DIGITAL MONEY: THE RISE OF THE ENTREPRENEURIAL STATE

Do Developing Markets hold the key to unlocking the value of digital money?

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Table of Contents

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Introduction

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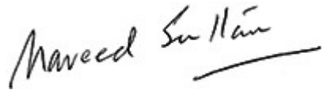
Recent technology developments, regulatory mandates, and pandemic induced change in consumer behavior towards digital are providing a significant impetus to digital money readiness. While some countries have taken advantage of these trends and marched ahead in driving readiness of their economies, others have struggled. What is common to several economies that are climbing up the readiness curve? Citi and Imperial College London's revamped Digital Money Index provides answers to these and more.

Digital money is here and now. While the benefits of digital money adoption have been well articulated and widely known for several years now, recent technology, regulatory and pandemic induced consumer behavioral changes and developments have provided the necessary impetus for a rapid acceleration of digital money readiness and adoption across the world.

However, driving digital money readiness and adoption has not been easy, as has been well documented by Citi and Imperial College London over the past seven years. It requires collaboration across economic stakeholders around a common digital vision and countries require a holistic digital policy. Such a holistic digital policy, which is explained in more detail within this report, can enable countries to reap the full benefits of a digitized economy.

However, it is not just about policy. As this paper later explains, it appears that across developing markets, policymakers who have followed up on their vision with targeted initiatives and direct investments to develop the building blocks of a digital economy have managed to drive digital adoption at an increased rate comparable to that of developed markets. Such countries have also outperformed their peers on economic growth.

Acknowledging this critical role of governments in driving readiness and adoption, Citi and Imperial College London revamped the Digital Money Index to provide sufficient primacy to government and market support – as evidenced in one of the Index's four core pillars. In addition to this, we have augmented the index with several new indicators that are increasingly getting tracked and made available across countries. All of this has helped us track and measure digital progress in a more robust fashion. The digital money journey gets more exciting with every day.



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Market developments – providing the necessary impetus to digital money readiness

Emerging Technology

Technology availability and maturity, driven by continuous innovation, has accelerated tremendously over the last few years. Technology is transforming the way businesses operate, consumers buy and use products and services, and how governments provide services to their citizens. According to World Economic Forum estimates, digital-led platforms would generate 70%[1] of incremental value this decade, proving that digital is the way forward.

Companies across industries are benefiting greatly from digitalization, which is encouraging them to use technology to alter their businesses. Forward-thinking businesses are looking for technology to improve customer experience and engagement, drive operational efficiency and explore newer business models. In fact, industry participants are leveraging application programming interfaces (APIs) to link up with partners and create ecosystems that enable them to better serve clients while providing differentiated experiences.

Digital ID is another foundational technology that helps improve efficiency while influencing overall client experience. Banks in India were able to issue around 440 million[2] no-frills bank accounts seamlessly to underprivileged individuals, using Aadhaar (India's digital ID). Digital ID solutions also have the potential to transform economies. According to McKinsey, digital identities might lead up to a 13%[3] rise in GDP by 2030 as they become more generally available.

Advancement in analytics and machine learning has now allowed firms to mine large volumes of consumer data to better understand their needs and offer personalized service. Likewise, Blockchain-based solutions are also gaining traction across industries including financial services. It is estimated that the technology will save banks $10 billion[4] in cross-border payments alone. Blockchain technology also improves accountability, transparency, and efficiency across the supply chain – a big focus area for industrial firms.

According to Citi, trends like APIs, Blockchain, Digital ID, IoT, and 5G will continue to grow over the next few years, and participants across industries will begin to take these technologies seriously as they evaluate their digitalization strategy. Citi's Emerging Technologies report[5] provides detailed point of view on technologies impact on various industries.

Regulatory trends

The rise of eCommerce, which necessitates real-time payments infrastructure, as well as the introduction of 24/7 closed-loop payment networks such as digital wallets, have helped the industry participants recognize the need to upgrade the ageing payments infrastructure. Regulators around the world are leading the charge to accelerate investments in payments infrastructure. Regulators are progressively evaluating their ability to make their infrastructure available 24 hours a day, seven days a week, either by extending the hours of operation of existing systems or by introducing Instant Payments schemes. There are currently around 60 countries[6] with live-instant payments schemes around the world.

Another development impacting the industry is open banking, which refers to the practice of allowing third-party providers to utilize clients' data available with the first party to offer goods and services. The UK took the first step toward open banking with the "Open Banking Initiative", followed by the EU's PSD2. Since then, a slew of other countries have launched their versions of open banking regulations. Open banking allows conventional banks and fintech companies to collaborate and offer superior products and

services to end clients. This open banking approach is expected to improve customer experience while lowering distribution costs for service providers. According to estimates, open banking and APIs can help the underprivileged save about 2.5%[7] of their income in fees due to the availability of better products and services.

Finally, the rise of payment instruments such as cryptocurrencies and stablecoins is forcing regulators to reconsider their regulatory framework around digital money. To combat the threat of high-risk alternative currencies to the financial system, 74%[8] of the central banks have already started exploring Central Bank Digital Currencies (CBDC). Policymakers expect CBDCs to preserve financial stability, in addition to streamlining the payment system. Harvard Business Review expects CBDCs to reduce the cost of managing payments, with the US economy alone expected to save $750 billion[9] every year with CBDC adoption. Adoption of CBDCs is expected to further accelerate with the advancement of the underlying DLT technology.

Such fundamental changes like instant payments, CBDCs, and open banking will take time to completely emerge on a global scale. However, the potential of these technologies to transform the payments landscape and its impact on consumers and corporates are already being felt. Policymakers across the globe will continue to focus on initiatives that address three main themes – driving innovation while ensuring financial stability, consumer protection & compliance.

Externalities

The global impact of the COVID-19 pandemic has been enormous. Lockdowns and associated supply chain disruptions led to consumers clearly understanding their needs, differentiating between essential versus luxury products, while also sharpening their focus on sustainable products. Lockdowns also influenced consumer shopping patterns. Even those who had never purchased online before the pandemic, shopped, and paid for their necessities online. Clearly, the pandemic has significantly impacted the scope and reach of the digital transformation. According to a Forbes survey, 58% of the US consumers were spending more money online, with 27% signing up for at least one new digital streaming service.[10]

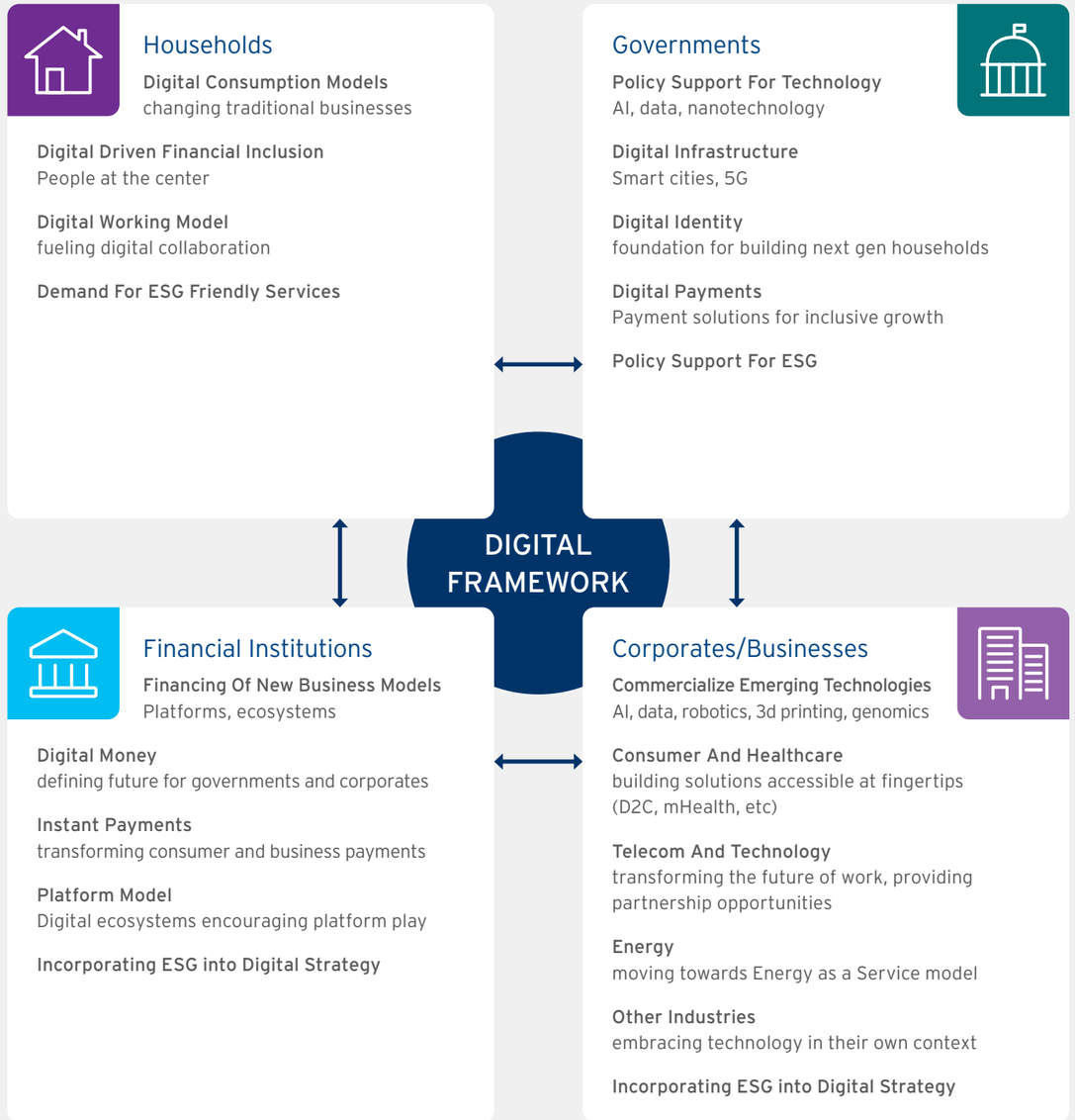
Many experts predict that the habits developed during the pandemic will last long after the crisis has passed, irreversibly altering what people value, how and where they shop and how they live and work. This irreversible change in consumer behavior is predicted to give countries the single major boost in driving overall digital money readiness and adoption.

Holistic Digital Policy – a key tool for countries to drive digital money readiness

The time is right for countries to rise to the occasion and drive digital money readiness in their economies by leveraging these favorable trends. However, the road to digital transformation isn't straight forward. There are numerous challenges such as a lack of critical digital infrastructure that has not kept pace with the growing demand for internet connectivity, a digital divide that can prevent the less skilled from the adoption of emerging technologies and concerns around trust that have the potential to block innovation and prevent the digital revolution from unleashing its full economic potential.

Driving readiness thus requires all the economic stakeholders – Governments, Corporates, Financial Institutions and Households (the larger society) to rally around a common vision. Governments naturally have a significant role to play in developing and articulating a holistic digital policy to align all these economic stakeholders towards a common digital vision.[11]

Figure 1: Citi Digital Policy, Strategy and Advisory Framework



Source: Citi Digital Policy, Strategy and Advisory Analysis

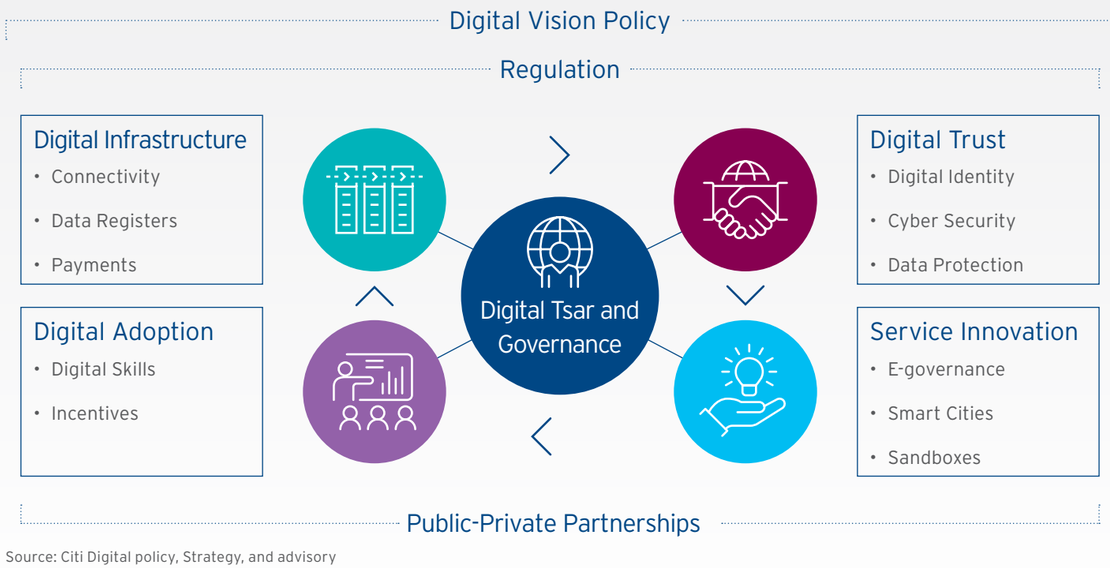
Holistic Digital Policy – What is it?

A holistic digital policy rests on four pillars, namely: digital infrastructure; digital adoption; service innovation; and digital trust, driven by a clear vision and supported by robust regulations and governance.

As a first step, governments must establish a digital vision that aligns with their larger goals, such as promoting growth, improving service delivery, and increasing public involvement, among others. Governments should establish rules to put things in motion after approving the vision and eventually have a solid governance and oversight structure in place. Governments should build a governance framework with a "Digital Tsar" or "Digital Transformation Owner" to ensure coordination and track progress. Regardless of a country's digital maturity, Digital Policy should then focus on these four pillars and governments should collaborate with the private sector and academia to achieve these goals.

- Ensure that everyone has access to the "infrastructure" that supports the digital economy, such as telecommunications, banking, and payments, as well as shared IT platforms.
- As the infrastructure gets built, it is equally important to establish "consumer and business trust" to bring them on board and raise their level of comfort with technology. Digital identification, cyber security, and data protection solutions are all essential to build this trust.
- Governments must ensure that innovative solutions are made available after developing confidence, and hence must focus on creating a conducive environment for innovation while leading their internal capability development. Sandboxes, government service digitization, smart cities, and other initiatives are relevant to drive service innovation.
- Finally, governments should focus on the development of digital skills and offer incentives as appropriate to induce cultural change to maximize consumer "adoption" of technology.

Figure 2: Holistic Digital Policy Framework



Source: Citi Digital policy, Strategy, and advisory

Going beyond policy formulation – entrepreneurial states have done exceedingly well in driving readiness

While it is a must to have a holistic digital policy to take advantage of these emerging trends, policymakers that played an active role beyond enacting policies have made even more considerable progress in driving digital adoption compared to their peers. These entrepreneurial markets have had a bold vision, enacted favourable policies, and made investments to drive the vision. A close observation of some such emerging markets indicates a superior performance on par with that of developed economies and well ahead of their peer emerging markets.

Figure 3: Digital Adoption across select markets

			Select Emerging Markets			
	Developed	Developing	Malaysia	UAE	Estonia	Uruguay
Internet Penetration	90%	57%	88%	93%	91%	77%
Bank Account Penetration	94%*	63%*	92%	88%*	99%	63%
Government Service Digitization	82%***	41%	78%	86%	95%	85%
Digital Skills	6.2***	3.3**	7.2	7.5	7.0	5.0

* Data for 2017 ** Average of low and low to middle income economies *** Data for high-income economies
Source: Center for financial inclusion, Statista, Wiley, World Bank

Malaysia

Malaysia's digital journey began in 1996 with the establishment of the Multimedia Super Corridor (MSC), a special economic zone designed to boost the country's digital economy. Since then, the Malaysia Digital Economy Corporation (MDEC), the organization responsible for developing the country's digital economy, has attracted over US $80 billion[12] in investments. However, the first initiative aimed at driving digital adoption was announced in 2007, when the government launched a US $4.5 billion[13] broadband project, promising to fund 30% of the initiative. Extending on this, the government in 2010 launched the National Broadband Initiative to ensure that all residents have access to high-speed Internet, with a particular focus on the underprivileged. Recently in 2019, the government also set aside US $11 billion for the National Fibre Connectivity Plan (NFCP).[14] The 5-year NFCP initiative is expected to increase the availability of high-speed, high-quality digital connectivity across the country.

The government has unveiled a comprehensive digital policy (the MyDigital program) that includes several specific initiatives. The overall vision is for the digital economy to contribute 23% of GDP by 2025, as well as to attract 50 Fortune 500 tech businesses and establish five unicorns, resulting in the creation of 500,000 jobs.[15] The government has released "Digital Investments Future 5 Strategy," which focuses on five key thrusts aimed at advancing Malaysia's digital economy in accordance with MyDigital.

- **Five focus sectors include:** AgTech, HealthTech, Islamic Digital Economy and FinTech, CleanTech, and EduTech. These industries are based on national strategic industries for digitization.
- **Five technology focus areas include:** Cloud computing, data centres, artificial intelligence, cybersecurity, and digital content tools.
- **Five emerging technology focus areas are:** Blockchain, DroneTech, Edge Computing, Extended Reality, and Advanced Robotics, which will drive innovation and guarantee the country's relevance in the rapid evolution of digital technologies.

To facilitate this transformation, the government has enacted several policy initiatives, including:

- The National Industry 4WRD policy, which aims to attract stakeholders to Industry 4.0 technologies and processes.
- A National eCommerce Roadmap to accelerate seller adoption of eCommerce.
- Digital Free Trade Zone to facilitate cross-border trade through digitalization.
- Big-data analytics (BDA), Internet of Things (IoT), and Artificial intelligence (AI) framework to accelerate adoption of emerging technologies across industries.

To help lead this transformation, the Malaysian government is also investing US $12 billion[16] in the digital economy. Besides, the country's central bank recently launched the financial sector digitization blueprint covering three broad themes namely (1) Finance for all which includes offering digital first solutions, (2) Finance for transformation such as growing alternative lending, and (3) finance for sustainability which includes green financing. Besides, there is also focus on broader digitization of financial sector with initiative such as Central bank digital currency proof-of-concepts, Strengthen cyber security readiness, leveraging Open data for select use-cases among others These investments are expected to lay the foundation for the country's transformation towards a digital economy.

United Arab Emirates

The UAE government established the 'National Digital Transformation Committee' to achieve its digital transformation goals. The group, which is chaired by the head of digital government services, includes members from important ministries, government agencies, and federal and municipal digital authorities. While the Telecommunications and Digital Government Regulatory Body (TDRA) oversees driving digital transformation at the federal level, each local eGovernment/digital government authority manages onboarding its local institutions.
To facilitate this transformation, the UAE government has initiated several initiatives. Among them, the most important are:

- **UAE Pass:** A national digital identity that grants residents access to over 5,000 services provided by the city's 100+ agencies.
- **UAE API Marketplace:** Is a platform that allows the private sector to use APIs to provide residents with seamless services. The Federal Tax Authority, TDRA, and Amazon formed the first partnership. This partnership assists in accelerating the registration of sellers on to the Amazon marketplace platform.
- **Digital health and education:** Include several initiatives such as telemedicine, distance learning and KidX, a digital platform for children.
- **The UAE Digital Government Roadmap:** The UAE Digital Government Roadmap is divided into six primary pillars: (1) unified digital platform, (2) shared digital enablers, (3) digital infrastructure and services, (4) digital enablement, (5) digital capacity, and (6) laws, policies, and standards. The United Nations' SDGs 2030 are also a priority for the Digital Government Strategy.
- **Regulatory sandboxes:** Abu Dhabi Global Market (ADGM) launched the country's first regulatory sandbox in 2016, followed by Dubai Financial Services Authority (DFSA) in 2017.

Regional Government's initiative

Abu Dhabi

The region of Abu Dhabi has seen several high-impact initiatives under the guidance of Abu Dhabi Digital Authority (ADDA). ADDA has delivered digital services, platforms and channels and implemented applied intelligence, shared government, and cybersecurity solutions for government entities. Some of the key initiatives taken include:

- **Abu Dhabi Open Data:** Launched to build the foundational capabilities of the data management agenda across the government of Abu Dhabi.
- **TAMM:** A one stop shop portal from the Abu Dhabi Government.
- **Abu Dhabi Pay:** A digital payment platform within the ecosystem of Abu Dhabi government services.
- **Apps:** City Guard, a free app lets users raise a complaint or an issue with the Government regarding its services.

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Dubai

Dubai's transformation began with the "Smart Dubai" initiative – first launched in 2014, followed by two more in 2017 and 2021. Under the umbrella of Smart Dubai initiative (2014 and 2017), the Dubai government has launched over 130 initiatives in collaboration with the private sector, leveraging emerging technologies to improve the lives of its citizens and businesses.

Some of the key initiatives covered under the Smart Dubai initiative include:[17]

- **Dubai Data Wealth:** Dubai is the first city to make data sharing, use, and reuse mandatory. As part of this, the 'Dubai Pulse' platform was launched, which has so far ingested over 600+ data sources and provides a single source of truth.
- **Smart Services:** A universal app, Dubai Now, was launched, providing users with access to over 120 services from over 30 entities. To date, the application has processed over 11 million transactions worth over US $1.6 billion.
- **The Dubai Paperless Strategy:** The initiative was launched to digitize government transactions across 42 government entities. So far, the initiative has saved more than US $200 million.
- **Dubai Blockchain Strategy:** Unveiled a slew of blockchain-powered initiatives and services across multiple industries. The government also unveiled the Dubai Blockchain Policy, the city's first comprehensive blockchain implementation policy.

The Smart Dubai initiative has already created significant impact – 100% digitization of government services that has helped the government save US $350 million[18] annually is a great example. The third iteration – Smart Dubai 2021 launched recently focuses on four pillars namely (1) offering seamless service, (2) efficient use of urban resources, (3) safe cities and (4) personalized experiences for individuals and businesses.

Like, Abu Dhabi and Dubai, the government of Sharjah has also launched 'Digital Sharjah' – an application and a website providing services of the government through a single interface. The platform currently offers services across seven categories namely: business, transportation, utilities, social services, general, real estate, and security. Soon, the platform will expand to cover other categories such as: culture, arts, creative industry among others. All these initiatives, both at the federal and regional levels are expected to further UAE's digital capabilities while making interactions with the government seamless and efficient for residents and businesses.

Estonia

Shortly after obtaining independence in 1991, Estonia launched a digital-first approach to modernising its economy. Estonia pursued a digital-first strategy for governance and sectoral digitization since the early 2000s. Estonia started with digitization of schools and today every school in the country is online. In addition, the government also offered free computer training for 10% of the adult population.[19] In 2002, Estonia implemented a high-tech national ID system that is now even used for voting in general elections. Another essential feature of the country's digital society is e-Residency, a first-of-its-kind project that allows anyone to launch a business without having to live there. The eNomads initiative, which allows employees to work remotely from anywhere in the world, is now being explored. Furthermore, the country boasts one of the strongest eGovernment program in the world, with nearly all services available online driven by X-road – a decentralised data platform launched in the early stages of their digitization journey.

The country has now passed a new Digital Agenda 2030, which intends to further digitalize the economy using emerging digital technologies. As part of the initiative to strengthen public services and essential infrastructure, the government plans to spend €100 million.[20] The emphasis areas for public service digitization will include government cloud adoption, open data centres of excellence, automated delivery of public services based on life events, and 5G adoption and cyber-security.

Uruguay

In terms of digitalization, Uruguay has been one of the most progressive countries in the Latin American region. So far, the country has implemented five digital agendas. Initially, the agenda was focused on closing the country's digital divide; however, digitalization is now completely integrated into the economic planning process. The first two agendas focused on developing the necessary ICT infrastructure, along with government service digitization. The third digital agenda launched in 2011 emphasized on solving for the digital divide by focusing on universal internet access, ICT education, and financial inclusion. The fourth agenda (2020) sought to accelerate the country's digital adoption by focusing on digital skilling, digitization of strategic sectors such as healthcare, utilities, and investments in next-gen ICT infrastructure.

The government has recently launched the fifth such agenda (2025), structured into twelve strategic objectives, classified into five main priority action areas for the government. The focus areas include (1) digital citizenship, (2) digital technologies as a tool for social integration, (3) digital transformation of productive sectors (use of IoT in public service management, energy, water, communications, and transportation), (4) innovation and (5) cybersecurity. The agenda's focus areas closely align with the Sustainable Development Goals (SDGs) 2030 and the Digital Agenda for Latin America and the Caribbean (ELAC).

The revamped Digital Money Index 2022

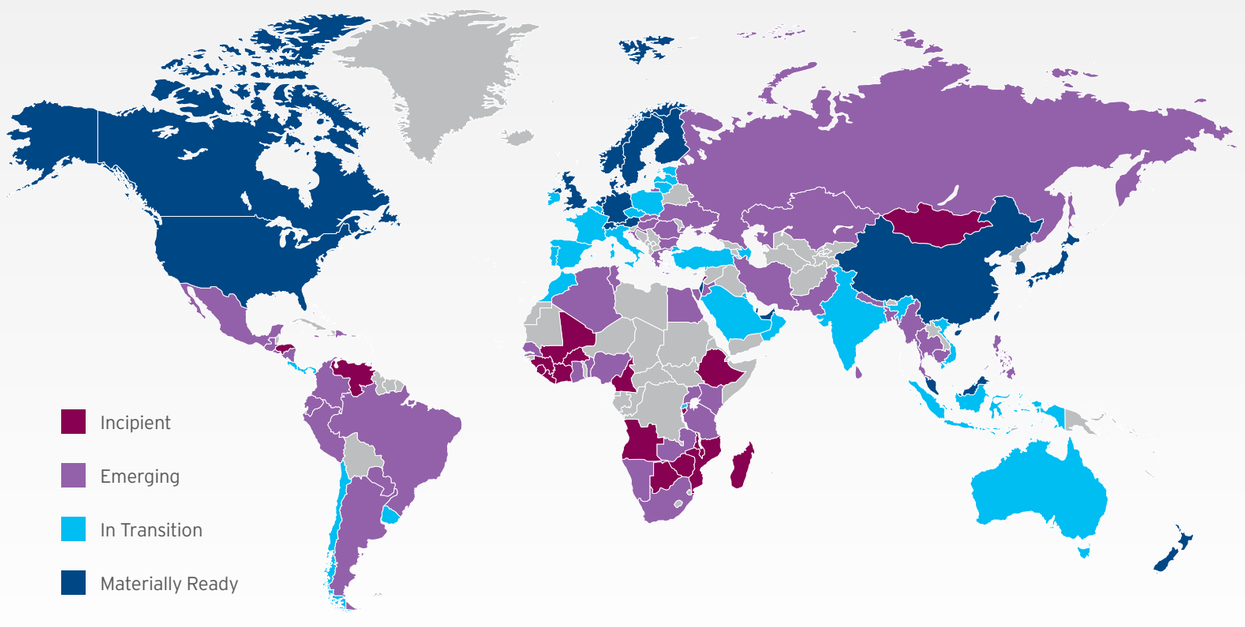
With the acceleration of digital money adoption, several new indicators are getting tracked and reported on a regular basis, providing us with an opportunity to strengthen our Digital Money Index with these newer indicators as well as include new countries to the Index. Further, recognizing the importance of governments in advancing digital readiness, Citi and Imperial College London have revamped the DMI to give the government and market support pillar more importance.

More information on the index construction can be found in the methodology section in the Appendix.

The updated index assesses digital money readiness in 113 countries, up from 84 countries in the previous iteration. The index continues to classify countries into 4 clusters – Incipient, Emerging, In-transition and Materially Ready – according to their levels of digital readiness. Digital Money Index 2022 has 22 countries in the materially ready cluster, 27 countries in In-transition cluster, 45 in Emerging, and 19 countries in Incipient cluster.

The revamped Index, with the addition of new indicators, acknowledges the progress made by several developing economies in driving digital money readiness with several of these countries entering the materially ready and in-transition clusters, to be classified on par with several developed economies and well ahead of their emerging market peers.

Figure 4: Digital Money Index 2022: Country classification



Conclusion

A holistic digital policy is required to promote digital money readiness and adoption. Countries that have augmented a holistic digital policy with targeted investments have performed well on digital money readiness as measured by our Digital Money Index. This is evident from the case studies of Malaysia, the United Arab Emirates, Estonia, and Uruguay that have all outperformed their peers.

Citi's holistic digital policy research report[21] released in November 2021 articulates how a holistic digital policy combined with focused investments can drive not just digital readiness, but also overall economic growth. The need for a holistic digital policy, targeted investments, and collaboration across all economic stakeholders to drive progress are very clear. The time to act is now.

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Appendix: 2022 Index Results

2022 Rank	Country Name	Government and Market Support Rank	Financial and ICT Infrastructure Rank	Availability of Solutions Rank	Propensity to Adopt Rank	Cluster
1	Switzerland	2	4	8	13	Materially Ready
2	Luxembourg	12	1	3	12	Materially Ready
3	Hong Kong	10	2	5	9	Materially Ready
4	Singapore	1	15	14	6	Materially Ready
5	United Arab Emirates	13	3	19	3	Materially Ready
6	US	14	11	9	2	Materially Ready
7	Sweden	5	13	25	4	Materially Ready
8	Denmark	9	8	24	5	Materially Ready
9	Netherlands	8	6	27	7	Materially Ready
10	Qatar	4	16	29	1	Materially Ready
11	Finland	3	36	11	11	Materially Ready
12	United Kingdom	28	5	10	10	Materially Ready
13	Norway	23	24	6	8	Materially Ready
14	Canada	45	12	1	15	Materially Ready
15	Japan	22	9	2	35	Materially Ready
16	Korea, Rep.	30	17	7	18	Materially Ready
17	Malaysia	7	18	41	19	Materially Ready
18	New Zealand	51	7	15	17	Materially Ready
19	Israel	29	14	4	28	Materially Ready
20	Germany	15	33	16	23	Materially Ready
21	Austria	17	20	22	25	Materially Ready
22	China	11	21	48	14	Materially Ready
23	Ireland	43	34	17	16	In-Transition
24	Belgium	46	25	21	20	In-Transition
25	Spain	55	29	13	30	In-Transition
26	Estonia	26	39	32	21	In-Transition
27	France	25	23	23	43	In-Transition
28	Australia	74	19	12	26	In-Transition
29	Oman	19	41	30	37	In-Transition

Appendix: 2022 Index Results

2022 Rank	Country Name	Government and Market Support Rank	Financial and ICT Infrastructure Rank	Availability of Solutions Rank	Propensity to Adopt Rank	Cluster
30	Uruguay	39	22	28	42	In-Transition
31	Bahrain	53	37	31	22	In-Transition
32	Portugal	44	27	26	38	In-Transition
33	Kuwait	52	26	37	33	In-Transition
34	Czech Republic	60	10	36	47	In-Transition
35	Italy	64	31	18	50	In-Transition
36	Saudi Arabia	27	47	45	31	In-Transition
37	Chile	77	44	34	27	In-Transition
38	Costa Rica	37	66	54	29	In-Transition
39	Indonesia	16	63	72	41	In-Transition
40	Lithuania	36	42	102	24	In-Transition
41	Turkey	71	58	20	53	In-Transition
42	Poland	66	38	40	52	In-Transition
43	India	41	51	61	39	In-Transition
44	Rwanda	6	98	83	68	In-Transition
45	Azerbaijan	33	74	69	32	In-Transition
46	Panama	59	32	66	51	In-Transition
47	Morocco	18	65	88	64	In-Transition
48	Latvia	54	43	101	36	In-Transition
49	Vietnam	32	55	75	59	In-Transition
50	Romania	76	28	52	62	Emerging
51	Jamaica	62	69	38	60	Emerging
52	Colombia	50	71	63	45	Emerging
53	Kazakhstan	73	53	53	46	Emerging
54	Hungary	81	35	43	77	Emerging
55	Thailand	63	30	105	34	Emerging
56	Egypt	47	61	68	55	Emerging
57	Kenya	34	75	67	63	Emerging
58	Jordan	67	45	78	49	Emerging

Appendix: 2022 Index Results

2022 Rank	Country Name	Government and Market Support Rank	Financial and ICT Infrastructure Rank	Availability of Solutions Rank	Propensity to Adopt Rank	Cluster
59	Tunisia	42	93	59	54	Emerging
60	Dominican Republic	40	83	57	72	Emerging
61	Brazil	70	79	39	71	Emerging
62	Russia	80	49	46	76	Emerging
63	Ukraine	83	67	33	74	Emerging
64	Slovak Republic	79	46	81	48	Emerging
65	Greece	75	60	42	81	Emerging
66	Bulgaria	87	40	44	79	Emerging
67	South Africa	61	59	58	80	Emerging
68	Argentina	90	48	47	57	Emerging
69	Mexico	69	80	77	40	Emerging
70	Philippines	72	70	85	44	Emerging
71	Trinidad and Tobago	49	73	103	56	Emerging
72	Ghana	31	78	91	86	Emerging
73	Nepal	20	95	90	98	Emerging
74	Paraguay	57	87	76	70	Emerging
75	Senegal	24	77	98	99	Emerging
76	Uganda	48	92	49	96	Emerging
77	Croatia	95	56	35	78	Emerging
78	Ecuador	82	64	65	67	Emerging
79	Nigeria	38	96	96	89	Emerging
80	Peru	84	72	64	75	Emerging
81	Pakistan	88	57	94	66	Emerging
82	Tanzania	35	103	99	88	Emerging
83	Iran	65	52	106	73	Emerging
84	Bangladesh	21	90	97	111	Emerging
85	Zambia	56	88	87	91	Emerging
86	El Salvador	85	86	71	69	Emerging
87	Guatemala	97	68	74	58	Emerging

Appendix: 2022 Index Results

2022 Rank	Country Name	Government and Market Support Rank	Financial and ICT Infrastructure Rank	Availability of Solutions Rank	Propensity to Adopt Rank	Cluster
88	Myanmar	58	91	100	95	Emerging
89	Cambodia	89	84	82	84	Emerging
90	Namibia	100	54	56	93	Emerging
91	Sri Lanka	104	50	62	94	Emerging
92	Nicaragua	78	62	108	87	Emerging
93	Benin	68	109	93	101	Emerging
94	Algeria	92	81	84	102	Emerging
95	Honduras	107	94	73	61	Incipient
96	Venezuela	109	85	51	82	Incipient
97	Mongolia	96	76	109	65	Incipient
98	Mozambique	91	112	79	107	Incipient
99	Ivory Coast	98	101	92	104	Incipient
100	Cameroon	102	105	89	92	Incipient
101	Malawi	93	97	111	85	Incipient
102	Angola	101	110	60	106	Incipient
103	Ethiopia	110	99	55	108	Incipient
104	Lebanon	111	82	104	83	Incipient
105	Botswana	108	89	70	109	Incipient
106	Burkina Faso	94	107	80	113	Incipient
107	Mali	86	108	107	103	Incipient
108	Zimbabwe	105	111	95	100	Incipient
109	Guinea	99	102	110	97	Incipient
110	Liberia	106	104	111	90	Incipient
111	Madagascar	103	106	113	105	Incipient
112	Sierra Leone	112	100	86	110	Incipient
113	Burundi	113	113	50	112	Incipient

Appendix: 2022 Index methodology – what has changed?

This section presents a detailed summary of Digital Money Index (DMI) construction methodology. The Index is constructed from 77 data feeds (referred to as indicators) originating from multiple opensource databases. The DMI website provides more details on the set of indicators used to inform the index. These feeds are grouped to compose a single index score following several layers of normalisations and transformations described below.

II. Methodology

a. Pre-Processing and Deprecation
First, to produce a more up to date index some of the previously included indicators were deprecated due to discontinuation or irregularity of survey/ database updates, correlation analysis of indicators, and poor reporting frequency. Furthermore, to make the index more current a host of newer indicators were added across many open sources.

b. Processing
There were lot of gaps in the dataset and two methods were explored for dealing with missing data. In the last iterations of the DMI the procedure was to calculate a K-cluster mean. A k-means unsupervised clustering algorithm was applied to a subset of indicators which contained no missing values. This model was re-run under several different initial conditions and optimization of the corresponding variance-ratio criterion led to a consistent identification of 10/11 clusters. The K means average was used to replace missing values. However, this year, missing values are replaced with zeros. This method pushed the overall index scores lower by "penalising" non-reporting countries rather than make any assumptions about country similarities.

c. Normalisation & Dropout
Once the data was collected, cleaned, and matched, the individual indicators were min-max normalised (0 to 1) and aggregated by categories (called pillars). The previous version of this index also made use of dimensions which inherently added unequal weights to each indicator. However, the current version of the index aggregates indicators at the pillar level without weighting them at the dimension level. Furthermore, given the role of governments in driving money readiness and adoption, this year's index has altered the weightages of the 4 pillars that define the overall index. Government and market support (pillar 1) has been weighed at 40% while the 3 other pillars (Financial and technology infrastructure, availability of solutions and propensity to adopt) were weighed at 20% each, compared to all of them being weighted equally (25% each) until 2020. Finally, the pillars were in turn also min-max normalised and aggregated to produce a final mean which is the DMI index.

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