world development report 2016

BACKGROUND NOTE

# Digital Dividends

# Digital Adoption Index (DAI): Measuring the Global Spread of Digital Technologies

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# Digital Adoption Index (DAI):

*Measuring the global spread of digital technologies*

## Context

The speed of diffusion of digital technologies has been unprecedented. It took 160 years after the invention of steamships for Indonesia to reap their benefits, 60 years for Kenya to have electricity, and only 15 years for Vietnam to introduce computers. The average diffusion lag is 17 years for personal computers, 13 years for mobile phones, and 5 years for the internet, and is steadily falling for newer technologies. More households in developing countries own a mobile phone than have access to electricity or clean water. The use of the internet, while growing less rapidly, has tripled since 2005.

While the world is more connected than ever before, there are no broad and reliable measures of the speed and extent of adoption of digital technologies within and across countries. The current set of indices (e.g., ICT Development Index, IDI, by International Telecom Union) are often incomplete, based primarily on the use of households and individuals, with little or no information on digital adoption by businesses and governments. Indices that try to provide more complete picture (e.g., Network Readiness index, NRI, by the World Economic Forum) have relied on perception surveys and not on actual coverage or usage data.

## DAI: Definition and advantages over existing indices

The Digital Adoption Index (DAI) is a composite index measuring the extent of spread of digital technologies within and across countries. The analytical underpinning for DAI is provided in the 2016 World Development Report, ***Digital Dividends***.

DAI holds two advantages over existing indices. First, it reflects the extent to which digital technologies are available and adopted by all the key agents in an economy: people, businesses (firms), and governments. Therefore it provides a more comprehensive picture of technology diffusion than the existing set of indices. Second, DAI is constructed using data on coverage and usage, often from the World Bank's internal databases, and therefore is likely to be more robust than those based on perception surveys.

DAI was developed with policymakers in mind. It is meant to serve as a benchmark for measuring the 'supply side' of the digital economy and to assist policymakers in designing a nuanced digital strategy with tailored policies to promote digital adoption across different user groups.

## Methodology

DAI is a composite index that measures the depth and breadth of adoption of digital technologies in 171 countries, spanning every region and income group. It is based on three sectoral sub-indices covering businesses, people, and governments, with each sub-index assigned an equal weight (see the Annex).

DAI (Economy) = DAI (Businesses) + DAI (People) + DAI (Governments)

- *DAI (Business)*: The Business cluster is the simple average of four normalized indicators: the percentage of businesses with websites, the number of secure servers, download speed, and 3G coverage in the country.
- *DAI (People)*: The People cluster is the simple average of two normalized indicators from the Gallup World Poll: mobile access at home and internet access at home.
- *DAI (Governments)*: The Government cluster is the simple average of three sub-indices: core administrative systems, online public services, and digital identification. Data for online public services are provided by the UN's Online Service Index. Data for core administrative systems and digital identification was collected by the World Bank.

The sixteen indicators used to develop the three sub-indices of the Government cluster is the most critical advantage offered by DAI. Much of the data so far have been collected as part of the preparation of the

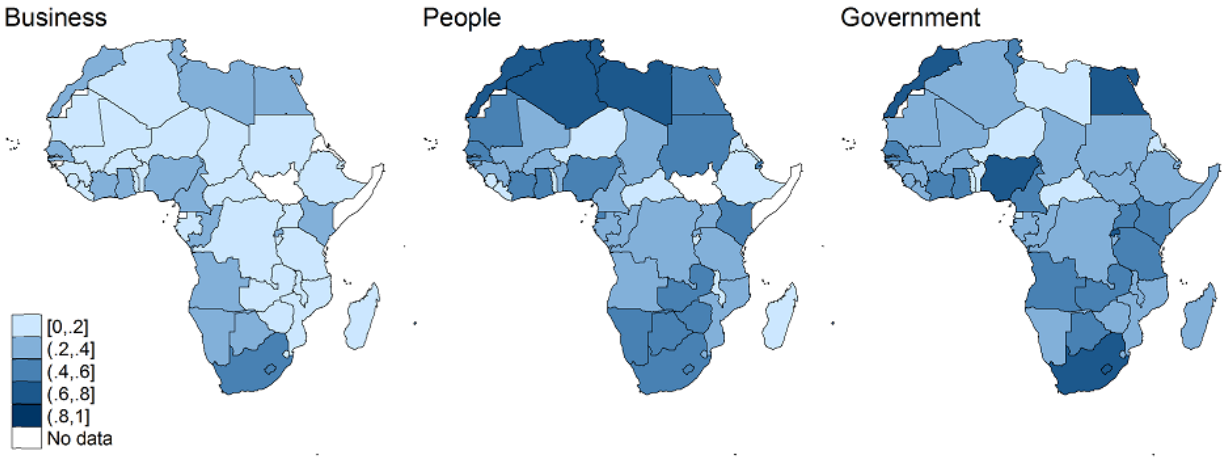
WDR 2016. To continue to be useful, these indicators need to be updated on a regular basis. Additional indicators to capture ministry-specific management information systems (such as education, health, and welfare payments) are also required. The four indicators used to create the Businesses cluster, while useful, are not enough. Firm-specific variables, such as Enterprise Resource Planning, Cloud Computing, Supply Chain Management software and E-purchases and E-sales, are currently available for advanced economies only and need to be expanded to include the developing world.

The methodology used to construct the DAI provides considerable flexibility to adjust the index to accommodate new digital technologies (e.g., mobile money or big data) as well as to drill down to more disaggregated level (e.g., DAI for e-retail or digital ID and so on) as required under different contexts.

## Application of DAI

DAI can be used in various ways to improve policymaking in the ICT space. An easy and straightforward application is to compare the level of digital adoption across countries as well as across the key agents of each national economy (see figure below). For example, in many countries in Africa, people are doing reasonably well in accessing digital technologies, but adoption by businesses seems unusually low. This should lead policymakers to investigate barriers to business adoption, including the possibility that obstacles might lie outside the ICT sector, e.g., in poor logistics, higher taxes, or protective regulations. In the WDR 2016, DAI was juxtaposed with demand-side indicators—level of skills of the labor force, degree of competition in the business sector, and quality of accountability in governments—to identify appropriate digital and 'analog' policies that can help to accelerate digital transformation of the developing world.

**Figure: Digital Adoption Index in Africa across different domains, 2014**




DAI, constructed by the World Bank economists in collaboration with Microsoft, and appropriately adjusted overtime to capture new ideas and emerging trends, can become a widely accepted way to measure the worldwide adoption and use of digital technologies. Availability of such a database and its basic analysis can spur new research, and encourage the private sector and the academic community to build on it.

# ANNEX

For each of the sectoral indexes, composite indicators are normalized on a 0 to 1 scale to ensure they have an equal impact on variation in the overall index.

**Table 1. Business cluster, with weights by component**

| Component | Weight | Source |
|---|---|---|
| Business websites | 1/4 | WBG Enterprise Surveys |
| Secure servers | 1/4 | Netcraft |
| Download speed | 1/4 | Ookla NetIndex |
| 3G coverage | 1/4 | GSMA |

**Table 2. Citizens cluster, with weights by component**

| Component | Weight | Source |
|---|---|---|
| Mobile-cellular access at home | 1/3 | Gallup World Poll |
| Internet access at home | 1/3 | Gallup World Poll |
| Cost of internet access | 1/3 | TBC (this is to be added) |

**Table 3. Government cluster, with weights by component**

| Sub-index | Component | Indicator | Weight | Source |
|---|---|---|---|---|
| Core administrative systems | Financial Management Information System | Budget execution | 1/20 | WBG |
| | | Budget formulation | 1/20 | |
| | | Treasury Single Account | 1/20 | |
| | | Source of financial data | 1/20 | |
| | Human Resources Information System | HRMIS functionality | 1/10 | |
| | | e-payroll functionality | 1/10 | |
| | e-tax | Tax management functionality | 1/10 | |
| | | e-filing functionality | 1/10 | |
| | e-customs | e-customs functionality | 1/5 | |
| | e-procurement | e-procurement functionality | 1/5 | |
| Digital identification | Access to services | Range of services | 1/2 | WBG |
| | Digital signature | Signature functionality | 1/4 | |
| | Card features | Card type | 1/8 | |
| | | Biometric functionality | 1/8 | |
| Online public services | | Online Service Index | 1 | UNDESA |

There are minor gaps in coverage for the two indicators comprising the People cluster, and substantial gaps in coverage for business use of websites and download speed data used in the Business cluster (particularly for the high-income countries). To achieve a more complete dataset, values are imputed based on income per capita, geographical region, and a "predictor" indicator (ITU's measure of mobile subscriptions for mobile access at home and ITU's measure of individuals using the internet for the other three indicators).[1]

Most of the data required to maintain the DAI is publicly available. But as currently formulated, costs would be incurred in maintaining access to the Gallup World Poll dataset, download speed (since Ookla is no longer releasing data under a Creative Commons License), and annual updating of the World Bank's dataset on core administrative services and digital identification that was created especially for the WDR 2016.

[1] Final values represent the average of 50 iterations of multiple-imputation using seed 1000 in Stata 13.