Digital Economy & Social Sustainability

DiGiX 2024 Update: A Multidimensional Index of Digitization[1]

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The 2024 DiGiX assesses digital performance and progress of the digitization levels of 98 economies, based on 2023 data (or last available):

- The five top-ranking countries are Hong Kong, Singapore, Denmark, Switzerland and the Netherlands.
- The five lowest-ranking countries are Honduras, Cameroon, Zimbabwe, Nigeria, and Nicaragua.
- Consistent regional leaders over time. Similar to 2020 and 2022, a selected group of countries continue to lead their respective regions. The United States remains the leader in North America. In South East Asia and Oceania, Hong Kong now appears as a top performer, overtaking previous leaders like Singapore. Denmark and the Netherlands continue to lead in Europe. In Latin America and the Caribbean, Uruguay and Chile outperforms. UAE and Israel consolidate their position in the regions of Northern Africa and Western Asia. In Sub-Saharan Africa the top performers are Mauritius and South Africa. Finally, North Macedonia and Georgia are the leaders in Central and Southern Asia. Persistent digital divide across different regions, despite significant heterogeneity within each region
- No single country ranks in the top 10 across all six dimensions, highlighting that while nations may excel in specific areas, none has uniform strength across the board. This diversity in performance underscores the complexity of achieving balanced digital development and provides valuable insights for refining digital strategies based on each country's unique strengths and challenges
- Several European countries have shown significant improvements in their digitization rankings. These advancements might be due to the impact of the Next Generation EU funds to enhance digital infrastructure and adoption across the region. Croatia saw the most remarkable progress, climbing 30 positions, followed by Greece, which advanced 27 positions. Hungary and Italy also made substantial gains, moving up 19 and 16 positions, respectively. Other notable improvements include Latvia (15 positions), Portugal (13 positions), the Slovak Republic (12 positions), and Spain (7 positions).

About DiGiX:

- DiGiX aims to capture the evolution of digitization in 98 countries to compare digitization dynamics and identify areas requiring action.
- The 24 indicators included in the index are grouped in six dimensions that represent three broad pillars: supply conditions (infrastructure and costs), demand conditions (user, government and enterprise adoption), and institutional environment (regulation).
- Collaboration of governments, financial institutions, and regulatory bodies will be necessary to enhance digitization in order to serve society.

1: New versions of this document might be updated if errors in the data are detected due to posterior updates or imprecisions.
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Digitization, sustainability and economic growth

In an era marked by rapid technological advancements and global challenges, digital development stands as a cornerstone of resilience and economic growth for nations worldwide. As the world endeavors to transform into a more sustainable and equitable place, the role of digital technologies becomes ever more critical in achieving this balance without sacrificing economic growth. From electric vehicles and cloud computing to comprehensive e-government systems, digital innovations are pivotal in driving the green transformation that our global society urgently needs. Artificial intelligence, in particular, stands out as a crucial enabler, offering powerful capabilities that can optimize resource efficiency, enhance productivity, and spur economic development, all while supporting sustainable practices. By automating complex processes, enabling data-driven decision-making, and fostering innovative solutions across industries, AI not only elevates productivity but also propels businesses and governments towards achieving more with less—ensuring economic activities align with sustainability goals.

Understanding the trajectory of digital transformation is vital for shaping effective policies and harnessing the full potential of digital technologies. DiGiX, through its comprehensive evaluation across six dimensions—infrastructure, affordability, user adoption, enterprise adoption, government adoption, and regulation—aims to capture the dynamic landscape of global digitization. By comparing the evolution of digitization across countries, the index highlights areas requiring targeted interventions and identifies best practices that can inspire and inform policymaking. DiGiX combines simplicity with methodological robustness, making it an essential tool for understanding and advancing digital progress globally.

This year's report places special emphasis on digitization as a necessary condition for leveraging the transformative potential of artificial intelligence (AI) and its far-reaching implications for productivity and social well-being. The Infrastructure dimension of DiGiX, which includes variables such as 5G Population Coverage, Mobile Download Speeds, and Mobile Upload Speeds, underscores the foundational role that robust digital infrastructure plays in enabling AI technologies. These infrastructure components are essential for the seamless integration of AI across various sectors, facilitating real-time data processing, improving connectivity, and ensuring that AI-driven innovations can be effectively deployed at scale. Moreover, the Enterprise Adoption dimension includes GitHub usage, reflecting the level of activity in software development, including AI-related projects, as well as Top-Level Domains, which indirectly suggest a readiness for AI adoption, as companies with a strong online presence are more likely to leverage AI technologies. By establishing a strong digital foundation, countries can unlock new avenues for innovation, streamline operations, and enhance service delivery, thereby accelerating their journey toward digital maturity and societal prosperity.

How to measure digitization: The Dimensions

DiGiX is structured into six dimensions, encompassing a total of 24 indicators. This design is intentional, aiming to keep the index straightforward to ensure both interpretability and continuity over time and across different countries. By focusing on a concise set of dimensions and indicators, DiGiX remains a practical tool for comparing digitization progress while retaining its relevance and clarity across various contexts. Moreover, it is important to consider that digitization is a dynamic process, and to accurately measure it, we recognize the need for flexibility within the index. While the dimensions in DiGiX remain consistent over time, the indicators within these dimensions evolve to reflect the latest technological advancements. For instance, while DiGiX 2019 included 3G coverage as a part of the infrastructure dimension, the current update uses 5G instead. This approach means that DiGiX is not directly comparable over time; however, maintaining consistent dimensions allows for meaningful comparisons and insights across different periods. Each indicator has been carefully selected to capture a specific aspect of

digitization, ensuring that the index provides a comprehensive and nuanced view of a country's digital environment.[2]

The weighting scheme of this index is not arbitrarily set but derived from data through a two-stage PCA[3]. This data-driven approach ensures that the index remains grounded in real-world conditions and outcomes. Each dimension's weight—Infrastructure (16%), Users Adoption (18%), Enterprise Adoption (16%), Cost (16%), Regulation (17%), and Government Adoption (18%)—reflects a balanced contribution across dimensions, avoiding any bias toward a particular aspect. This approach underscores the index's view that all facets of digitization are equally important. Similar balance is also observed among the indicators within each dimension.

Digitization ranking

The five top-ranking countries are Hong Kong, Singapore, Denmark, Switzerland and the Netherlands. The five lowest-ranking countries are Honduras, Cameroon, Zimbabwe, Nigeria, and Nicaragua. By region, the results are consistent and regional leaders maintains over time. The United States remains the leader in North America. In South East Asia and Oceania, Hong Kong now appears as a top performer, overtaking previous leaders like Singapore. Denmark and the Netherlands continue to lead in Europe. In Latin America and the Caribbean, Uruguay and Chile outperforms. UAE and Israel consolidate their position in the regions of Northern Africa and Western Asia. In Sub-Saharan Africa the top performers are Mauritius and South Africa. Finally, North Macedonia and Georgia are the leaders in Central and Southern Asia. Figure 1 illustrates the persistent digital divide across different regions, despite significant heterogeneity within each region. While some countries in regions like Europe and North America demonstrate high levels of digitization in line with their GDP per capita, other regions, particularly Sub-Saharan Africa and parts of Asia, show a broader range of digitization degrees. This underscores the need for targeted policies to bridge the digital gap both between and within regions, ensuring more equitable access to the benefits of digitization.

Several European countries have shown significant improvements in their digitization rankings. These advancements might be due to the impact of the Next Generation EU funds to enhance digital infrastructure and adoption across the region. Croatia saw the most remarkable progress, climbing 30 positions, followed by Greece, which advanced 27 positions. Hungary and Italy also made substantial gains, moving up 19 and 16 positions, respectively. Other notable improvements include Latvia (15 positions), Portugal (13 positions), the Slovak Republic (12 positions), and Spain (7 positions).

The rankings for each dimension of the DiGiX index reveal a diverse set of leaders across different aspects of digitization.

- Infrastructure: Countries like Kuwait, the Netherlands, Switzerland, and Qatar achieve the maximum score, highlighting their exceptional digital infrastructure, which is critical for supporting advanced digital services.
- Access for Individuals: Japan leads this dimension, followed by the United Arab Emirates and Hong Kong. These results indicate strong individual-level digital engagement in these countries, driven by widespread usage of digital services.
- Access for Firms: Hong Kong and Singapore are at the forefront, emphasizing their role as global business hubs with robust digital capabilities that support enterprises.

2: See Appendix A1 for a detailed explanation of the indicators within each dimension of DiGiX, their role and interpretation in the index. By understanding these indicators and their contributions, we can better interpret the overall score and ranking, gaining insights into where a country excels and where there may be opportunities for improvement.
3: For a detailed explanation of Digix methodology see Cámara and Tuesta (2017). Also the Appendix A3 of this document.

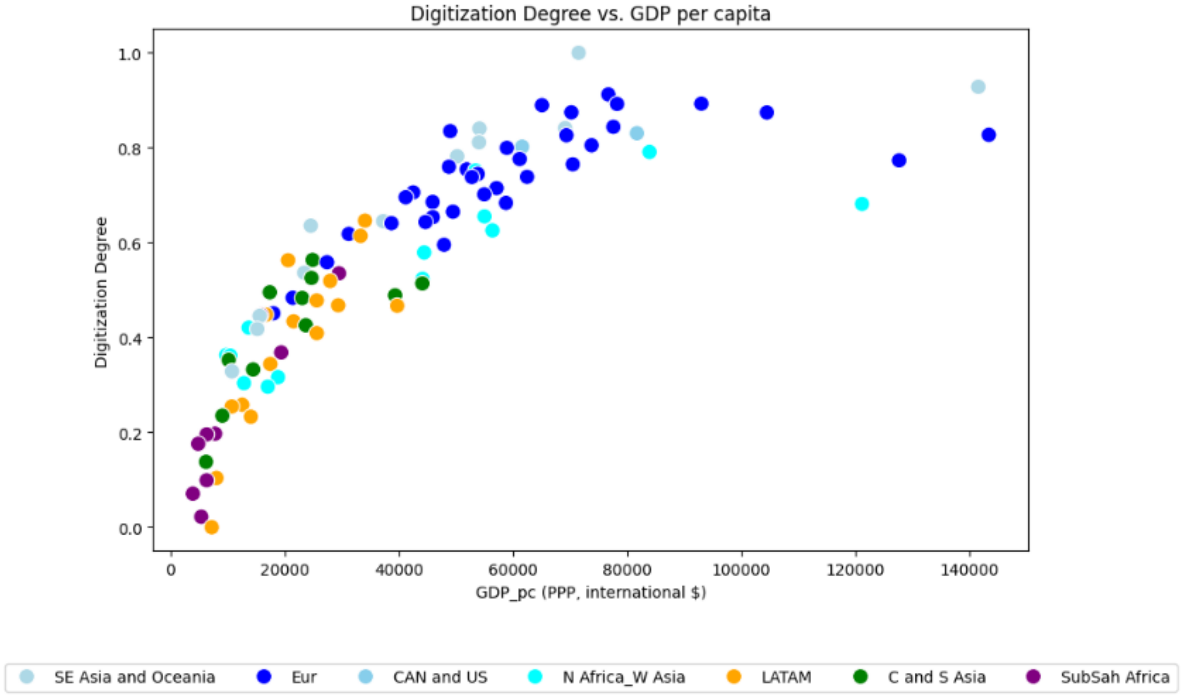
- Affordability: Luxembourg and Hong Kong top this dimension, suggesting that these countries offer affordable digital services, a key factor in driving widespread adoption and digital equity.
- Regulation: Denmark, Switzerland, and Finland lead the way, demonstrating their strong governance frameworks that support and protect digital environments.
- Government Adoption: Denmark, Finland, and South Korea excel in digitizing government services, which is crucial for enhancing public service delivery and encouraging broader digital adoption.

No single country ranks in the top 10 across all six dimensions, illustrating that while each nation may excel in specific areas, none has achieved uniform strength across the board. These results underscore the multidimensional nature of digital development, where countries may lead in infrastructure or regulation, but others might excel in government adoption or firm-level access. This diversity in performance reflects the varied paths nations take toward digital maturity and highlights the inherent complexity in achieving balanced digital development. Disaggregated rankings by dimension offer crucial insights for policymakers and stakeholders, guiding them in refining and enhancing their digital strategies based on specific strengths and areas needing improvement.[4]

DiGiX stands out among other digitization indices for two key reasons: its ease of interpretation and its methodologically sound approach. Unlike many other indices, such as the GSMA Mobile Connectivity Index, the State of the Digital Decade Report (DESI), and the Global Innovation Index by WIPO, DiGiX is specifically designed to offer clear insights that are easily accessible to policymakers, researchers, and stakeholders. The structure of DiGiX, with its six well-defined dimensions and a transparent weighting system, ensures that the results are not only straightforward to interpret but also actionable. Moreover, DiGiX is methodologically rigorous, with its weights derived from data through a two-stage Principal Component Analysis (PCA). This data-driven approach avoids arbitrary assignments of importance to different aspects of digitization. In contrast, while the other indices also offer valuable insights, they may rely on more complex structures, making them harder to interpret and apply in policy contexts.

4: Results for each dimension of DiGiX are available upon request

Figure 1. **DiGiX AND GDP PER CAPITA BY REGION**



Source: BBVA Research

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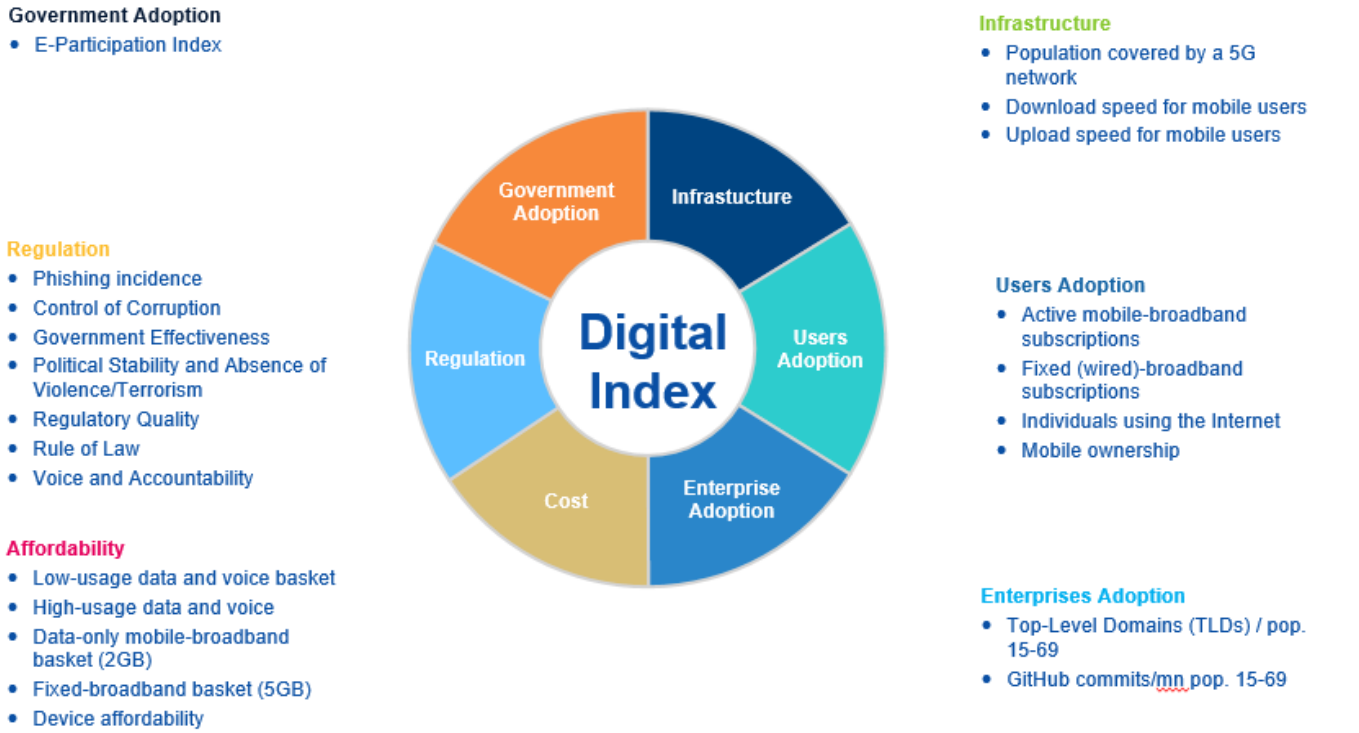
Appendix A: Construction of DiGiX 2024

1. Variable Selection

Figure A1 illustrates the structure of DiGiX 2024 – an index made of 24 indicators grouped in six distinct dimensions. These dimensions can be classified into three broad categories, supply conditions, demand conditions, and institutional environment. Our theoretical framework to define digitization has not changed, that is, the broad structure of six dimensions remains unaltered but indicators inside dimensions might change.

Figure A1. **DIGITAL INDEX 2024: COMPOSITION AND STRUCTURE**



Source: BBVA Research

Infrastructure (16%): The Infrastructure dimension is a necessary condition as it forms the backbone of a country's digital ecosystem. It assesses the availability and quality of the digital infrastructure necessary to support widespread digitization. It is considered as an input variable in the digitization process since a robust infrastructure is crucial for connectivity and the effectiveness of digital solutions, impacting all other dimensions of digitization. Moreover, it is a part of the supply side conditions together with affordability. This dimension includes three key variables:

- 5G Population Coverage: This variable measures the extent to which the population has access to 5G networks, a critical factor for enabling high-speed connectivity and supporting advanced digital services.
- Mobile Download Speeds: This reflects the average speed at which data can be downloaded over mobile networks, influencing the efficiency of online activities and overall user experience.

- Mobile Upload Speeds: Similarly, this variable measures the average speed at which data can be uploaded via mobile networks, which is essential for activities such as content creation, video conferencing, and cloud computing.

- Users Adoption (18%) dimension is designed to gauge how deeply individuals in a country are engaged with digital technologies. This dimension is critical because high user adoption rates not only drive demand for digital services but also signal a population that is digitally literate and ready to participate in the digital economy. It is considered an output indicator of the digitization process. This dimension includes four key variables:
  - Active Mobile-Broadband Subscriptions per 100 Inhabitants: This variable measures the penetration of mobile broadband services, indicating how widely accessible mobile internet is within the population.
  - Fixed Broadband Subscriptions per 100 Inhabitants: This captures the extent of access to fixed-line broadband services, reflecting the availability and usage of high-speed internet at homes and businesses.
  - Internet Users (%): This variable shows the proportion of the population that regularly uses the internet, serving as a direct indicator of digital engagement and access.
  - Mobile Ownership (%): It is a prerequisite for accessing digital services. A high rate of mobile ownership is a proxy of actual usage of the Internet since mobile devices are the primary means of accessing the internet. High mobile ownership rates can indicate a population's readiness to adopt mobile broadband services and participate in the digital economy. It captures both the potential and actual usage of digital technologies, offering a more comprehensive view of user engagement in the digitization process.
- Enterprise Adoption (16%): dimension evaluates how extensively businesses integrate digital technologies into their operations, a critical factor in driving productivity, innovation, and competitive advantage. When enterprises adopt digital tools, they can streamline operations, enhance customer engagement, and leverage data for strategic decision-making, which collectively boosts economic growth and competitiveness. This dimension includes two variables:
  - Aggregation of Top-Level Domains (TLDs) per Person and Generic Top-Level Domains (TLDs) per Person. Top-Level Domains (TLDs) per Person: This variable measures the number of country-specific top-level domain registrations relative to the population. A higher number indicates a stronger online presence of businesses within the country, reflecting their digital engagement and readiness to operate in the global digital economy. Similar to the first variable, this one measures the registration of generic top-level domains (like .com, .net) per person. This highlights the extent to which businesses are leveraging global digital platforms, indicating their participation in broader online markets.
  - GitHub Commit Pushes Received (per million population, 15–69 years old): This variable tracks the activity on GitHub, a leading platform for software development and collaboration. The number of commit pushes received and sent indicates the level of active participation in software development, innovation, and the open-source community among the working-age population. High activity suggests a robust digital culture within enterprises, particularly in tech-driven industries.
- Affordability (16%): This dimension is crucial for ensuring that digital services are accessible to the entire population, including both individuals and businesses. Affordable digital services are a cornerstone of inclusive digitization, as they enable broad participation in the digital economy and ensure that all segments of society can benefit from technological advancements. This dimension includes five variables:
  - Data-only Mobile-Broadband Basket (2GB): This variable measures the cost of a mobile broadband plan that provides 2GB of data, a basic level of internet access for mobile users. Lower prices in this category make mobile internet more accessible to the population.

- Fixed-Broadband Basket (5GB): This variable assesses the cost of a fixed broadband plan that offers 5GB of data, reflecting the affordability of home or business internet services. Reasonable costs here are essential for supporting activities that require stable and consistent internet connections, such as remote work and education.
- Mobile Data and Voice High-Consumption Basket (% GNI per capita): This variable represents the cost of a mobile plan that includes a high level of data and voice services, expressed as a percentage of Gross National Income (GNI) per capita. It reflects how affordable comprehensive mobile services are relative to the average income in the country.
- Mobile Data and Voice Low-Consumption Basket (% GNI per capita): Similar to the previous variable, this one measures the cost of a mobile plan with low data and voice consumption, again expressed as a percentage of GNI per capita. This metric is particularly relevant for lower-income users who require basic connectivity.
- Device Affordability: This variable tracks the cost of the most basic device needed to access the internet, such as a smartphone or a basic computer. Affordable devices are critical for enabling first-time internet users and ensuring that economic barriers do not prevent people from going online.

- Regulation (17%): The Regulation dimension assesses the quality of a country's governance environment in supporting digital innovation, protecting digital rights, and facilitating business activities in the digital economy. A robust regulatory framework is essential for fostering a secure, fair, and dynamic digital landscape that encourages innovation while safeguarding users and enterprises from potential risks[5]. The governance indicators are composed of multiple individual indicators, each contributing to the overall aggregate measure. These individual components provide a detailed foundation that collectively forms a comprehensive assessment of governance quality[6]. This dimension includes 7 indicators:
  - Control of Corruption: This indicator measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. A low level of corruption is crucial for maintaining trust in digital services and ensuring fair competition in the digital economy.
  - Government Effectiveness: This reflects the quality of public services, the capacity of the civil service, and the degree of its independence from political pressures. It also measures the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Effective governance is essential for implementing digital policies that drive innovation and inclusion.
  - Political Stability and Absence of Violence/Terrorism: This indicator assesses the likelihood of politically motivated violence, including terrorism. A stable political environment is vital for the sustained growth of digital services and the confidence of investors and consumers in the digital economy.
  - Regulatory Quality: This measures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. High regulatory quality ensures that the digital economy is governed by rules that foster innovation while protecting users and businesses.
  - Rule of Law: This indicator captures perceptions of the extent to which agents have confidence in and abide by the rules of society, particularly the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. A strong rule of law is crucial for the protection of digital rights and the enforcement of regulations that safeguard the digital environment.
  - Voice and Accountability: This indicator measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a

5: The lack of data on digitally oriented measures hinders our capacity to assess the regulatory environment in a more specific and targeted manner.
6: For more details see Daniel Kaufmann and Aart Kraay (2023). Worldwide Governance Indicators, 2023 Update (www.govindicators.org).

free media. These elements are essential for ensuring that digital policies are transparent, inclusive, and reflective of the public's interests.

  - Cyberattack Risk assesses the frequency and impact of cyber threats within the country. These indicators are vital for understanding the risks to digital security and the effectiveness of regulatory measures in protecting against such threats. We measure such a risk through the registered phishing incidence.

- Government Adoption (18%): This dimension evaluates the extent to which government services and operations are digitized. A government that effectively leverages digital tools can significantly enhance public service delivery, improve transparency, and set a strong example that encourages digital adoption among private companies and consumers. High levels of government adoption of digital technologies also signal a commitment to modernization and efficiency, creating a conducive environment for broader digital transformation across society. The Government Adoption dimension includes the E-Participation Index as its key indicator:
  - The E-Participation Index measures how effectively a government uses online services to engage with its citizens. It evaluates three main aspects: E-Information Sharing: The extent to which governments provide information to the public through online platforms, E-Consultation: How governments use digital tools to interact with stakeholders, gathering input and feedback on various issues, and E-Decision-Making: The degree to which governments involve citizens in the decision-making process through digital channels.

The changes in this version of DiGiX for 2024 consist of two actions:

1. Eliminating the following variables. Digital skills among the population, secure internet servers, innovation ecosystem component and growth of innovative companies, due to lack of data.
2. Adding new variables. Firstly, the variables Mobile Download/Upload Speeds have been added to the Infrastructure dimension in order to measure network performance and not only coverage. Secondly, the user adoption dimension includes Mobile ownership as a necessary condition to use the internet since it is the most popular device to access the internet. Finally, we have replaced all the variables but phishing attracts in the Regulation dimension for a sake of continuity and accuracy since the previous variables provided by the World Economic Forum are not available anymore. Similar argument applies to the Enterprise adoption dimension, which includes three new variables to reflect digital content and services generated and used by firms.

For the robustness check and sensitivity analysis, we tested the effect of discarding a variable, as well as the effect of using different normalization strategies and the effect of varying weightings of variables. In general, we observe that the top ranking and bottom ranking countries were the least sensitive to changes in the Index composition with middle ranking countries being more sensitive. This analysis shows that the ranking is relatively stable to minor changes in variable composition.

Geographic Coverage and Data Consistency

In terms of geographical coverage, our sample includes 98 developed and developing countries. This is the same sample of countries as in previous waves (i.e. 2022, 2019 and 2018 excluding Zambia). The requirement for a country to be included in our sample is having complete information in all the indicators in order to minimize data imputation. The rankings are primarily based on 2023 data, but in cases where 2023 data was unavailable, the most recent data, from 2022 in general, was used.

2. Data checking and structure

We collect annual information from different official public data sources.[7] We check different aspects that are relevant for composite index constructions. Firstly, in terms of information, standard correlation structure is explored to examine similarities in information across variables belonging to the same dimension and across dimensions. Since our sample of variables represent the same underlying structure (i.e. digitization), we expect to have acceptable levels of correlation, both within dimensions and between dimensions.[8] Although collinearity is not a concern since our aggregation method of Two Stage Principal Components Analysis (2PCA) is robust to redundant information, we avoid using highly correlated variables in order to keep our indicator as simple as possible. We also check the correlation between the per capita GDP and our sample of variables in order to make decisions to simplify our index. The strategy is to exclude those variables that are highly correlated with GDP since they do not add different information from income conditions.

Secondly, the discriminatory power of the variables across countries is another relevant issue. As any phenomenon advances, it is more likely that countries reach their saturation level for the different indicators involved (i.e. percentage of population covered by at least 3G, instead we use 5). Since saturation levels for different variables might coincide at least within the group of developed countries and, at a different level, within developing countries, some indicators might tend to discriminate less and less. They might just reflect the economic development status and do not add any extra information. This feature is tested through standard deviations of the variables.

Thirdly, the imputation strategy for missing values takes into account the convergence process of each variable. Growth rates adjusted by the distance to maximum values for each variable are used for the computation.

Finally, the treatment for outliers has been done in a conservative manner. We consider a variable with an outlier as those having distributions with a kurtosis greater than 3.5 and an absolute skewness greater than 2. For variables with upper-end outliers, the largest value was transformed to have the same value as the second largest value and for those with lower-end outliers, the smallest value was transformed to have the same value as the second smallest value. This process was iterated until the variable's skewness and kurtosis fell within the commonly acceptable limits.

3. Aggregation Strategy and Results

The methodology used to compute DiGiX, as well as dimensions, is two-stage Principal Component Analysis, which is consistent for every period.

This section briefly describes the methodology applied for the aggregation strategy and the weighting scheme, and focuses on the results in terms of the ranking and discussion.

When constructing a composite index, it is important to carefully assess the suitability of the data by studying the overall structure of the indicators and correlation between them. 2PCA is used to explore the underlying structure of the data and then construct our composite index using the weights obtained from the 2PCA. First, PCA is applied to the indicators belonging to each dimension in order to get the six different dimensions. Then, we apply PCA to our dimensions to compute the overall index. Only the first component is retained in each iteration. However, if we were to apply just PCA to the three first components it would have been necessary to retain similar cumulative variation. By doing it in two stages, we end up with a composite indicator that has desirable properties and helps us in ranking countries according their degree of digitization. The size of colored areas in Figure A1

7: See Table A3 in the Appendix for a detailed explanation of the variables and data sources.
8: Results are available upon request.

represent the weights of dimensions and shows that all dimensions are nearly equally weighted. Our index and dimensions are not biased toward any particular indicator, which is a desirable condition for indices.

4. Results and Ranking

Table A2. **DiGiX 2024 RANKING**

Rank	Country	Score	Rank	Country	Score
1	Hong Kong	1,00	51	Macedonia	0,56
2	Singapore	0,93	52	Brazil	0,56
3	Denmark	0,91	53	Serbia	0,56
4	Switzerland	0,89	54	Thailand	0,54
5	Netherlands	0,89	55	Mauritius	0,54
6	Finland	0,89	56	Georgia	0,53
7	Sweden	0,87	57	Turkey	0,52
8	Norway	0,87	58	Costa Rica	0,52
9	Iceland	0,84	59	Russian Federation	0,51
10	Australia	0,84	60	Moldova	0,50
11	New Zealand	0,84	61	Kazakhstan	0,49
12	Estonia	0,83	62	Albania	0,48
13	United States	0,83	63	Armenia	0,48
14	Luxembourg	0,83	64	Mexico	0,48
15	Germany	0,83	65	Argentina	0,47
16	Korea, Rep.	0,81	66	Panama	0,47
17	Austria	0,81	67	Ukraine	0,45
18	Canada	0,80	68	Peru	0,45
19	United Kingdom	0,80	69	South Africa	0,45
20	United Arab Emirates	0,79	70	Indonesia	0,45
21	Japan	0,78	71	Colombia	0,43
22	France	0,78	72	Azerbaijan	0,43
23	Ireland	0,77	73	Tunisia	0,42
24	Belgium	0,77	74	Vietnam	0,42
25	Portugal	0,76	75	Dominican Republic	0,41
26	Lithuania	0,75	76	Botswana	0,37
27	Israel	0,75	77	Morocco	0,36
28	Czech Republic	0,74	78	Jordan	0,36
29	Malta	0,74	79	India	0,35
30	Spain	0,74	80	Paraguay	0,34
31	Cyprus	0,71	81	Sri Lanka	0,33
32	Latvia	0,71	82	Philippines	0,33
33	Slovenia	0,70	83	Egypt	0,32
34	Greece	0,70	84	Lebanon	0,30
35	Croatia	0,69	85	Algeria	0,30
36	Italy	0,68	86	El Salvador	0,26
37	Qatar	0,68	87	Bolivia	0,25
38	Poland	0,67	88	Bangladesh	0,24
39	Saudi Arabia	0,66	89	Guatemala	0,23
40	Hungary	0,65	90	Cote dIvoire	0,20
41	Uruguay	0,65	91	Kenya	0,20
42	Malaysia	0,65	92	Senegal	0,18
43	Slovak Republic	0,64	93	Pakistan	0,14
44	Bulgaria	0,64	94	Nicaragua	0,10
45	China	0,64	95	Nigeria	0,10
46	Kuwait	0,63	96	Zimbabwe	0,07
47	Montenegro	0,62	97	Cameroon	0,02
48	Chile	0,61	98	Honduras	0,00
49	Romania	0,60			
50	Oman	0,58			

Source: BBVA Research

Table A3. **VARIABLE SELECTION**

Short name	long name	Source	Definitions
Infrastructure			
i1_5G	Proportion of population covered by a 5G network	GSMA Intelligence	% of population covered by a 5G network
i2_speed_down	Average download speed for mobile users	Ookla Speedtest Intelligence	Average download speed for mobile users in Mbps
i3_speed_up	Average upload speed for mobile users	Ookla Speedtest Intelligence	Average upload speed for mobile users in Mbps
Users Adoption			
au1_mbroadband	Active mobile-broadband subscriptions per 100 inhabitants	ITU (2023)	Active mobile-broadband subscriptions per 100 inhabitants
au2_fbroadband	Fixed broadband subscriptions per 100 inhabitants	ITU (2023)	Fixed broadband subscribers divided by population and multiplied by 100.
au3_intpeople	Internet users (%)	ITU (2023)	This indicator can include both; estimates and survey data corresponding to the proportion of individuals using the Internet; based on results from national households surveys. The number should reflect the total population of the country; or at least individuals of 5 years and older. If this number is not available (i.e. target population reflects a more limited age group) an estimate for the entire population should be produced. If this is not possible at this stage; the age group reflected in the number (e.g. population aged 10+; population aged 15-74) should be indicated in a note. If no survey data are available at all; please provide an estimate specifying in detail the methodology that has been applied to calculate the estimate.
au4_mob_ownership	Mobile ownership	GSMA Intelligence	Unique mobile subscribers as a % of population
Firms Adoption			
ae1_code	Top-Level Domains (TLDs) per person	ZookNIC	Sum of the number of generic top-level domains (gTLDs) registered in a country and the number of registered country-code top-level domains (ccTLDs)
ae2_github	GitHub commits/mn pop. 15-69	WIPO (2023)	GitHub is the world's largest host of source code and a commit is the term used for a change on this platform. One or more commits can be saved (or pushed) to projects (or repositories). Thus, "GitHub commit pushes received and sent" refers to the sum of the number of batched changes received and sent by projects on GitHub that are publicly available within a specific economy. Automated activity resulting in non-productive commits is excluded

Table A3. **VARIABLE SELECTION** (cont)

Short name	long name	Source	Definitions
Costs			
c1_data	Data-only mobile-broadband basket (2GB)	ITU (2023)	Data-only mobile-broadband basket (2GB)
c2_datafixed	Fixed-broadband basket (5GB)	ITU (2023)	Fixed-broadband basket (5GB)
c3_high	Mobile data and voice high-consumption basket	ITU (2023)	Mobile data and voice high-consumption basket. Combined time series data: from 2018 to 2020, the basket is based on a monthly usage of a minimum of 140 voice minutes, 70 SMSs and 1.5 GB of data using at least 3G technology. From 2021, the basket is based on a monthly usage of a minimum of 140 voice minutes, 70 SMSs and 2 GB of data using at least 3G technology.
c4_low	Mobile data and voice low-consumption basket	ITU (2023)	Mobile data and voice low-consumption basket. The basket is based on a monthly usage of a minimum of 70 voice minutes, 20 SMSs and 500 MB of data using at least 3G technology.
c5_device	Device affordability	Tarifica	the unconnected, we are interested in measuring Prices of entry-level handsets that allow users access to the internet as a percentage of average monthly GDP per capita
Regulation			
r1_cybercrime	Phising incidence	Netcraft	Cybercrime incidents / total sites (Inverse of Incidents to Sites Ratio)
r2_corrupt	Control of Corruption: Estimate	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010), WB (2023)	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
r3_goveffectiv	Government Effectiveness: Estimate	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010), WB (2023)	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
r4_stability	Political Stability and Absence of Violence/Terrorism: Estimate	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010), WB (2023)	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
r5_regquality	Regulatory Quality: Estimate	Kaufmann, Daniel, Aart Kraay and Massimo	Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the

		Mastruzzi (2010), WB (2023)	aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
r6_ruleoflaw	Rule of Law: Estimate	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010), WB (2023)	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.
r7_voice	Voice and Accountability	Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010), WB (2023)	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
Government Adoption			
co1_gov	E-Participation Index	ONU (2022)	0–1 (best). Government use of online services in providing information to its citizens or “e-information sharing”, interacting with stakeholders or “e-consultation” and engaging in decision-making processes or “e-decision-making”

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