	44
Netherlands	269	45
Colombia	269	46
Chile	272	47
Guatemala	273	48
Ireland	285	49
Cameroon	286	50
Peru	288	51
Nicaragua	288	52
Honduras	290	53
Zimbabwe	298	54
Rwanda	302	55
Italy	324	56
Greece	337	57
Bulgaria	339	58
Tanzania	339	59
Argentina	354	60
Belarus	364	61
Lebanon	369	62

Table 6b
Digital Economies Ranked by Carbon Intensity

Economy	Carbon intensity (CO_2e / KWh, 2023)	Carbon Intensity Rank
United States	370	63
Germany	371	64
Estonia	390	65
Cote d'Ivoire	394	66
Montenegro	418	67
South Korea	432	68
Czechia	443	69
Russia	445	70
Pakistan	446	71
Ghana	453	72
Turkey	465	73
Cambodia	471	74
Singapore	471	75
Vietnam	472	76
Madagascar	477	77
Bolivia	489	78
Mexico	492	79
United Arab Emirates	493	80
Japan	494	81
Malta	494	82
Nigeria	509	83
Sri Lanka	510	84
Cyprus	534	85
Senegal	535	86
Jordan	539	87
North Macedonia	540	88
Oman	546	89
Thailand	550	90
Australia	556	91
Tunisia	560	92
Jamaica	561	93
Israel	567	94

Economy	Carbon intensity (CO_2e / KWh, 2023)	Carbon Intensity Rank
Egypt	574	95
Dominican Republic	579	96
China	584	97
Myanmar	589	98
Benin	590	99
Bosnia & Herzegovina	601	100
Philippines	601	101
Qatar	603	102
Malaysia	608	103
Morocco	617	104
Moldova	626	105
Mauritius	633	106
Algeria	634	107
Kuwait	637	108
Iran	642	109
Taiwan	644	110
Serbia	648	111
Poland	655	112
Azerbaijan	670	113
Hong Kong	682	114
Indonesia	682	115
Bangladesh	683	116
Iraq	689	117
Saudi Arabia	696	118
South Africa	710	119
India	713	120
Mongolia	785	121
Kazakhstan	822	122
Botswana	849	123
Bahrain	902	124
Uzbekistan	1121	125

Source: Ember[38]

Country Selection (125 Economies)

Asia Pacific

Australia, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, New Zealand, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam

North America

Canada, United States

Latin America & Caribbean

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay

Europe & Central Asia

Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Moldova, Mongolia, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Uzbekistan

Middle East & Africa

Algeria, Angola, Bahrain, Benin, Botswana, Cameroon, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Iran, Iraq, Israel, Jordan, Kenya, Kuwait, Lebanon, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Oman, Qatar, Rwanda, Saudi Arabia, Senegal, South Africa, Tanzania, Tunisia, Uganda, United Arab Emirates, Zambia, Zimbabwe

Glossary

Advertising Spending: This refers to the practice of promoting products or services through online channels. It is the sum of audio, banner, classifieds, influencer, search, and video advertising.

Communication Services: The Communication Services market encompasses a wide array of services and technologies that enable people to connect, share information, and communicate with each other. It is the sum of fixed data, fixed voice, mobile data, and mobile voice.

Consumption: This is the sum of Household Consumption Expenditure and Government Consumption Expenditure.

Cybersecurity: It refers to the process that provides and maintains confidentiality, integrity, availability, and privacy. It includes cyber solutions, and security services.

Data Centers: The Data Center market is a critical segment of the technology industry focusing on supplying and managing physical infrastructure necessary for hosting and operating IT systems, primarily servers, storage, and network equipment. This is the sum of network infrastructure, servers, and storage.

Devices: The Devices market encompasses a wide range of electronic hardware, primarily personal computers (PCs) and phones. This is the sum of personal computers, phones, drones, digital cameras, smart televisions, etc.

Digital Economy: This is a sum of all three sectors: Digital Platforms, Hardware and Enabling Infrastructure, and Value-added Services and Solutions.

Digital Health: it refers to the use of technology to improve health and healthcare delivery. This is a sum of digital fitness & well-being, digital treatment & care, online doctor consultations.

Digital Platforms: This consists of E-Commerce, Digital Media, Advertising Spending, Digital Health, and Other Services.

Digital Public Infrastructure (DPI): A set of foundational digital systems that forms the backbone of modern societies. DPI enables secure and seamless interactions between people, businesses, and governments.

Digital Media: It is defined as audiovisual media content and applications that are distributed directly over the internet. This is a sum of digital music, e-publishing, video games, and video-on-demand services offered through digital channels.

E-Commerce: It refers to the sale of physical goods through a digital channel to a private end consumer. This is a sum of the following goods and services offered through digital channels, beauty and personal care, beverages, DIY & hardware store, electronics, eyewear, fashion, food, furniture, household essentials, luxury goods, media, OTC pharmaceuticals, tobacco products, toys & hobby.

Fintech: This is a combination of revenues from digital investment and digital assets, and digital remittances and capital raising transactions.

Hardware and Enabling Infrastructure: This consists of Data Centers, Communication Services, Devices, and Semiconductors.

Gross Domestic Product (GDP): Gross domestic product is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.

Internet of Things: The term Internet of Things (IoT) describes a network of physical and virtual devices that can communicate autonomously with each other using the Internet Protocol (IP). This includes automotive IoT, consumer IoT, healthcare IoT, industrial IoT, other IoT, smart cities, smart finance.

Internet Users: Internet users are people aged 5+ with access to the world-wide network via home, work internet-enabled computers, internet cafes or mobile phones.

IT Services: The IT Services market encompasses a wide range of services used by organizations to create, manage, and deliver information, and it includes services that assist with various other business functions. This includes business process outsourcing, IT consulting & implementation, IT outsourcing, other IT services.

Momentum: The Compound Annual Growth Rate (CAGR) of the relevant indicator or data point. Measures change over time.

Other Services: This includes eservices offered typically through the internet. It includes dating services, event tickets, online education, and online gambling.

Per Capita: Indicator divided by the total population of the country.

Per Internet User: Indicator divided by population of internet users in the country.

Population: The total population of each country.

Public Cloud: It is defined as the digital infrastructure and computing resources that are managed by a service provider. This includes business process as a service, desktop as a service, infrastructure as a service, platform as a service, and software as a service.

Robotics: The Robotics market refers to the industry that encompasses the design, development, manufacturing, and deployment of robotic systems and technologies. This includes industrial robotics and service robotics.

Semiconductors: Semiconductors are the crucial building blocks of all the electronics we see daily. The semiconductor industry comprises companies that design, fabricate, assemble, test, and supply semiconductors that are suitable for various applications. It is the sum of discrete semiconductors, integrated circuits, optoelectronics, and sensors & actuators.

Software: It is defined as a set of instructions written as programming code to execute specific tasks on a computing device. This includes application development software, enterprise software, productivity software, and system infrastructure software.

State: Used in contrast to "momentum," the value of a given indicator or data point for a single point in time.

Value-added Services and Solutions: This consists of IT Services, Digital Assets, Digital Investment, Public Cloud, Cybersecurity, Internet of Things, Robotics, Software.

Data Center Market (detailed definition): The Data Center market is a critical segment of the technology industry focusing on supplying and managing physical infrastructure necessary for hosting and operating IT systems, primarily servers, storage, and network equipment. This market spans from traditional in-house data centers to sophisticated facilities offered by specialized providers, covering services like hosting, shared data center facilities, and managed data center solutions. It targets a diverse client base, ranging from small businesses to large enterprises, offering flexible, scalable solutions for their IT infrastructure needs. This sector is integral to the efficient functioning and security of IT operations in various organizations.

Structure: The Data Center market is structured in three markets based on the services model provided by the companies. The Server market covers the resources and services related to servers, integral for hosting websites, managing databases, and supporting cloud computing. The Storage market covers the resources and services related to data storage systems, crucial for archiving, data backup, and ensuring data recovery. The Network Infrastructure market covers the resources and services related to network hardware essential for ensuring connectivity, data transmission, and network security.

Additional Information: The Data Center market includes revenue, revenue change, average spend per employee, and key player market shares as key performance indicators. Market values represent revenues paid to primary vendors at the manufacturer price level either directly or through distribution channels (excluding VAT). Revenues are generated through both online and offline sales channels and include spending by consumers (B2C), enterprises (B2B) as well as governments (B2G). Detailed definitions of each market can be found on the respective page where the market data is displayed. Key players in the Data Center market include companies such as Dell, HPE, Huawei, and Ericsson.

Endnotes

1 Michael O'Grady (2024). The global economy will reach reach $16.5 trillion and capture 17% of global GDP by 2028. Accessed on 05/21/2025. Forrester. https://www.forrester.com/blogs/the-global-digital-economy-will-reach-16-5-trillion-and-capture-17-of-global-gdp-by-2028/

2 Consultancy (2024). Global eco-digital economy to double in next five years. Accessed on 05/21/2025. Consultancy. https://www.consultancy.eu/news/9716/global-eco-digital-economy-to-double-in-next-five-year

3 OECD (2025), Going digital toolkit. OECD publishing, Paris. Assessed on the 01/19/2025. https://goingdigital.oecd.org/

4 OECD (2023), OECD Handbook on Compiling Digital Supply and Use Tables, OECD Publishing, Paris, Accessed on 05/21/2025. https://doi.org/10.1787/11a0db02-en

5 Sustainable Web Design (2024): Estimating Digital Emissions. Assessed on the 05/19/2025. https://sustainablewebdesign.org/estimating-digital-emissions/

6 Digital Planet (2025): Digital Evolution Index 2025: From the Covid shock: How 125 Digital Economies around the world are evolving and changing. Assessed on the 05/19/2025. https://digitalplanet.tufts.edu/digitalevolutionindex2025/

7 Digital Planet (2019). Ease of doing digital business 2019. Assessed on the 05/19/2025. https://digitalplanet.tufts.edu/ease-of-doing-digital-business-2019/

8 OECD (2022), "The OECD Going Digital Measurement Roadmap", OECD Digital Economy Papers, No. 328, OECD Publishing, Paris, Accessed on the 01/20/2025. https://doi.org/10.1787/bd10100f-en.

9 [Dataset]: Statista market insights Accessed on 01/20/2025. https://www.statista.com/outlook/

10 IEA (2024). Global electricity demand rose moderately in 2023 but is set to grow faster through 2026 Accessed on the 01/19/2025. https://www.iea.org/reports/electricity-2024/executive-summary

11 Statista (2024). Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2023, with forecasts from 2024 to 2028. Accessed on the 01/19/2025. https://www.statista.com/statistics/871513/worldwide-data-created/

12 [Dataset]: Ember. Accessed on the 01/19/2025. https://ember-energy.org/data/

13 [Dataset]: ITU Accessed on the 01/19/2025. https://datahub.itu.int/query/

14 IEA (2023): Data centres and data transmission networks. Accessed on the 01/19/2025. https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks#tracking

15 [Dataset]: ITU datahubs. https://datahub.itu.int/query/

Endnotes

16 UNCTAD (2024). Digital Economy Report 2024. Assessed on the 05/19/2025. https://unctad.org/publications-search?f%5B0%5D=product%3A598

17 UNCTAD (2024). Digital Economy Report 2024. Assessed on the 05/19/2025. https://unctad.org/publications-search?f%5B0%5D=product%3A598

18 Sustainable Web Design (2024): Estimating Digital Emissions. Assessed on the 05/19/2025. https://sustainablewebdesign.org/estimating-digital-emissions/

19 UNCTAD (2024). Digital Economy Report 2024. Assessed on the 05/19/2025. https://unctad.org/publications-search?f%5B0%5D=product%3A598

20 IEA (2022). Energy system of Namibia. Accessed on 05/20/2025. https://www.iea.org/countries/namibia

21 IEA (2021). Net zero by 2050: A roadmap for the global energy sector. 01/20/2025. https://www.iea.org/reports/net-zero-by-2050

22 Ting Li (2024). Powering the data-center boom with low-carbon solutions: China's perspective and global insights. Accessed on 05/20/2025. RMI. https://rmi.org/wp-content/uploads/dlm_uploads/2024/11/powering_the_data_center_boom.pdf

23 IRENA (2025). Geopolitics of the energy transformation: The hydrogen factor. Accessed 05/20/2025. https://www.irena.org/Digital-Report/Geopolitics-of-the-Energy-Transformation#:~:text=Renewables%20can%20be%20deployed%20in%20every%20country%2C,shipping%2C%20thus%20unlocking%20untapped%20renewable%2

24 DiNu (2024). Energy-efficient computing: Building a greener digital future. Accessed 05/20/2025. Medium. https://medium.com/@dinukamax1/energy-efficient-computing-895e33a4d976

25 Jacob Yothment (2024). 5 ways to reduce your AI energy footprint. 05/20/2025. Purestorage. https://blog.purestorage.com/purely-educational/5-ways-to-reduce-your-ai-energy-footprint/#:~:text=Optimizing%20AI%20algorithms%20means%20creating%20more%20efficient,less%20energy%20required%20to%20keep

26 Landbell Canada (2024). E-waste recycling: A circular economy imperative Circular Economy Month. https://circulareconomymonth.ca/e-waste-circular-imperative/

27 Bhaskar Chakravorti (2023). The case for investing in digital public infrastructure. 05/20/2025. Harvard Business Review. https://hbr.org/2023/05/the-case-for-investing-in-digital-public-infrastructure

28 Maxx South Broadband (2024). Sustainable internet: How fiber internet contributes to energy efficiency. Accessed on 05/20/2025. https://www.maxxsouth.com/maxxcommunity/how-fiber-is-energy-efficient

29 GSMA (2019). GSMA Beta Labs: Latest report digs deep on 5G-era network cost optimization. 05/20/2025.

https://www.gsma.com/solutions-and-impact/technologies/networks/digest/5g-network-cost-optimisation/#:~:text=5G%2Dera%20networks%20will%20be%20far%20more%20efficient,up%20to%20300%%20more%20than%20under%204G.

30 Marc Hamilton (2025). Chill Factor: NVIDIA Blackwell platform boosts water efficiency by over 300x. Accessed on 05/20/2025. NVIDIA. https://blogs.nvidia.com/blog/blackwell-platform-water-efficiency-liquid-cooling-data-centers-ai-factories/#:~:text=The%20NVIDIA%20GB200%20NVL72%20rack,footprint%20of%20legacy%20cooling%20methods.

31 Bhaskar Chakravorti (2025). How companies can mitigate the harms of AI-driven inequality. Accessed on 05/20/2025. Harvard Business Review. https://hbr.org/2025/05/how-companies-can-navigate-the-age-of-ai-driven-inequality?ab=HP-hero-latest-1

32 FDM (2024). Top 10 applications of AI in the energy sector. Accessed on 05/20/2025. FDM. https://www.fdmgroup.com/news-insights/ai-in-energy-sector/

33 World Bank. Carbon pricing: Carbon pricing is critical to scaling up climate action. Accessed on 05/20/2025. World Bank. https://www.worldbank.org/en/programs/pricing-carbon

34 Maskus K. et al. (2004). Transfer of technology to developing countries: Unilateral and multilateral policy options. Accessed on 05/20/2025. World Bank Group. https://openknowledge.worldbank.org/entities/publication/defb7c52-921f-5f2a-90c2-d0de681b8be6

35 Alexander Dobrinevski & Raphael Jachnik (2021). Measurin the alignment of real economy investments with climate mitigation objectives: The United Kingdom's building sector. Accessed on 05/20/2025. OECD Environment Working Papers No. 172. https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/03/measuring-the-alignment-of-real-economy-investments-with-climate-mitigation-objectives_3e68ca28/8eccb72a-en.pdf

36 PWC (2024). How tech companies can turn sustainability compliance into a strategic advantage. Accessed 05/20/2025. Pwc. https://www.pwc.com/us/en/industries/tmt/library/tech-insights-for-sustainability-reporting-and-compliance.html

37 Sustainability Directory (2025). Democratizing sustainability metrics with AI platforms. Accessed on 05/20/2025. Prism. https://prism.sustainability-directory.com/scenario/democratizing-sustainability-metrics-with-ai-platforms/

38 [Dataset]: Ember. Accessed on the 01/19/2025. https://ember-energy.org/data/

About

Digital Planet
Where Digital Innovation Meets the World

Digital Planet, an interdisciplinary research initiative of The Fletcher School's Institute for Business in the Global Context, is dedicated to understanding the impact of digital innovations on the world and providing actionable insights for policymakers, businesses, investors, and innovators.

SGTECH
WHERE TECH MEETS

SGTech is the leading trade association for Singapore's tech industry. Representing over 1,400 member companies ranging from top multinational corporations, large local enterprises, vibrant small and medium-sized enterprises, and innovative startups, it is the largest community in Singapore where companies converge to advocate for change and drive what enables tech innovation and accelerates tech adoption to spur greater sustainability in the sector.

Tufts UNIVERSITY

Institute for Business in the Global Context
The Fletcher School at Tufts University
160 Packard Avenue, Cabot 503
Medford, MA 02155 USA

Digital Planet
Where Digital Innovation Meets the World

FLETCHER
The graduate school of global affairs at Tufts University

SGTECH
WHERE TECH MEETS