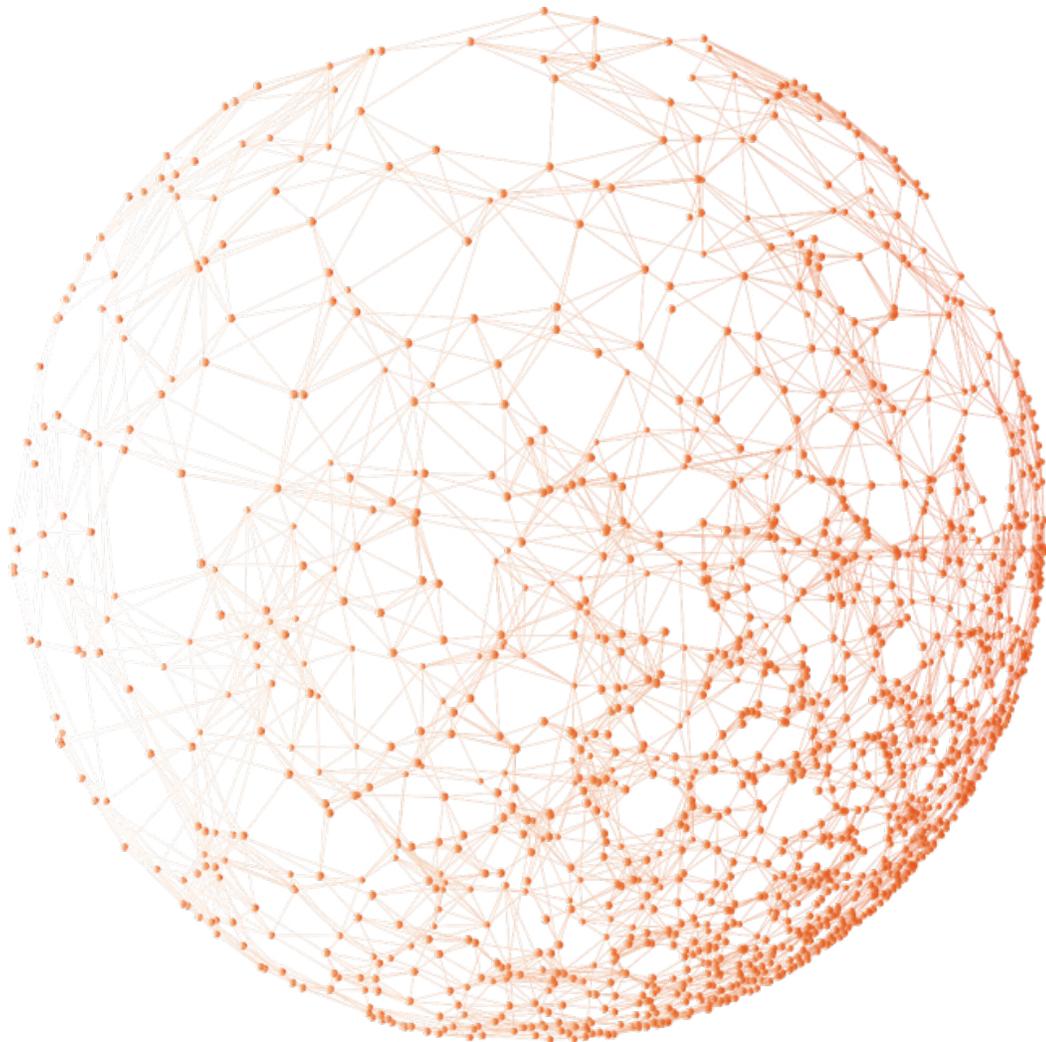


# Digital Planet: Readying for the Rise of the e-Consumer

Bhaskar Chakravorti, Christopher Tunnard, Ravi Shankar Chaturvedi



# Digital Planet: Readying for the Rise of the e-Consumer

A report on the state and trajectory of global digital evolution  
September 2014

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## A Message From Anabel González



*Senior Director of the Trade and Global Competitiveness Practice, The World Bank*

I congratulate The Fletcher School at Tufts University for taking the lead in measuring the digital evolution of nations in a dynamic and integrative manner and it is with great pleasure that I am introducing the Digital Evolution Index (DEI) to the wide set of users who would find it of interest and use. The DEI and this Digital Planet Report are the culmination of six years of data that illuminate the unique trajectories of 50 countries as they usher their citizens and economies into the digital future. The six years following the great global economic decline in 2008 and the ongoing developments make for an interesting study. The report has many rich insights on the regenerative capacities of countries, governments, consumers and businesses as they dust themselves off and prepare to meet the challenges and opportunities of a rapidly digitizing world.

For policymakers and governments, this Index provides the insights necessary to design policies that can boost digital competitiveness. For businesses, investors and entrepreneurs in the digital economy, the DEI uncovers patterns that can inform their strategies as they seek to expand globally. While there is a great deal of optimism around the potential economic and social gains from improved information and communication technologies, countries would need to improve policies and businesses would have to formulate cogent strategies based on a strong grasp of the quality and depth of digital ecosystem. They need also a means to compare the quality of digital ecosystems across markets. The old adage “we can’t improve what we don’t measure” rings true as we consider the economic impact of digital technologies on humankind. To measure and offer pointers for improvement requires knowledge and the DEI distinguishes itself as a knowledge asset in this regard.

The Fletcher School’s dynamic classification of evolution zones captures the journey of individual countries and adds a refreshing element of nuance to understanding complex digital ecosystems. Rather than use a static ranking system, the DEI illustrates how countries evolve over time through the interplay between innovation, institutional policies, demand and supply conditions. This approach allows countries not only to benchmark against the best, but also to track their own progress and identify where policy improvements may be made.

While the countries represented in this maiden initiative cover 73 percent of the world’s population, the remaining countries — many of which are developing — would also benefit from knowledge shared through this Index. I am sure that the Fletcher School will continue to consolidate this Index and even expand the scope of this important study in the coming years.

I welcome you to discover the insights, patterns and surprises in this report.

*Anabel González*

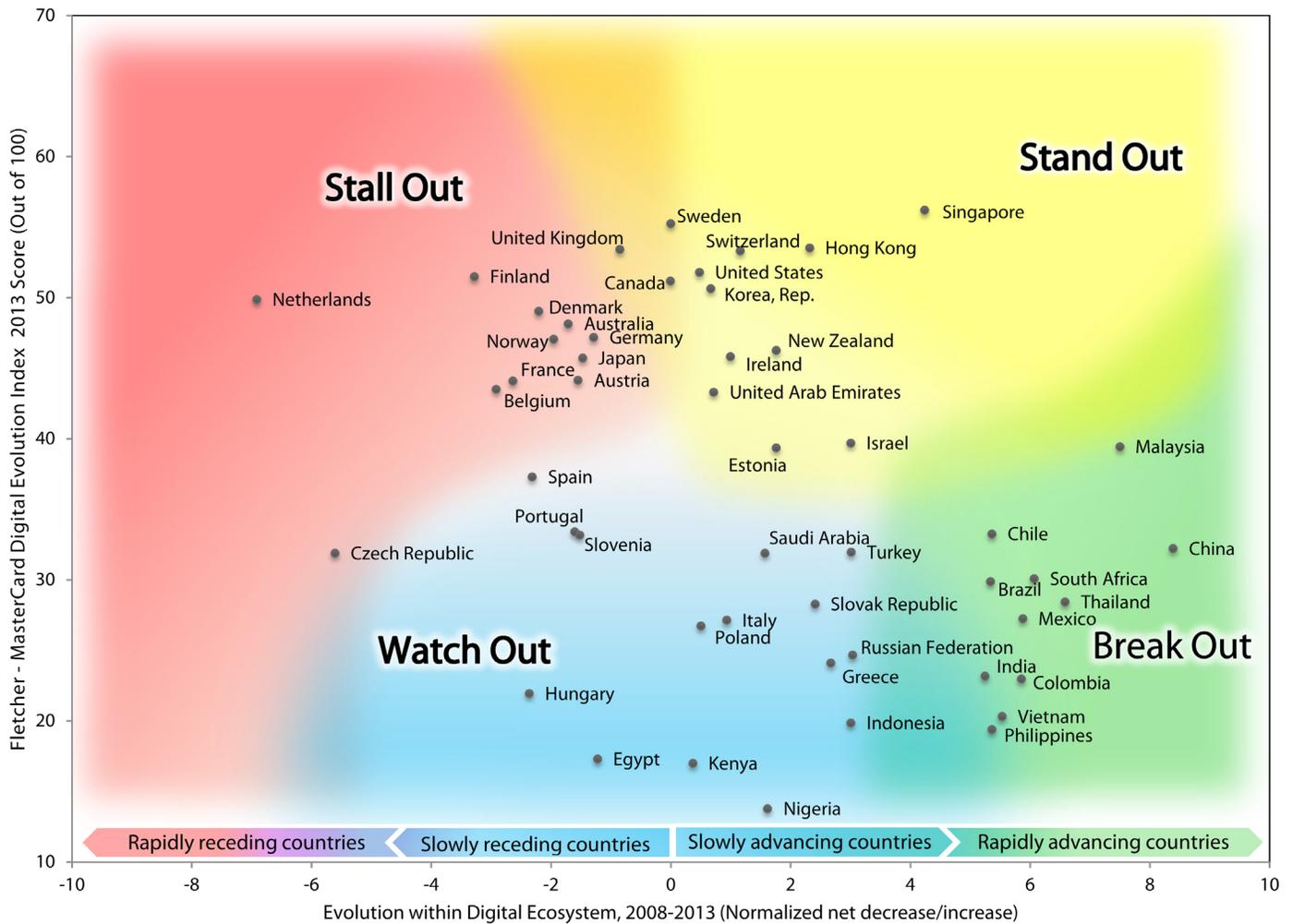
## Overview

This report introduces the **Digital Evolution Index** (DEI) as a way to gauge the transformation of economies in the advanced and developing world from traditional brick-and-mortar to digitally enabled. The DEI measures the digital trajectories of 50 countries to provide actionable, data-informed insights for businesses, investors and policymakers. Created by The Fletcher School, in collaboration with MasterCard Worldwide and DataCash, the DEI analyzes the key underlying drivers and barriers that govern a country's evolution into a digital economy: Demand, Supply, Institutional Environment and Innovation. A longitudinal analysis of these four drivers during the years 2008 to 2013 reveals both the current state of a country's digital economy, as well as changes over time. Combining these two measures allows us to assign each country to one of four Trajectory Zones:

- **Stand Out** countries have shown high levels of digital development in the past and continue to remain on an upward trajectory.
- **Stall Out** countries have achieved a high level of evolution in the past but are losing momentum and risk falling behind.
- **Break Out** countries have the potential to develop strong digital economies. Though their overall score is still low, they are moving upward and are poised to become Stand Out countries in the future.
- **Watch Out** countries face significant opportunities and challenges, with low scores on both current level and upward motion of their DEI. Some may be able to overcome limitations with clever innovations and stopgap measures, while others seem to be stuck.

**FIGURE 1: TRAJECTORY CHART**

The 50 countries in the Index as they align with the four Trajectory Zones



### The DEI reveals actionable insights for governments, businesses and investors:

- **Break Out** countries such as India, China, Brazil, Vietnam and the Philippines are evolving rapidly. If their evolution rates sustain, these countries will emerge as strong digital economies. However, the next phase of growth is harder to achieve and requires a concerted effort across drivers by all actors concerned. The greatest challenges to growth and opportunities for improvement in the medium term in these markets lie in improving supply infrastructure and in nurturing sophisticated domestic consumers.
- **Stand Out** countries such as Singapore, Hong Kong, the United States and New Zealand have highly evolved digital ecosystems, with very competitive e-commerce markets supported by cutting edge infrastructure and sophisticated domestic consumers. Sustaining upward trajectories at this level is difficult. To remain Stand Out markets, these countries need to continue to fast-track innovation and seek markets beyond their borders.
- **Stall Out** countries (most of Western and Northern Europe, Australia and Japan) can only jumpstart their economies by following what Stand Out countries do best: redoubling on innovation and continuing to seek markets beyond domestic borders. Stall Out countries are also older and aging: Attracting highly talented young immigrants could help revive innovation.
- **Watch Out** countries are home to 2.5 billion people. The biggest among them — Indonesia, Russia, Nigeria, Egypt and Kenya — have institutional uncertainty and a low commitment to reform. The other distinguishing aspect of Watch Out countries is that they possess one or two outstanding qualities — predominantly demographics — that make them attractive to businesses and investors. These countries expend a lot of energy innovating around institutional and infrastructural constraints. Unclogging these bottlenecks would enable these countries to direct their innovations where they matter most.

The report begins with an explanation of how the DEI is constructed and then presents country scores and rankings. This is followed by a discussion of the Trajectory Zones at the end of Section 2. In Section 3, we present key patterns, insights and surprises gleaned from DEI data. We conclude with emerging implications for businesses, investors and policymakers.

# 1. Introduction

**The Internet has come of age.** Twenty-one years since the marketplace first took notice, the World Wide Web today is the heart of the global economy, channeling interactions for nearly 40 percent of the world's population.<sup>1</sup> It took the internet 12 years to gather its first billion users and a third of that time to amass its third billion.<sup>2</sup> Meanwhile, the emerging world is leapfrogging toward mobile phones at an astonishing pace, opening more avenues to internet adoption. Broadband subscriptions on mobile phones, now 34 percent of global mobile phone subscriptions, have tripled since 2008.<sup>3</sup> The next billion Internet users, logging on in an era of near-universal mobile connectivity, offer promise of greater economic growth and increased business opportunities.

**The next billion will be different.** The current 3 billion started off primarily as Internet users, surfing and emailing, before they became consumers of digital marketplaces. The next billion, already mobile customers used to interacting and transacting — downloading ringtones, content, etc., — in a mobile ecosystem on their feature phones, will start off not as mere users, but rather as e-consumers: Internet-enabled mobile devices will vastly expand their access to downloadable content; buying and selling goods and services through a mobile phone is a logical next step. This has profound implications for the future of global commerce. Where the future e-consumers will come from, who they are, what they are like and how they will shape the digital marketplaces of the future are questions of great importance to businesses and investors globally. The answers depend on how governments, businesses and consumers co-evolve to face the challenges and opportunities of the digital future.

**Investor interest is driving competitive activity and innovation in digital marketplaces.** In anticipation of universal mobile Internet access, institutional investors and sovereign wealth funds are pouring money into e-commerce ecosystems and digital marketplaces in the emerging world. In just one week in July 2014, India saw investments of \$3 billion flow into competing digital marketplaces Amazon and Flipkart.<sup>4</sup> The Chinese e-commerce giant Alibaba's IPO in September 2014 ranks among the largest public offerings on record and Rocket Internet, the German startup conglomerate aiming to be the Amazon of the developing world, has been valued at \$4.3 billion following a stake sale to the biggest telecom operator from the Philippines.<sup>5</sup>

**Understanding the many forces that drive digital evolution will help in designing regulatory policies, steering innovation and allocating resources.** To measure the digital trajectories of countries and to provide actionable, data-informed insights for businesses, investors and policymakers, The Fletcher School, in collaboration with MasterCard Worldwide and DataCash, created the **Digital Evolution Index (DEI)**. The DEI analyzes the key underlying drivers and barriers that govern a country's evolution into a digital economy: Demand, Supply, Institutional Environment and Innovation. A longitudinal analysis of these four drivers during the years 2008 to 2013 enables us to make sense of the evolving global digital landscape, reveal patterns and provide insights into both current consumers and those to come.

## 2. The Digital Evolution Index

### 2.1 The Drivers of Digital Evolution

The Digital Evolution Index analyzes the key underlying drivers that govern a country's evolution into a digital economy: **Demand Conditions, Supply Conditions, Institutional Environment and Innovation and Change**. To gain a comprehensive view of digital readiness across countries, we further divided these drivers into 12 components, measured using a total of 83 indicators. (The four drivers, 12 components and sample indicators are laid out in Figure 2.)

Very early in our research, we recognized that digital evolution isn't governed by just one, two or a few silver bullets such as technology, government regulation, consumer behavior or fulfillment networks. It is these factors and many others, often in different combinations in different countries. An insight into the drivers of the digital economy helps us move beyond a static snapshot and appreciate the systemic nature of forces at play. It enables us to explain why some countries are transitioning more quickly than others from brick and mortar to digital systems and outline the contributions that specific actors in the private and public space can make to unclog bottlenecks and to get innovation moving. Finding these key leverage points could propagate changes through the entire system. This systemic approach also helps explain why change may be slower than expected: The interlocking nature of these indicators could keep the status quo frozen until certain essential barriers are overcome.

**FIGURE 2: THE DRIVERS OF DIGITAL EVOLUTION**

*The four drivers, 12 components and sample indicators*



#### Supply Conditions

##### Access Infrastructure

Bandwidth, servers, security and accessibility of digital content

##### Transaction Infrastructure

Depth of consumer financial services, business use of ICT

##### Fulfillment Infrastructure

Quality of transportation networks, logistics performance



#### Demand Conditions

##### Consumer Profile

Consumer income, consumption, demographics

##### Financial Savviness

Consumer use of financial services and digital payment technology

##### Internet & Social Media Savviness

Broadband and mobile Internet use, use of informational websites, social media usage



#### Institutional Environment

##### Gov't Effectiveness

Political stability, rule of law, governance quality, corruption

##### Gov't & Business Environment

Investment inflows, competitive marketplace facilitation, ease of business in-country

##### Gov't & Digital Ecosystem

e-Governance, government facilitation of ICT and digital ecosystem creation



#### Innovation and Change

##### Ecosystem Attractiveness & Competitive Landscape

Private equity investment, business focus on customers

##### Extent of Disruption

User adoption of new technology and services, advertising

##### Startup Culture

Venture capital availability, ease of registration of new businesses



### Supply Conditions

*How developed is digital and business infrastructure?* The Index looks at both digital supply conditions, such as available bandwidth and security of transactions, as well as physical infrastructure like quality of roads. Developing countries with fledgling infrastructure comprise the low end of the scores on the Supply driver.



### Demand Conditions

*Are consumers willing and able to transact in the digital environment?* While high demand is always a welcome sign, low demand scores can be interpreted as an indication of untapped market potential that investors and businesses can take advantage of in an enabling institutional environment. Income, Internet usage and use of financial services all play a role in determining demand.

Demand fell in many of the developed countries most affected by the Great Recession. As the majority of these countries already have high levels of Internet usage, strong social media participation and a robust electronic payments culture, consumption will be a key factor in improving this driver over time. By contrast, emerging markets are seeing steady growth across all three components. As a result, these countries have headroom for demand growth over a longer period of time before leveling out.



### Institutional Environment

*Are government policies and regulations facilitating the creation of digital ecosystems?* Political stability and rule of law are basic starting points. Beyond those, the institutional environment is measured on more than simply tax rates and openness of government policies. It takes into account how governments enact business-friendly regulations while also helping to build common infrastructure to facilitate trade. Internet and communications regulation plays a role: The network neutrality debate in the United States and instances of Internet censorship in many parts of the world highlight the ability of governments to fundamentally alter and control the nature of the Internet. On the other hand, enabling governments are creating new opportunities for businesses by bringing their citizens online.

Changes in government policies and practice tend to be slow and gradual. From 2008-2013, emerging markets showed a slight decline in the Institutional Environment driver, while developed countries displayed gradual improvement.



### Innovation and Change

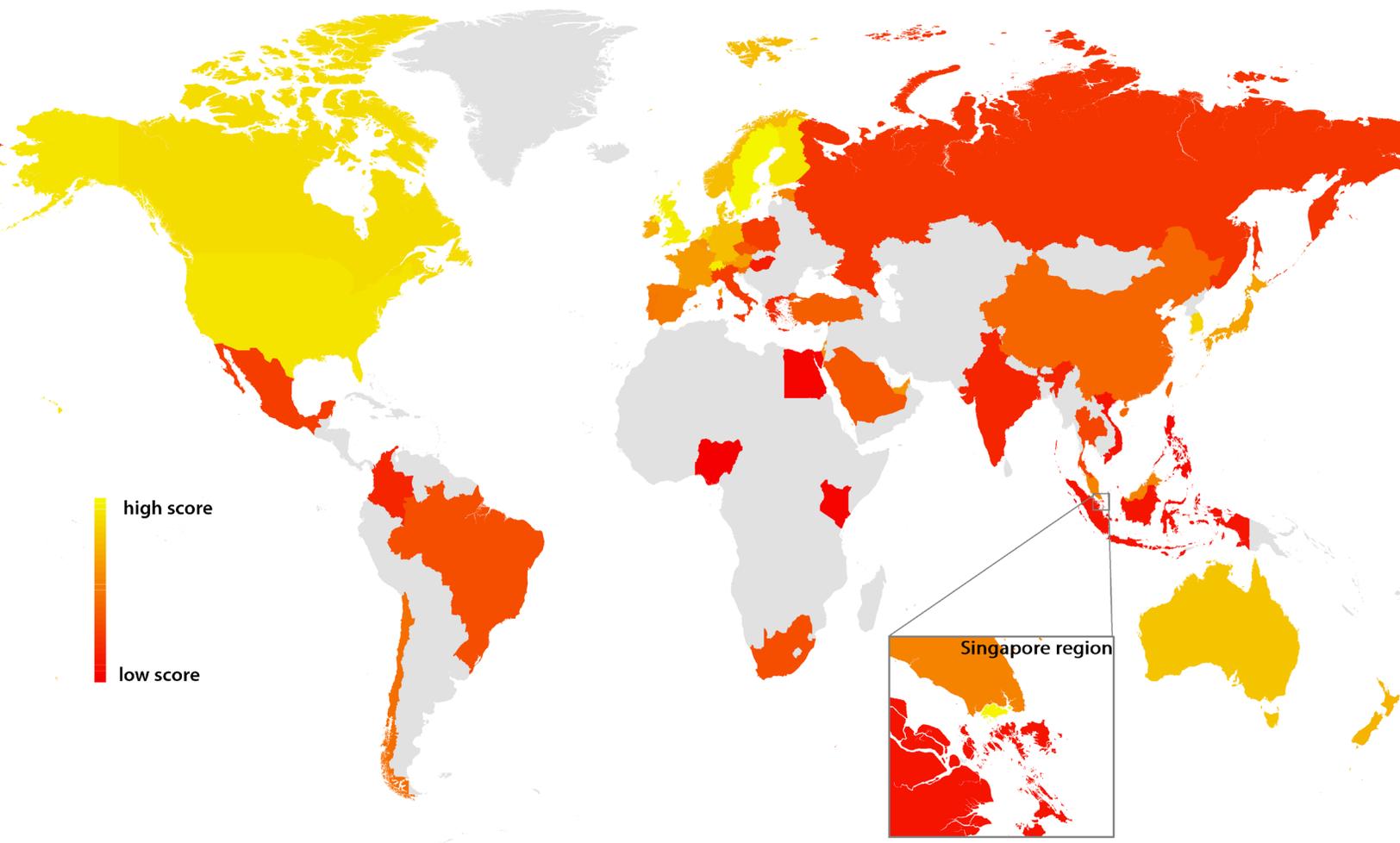
*What is the extent of innovation happening in the digital commerce realm?* The Index considers investments into digital ecosystems (with private equity inflows as a proxy) and ease of creating startups. While many of the elements that are important to startups have deep connections to the other three drivers, this driver uses proxies to help measure the quality of innovation in our 50-country sample. Though developed countries do dominate the top rankings for the first three drivers, emerging and frontier markets, buoyed by investor interest, make a strong showing in the Innovation and Change driver.

## 2.2 Country Scores and Rankings

The 50 countries we chose for our analysis span a wide range between developed and emerging economies and together represent almost three quarters of the global population (5.2 billion). These are where most of the world's current Internet users live and where the next billion users are likely to come from.

**FIGURE 3: DIGITAL EVOLUTION INDEX 2013 MAP**

*The 50 Index countries, with highest scoring countries in yellow*



**FIGURE 4: COMPOSITE DEI SCORE AND RANKINGS (2013)**

*Countries ranked on 2013 composite total scores across the four drivers: Demand, Supply, Institutional Environment and Innovation*

Rank	Country	Index Score	Rank	Country	Index Score
1	Singapore	56.21	26	Portugal	33.41
2	Sweden	55.23	27	Chile	33.25
3	Hong Kong	53.52	28	Slovenia	33.17
4	United Kingdom	53.41	29	China	32.20
5	Switzerland	53.32	30	Turkey	31.95
6	United States	51.79	31	Czech Republic	31.87
7	Finland	51.49	32	Saudi Arabia	31.87
8	Canada	51.17	33	South Africa	30.06
9	South Korea	50.63	34	Brazil	29.86
10	Netherlands	49.86	35	Thailand	28.42
11	Denmark	49.03	36	Slovak Republic	28.27
12	Australia	48.14	37	Mexico	27.23
13	Germany	47.18	38	Italy	27.12
14	Norway	47.04	39	Poland	26.73
15	New Zealand	46.26	40	Russia	24.65
16	Ireland	45.81	41	Greece	24.08
17	Japan	45.71	42	India	23.17
18	Austria	44.13	43	Colombia	22.97
19	France	44.07	44	Hungary	21.92
20	Belgium	43.49	45	Vietnam	20.29
21	United Arab Emirates	43.29	46	Indonesia	19.85
22	Israel	39.69	47	Philippines	19.38
23	Malaysia	39.43	48	Egypt	17.28
24	Estonia	39.36	49	Kenya	16.98
25	Spain	37.29	50	Nigeria	13.77

The 2013 DEI score tells us the *current* state of a country's digital landscape. However, digital development is not static: DEI score alone in any year does not tell us how a country has progressed over time or where it is likely to go in the future. One way to measure this change is simply to look at how scores have increased or decreased in the recent past. We chose 2008 as a starting point to look at how countries have been faring after the Great Recession. Figure 5 lists changes in DEI score (in absolute terms) between 2008 and 2013 and ranks countries from rapidly advancing to rapidly receding. China has seen the largest increase in score, while the Netherlands shows the largest decrease.

**FIGURE 5: CHANGE IN SCORES SINCE 2008**

Countries ranked by change in DEI scores from 2008 to 2013, with fastest increases at the top.

Rank	Country	Change ('08-'13)		Rank	Country	Change ('08-'13)	
1	China	8.39	Rapidly advancing countries	26	Italy	0.94	Slowly advancing countries
2	Malaysia	7.50		27	United Arab Emirates	0.72	
3	Thailand	6.59		28	South Korea	0.67	
4	South Africa	6.07		29	Poland	0.51	
5	Mexico	5.88		30	United States	0.48	
6	Colombia	5.85		31	Kenya	0.37	
7	Vietnam	5.54		32	Sweden	0.00	
8	Chile	5.37		33	Canada	-0.01	
9	Philippines	5.37		34	United Kingdom	-0.85	
10	Brazil	5.34		35	Egypt	-1.22	
11	India	5.25		36	Germany	-1.28	
12	Singapore	4.24		37	Japan	-1.47	
13	Russia	3.04		38	Slovenia	-1.52	
14	Turkey	3.01		39	Austria	-1.55	
15	Indonesia	3.01	40	Portugal	-1.60	Slowly receding countries	
16	Israel	3.01	41	Australia	-1.71		
17	Greece	2.67	42	Norway	-1.95		
18	Slovak Republic	2.41	43	Denmark	-2.20		
19	Hong Kong	2.32	44	Spain	-2.32		
20	Estonia	1.76	45	Hungary	-2.36		
21	New Zealand	1.76	46	France	-2.64		
22	Nigeria	1.62	47	Belgium	-2.92		
23	Saudi Arabia	1.57	48	Finland	-3.28		
24	Switzerland	1.16	49	Czech Republic	-5.61		
25	Ireland	1.00	50	Netherlands	-6.91		

## 2.3 Mapping Digital Trajectories

Whether and how consumers engage in e-commerce will depend on the evolving ecosystems around them: both where they are today and where they might go tomorrow. We created the **DEI Trajectory Chart** to address precisely these questions. We arrayed countries' current (2013) status on the vertical axis against the five-year change in each country (positive or negative, in absolute points) on the horizontal axis. To classify the performance of countries, we divided the trajectory chart into four distinct Trajectory Zones: **Watch Out, Break Out, Stall Out and Stand Out**. Each of these is described in Figure 6. Countries move between zones as their digital ecosystems evolve and change and can embody qualities of two zones at the same time during these transition periods.

### The Four Trajectory Zones Defined

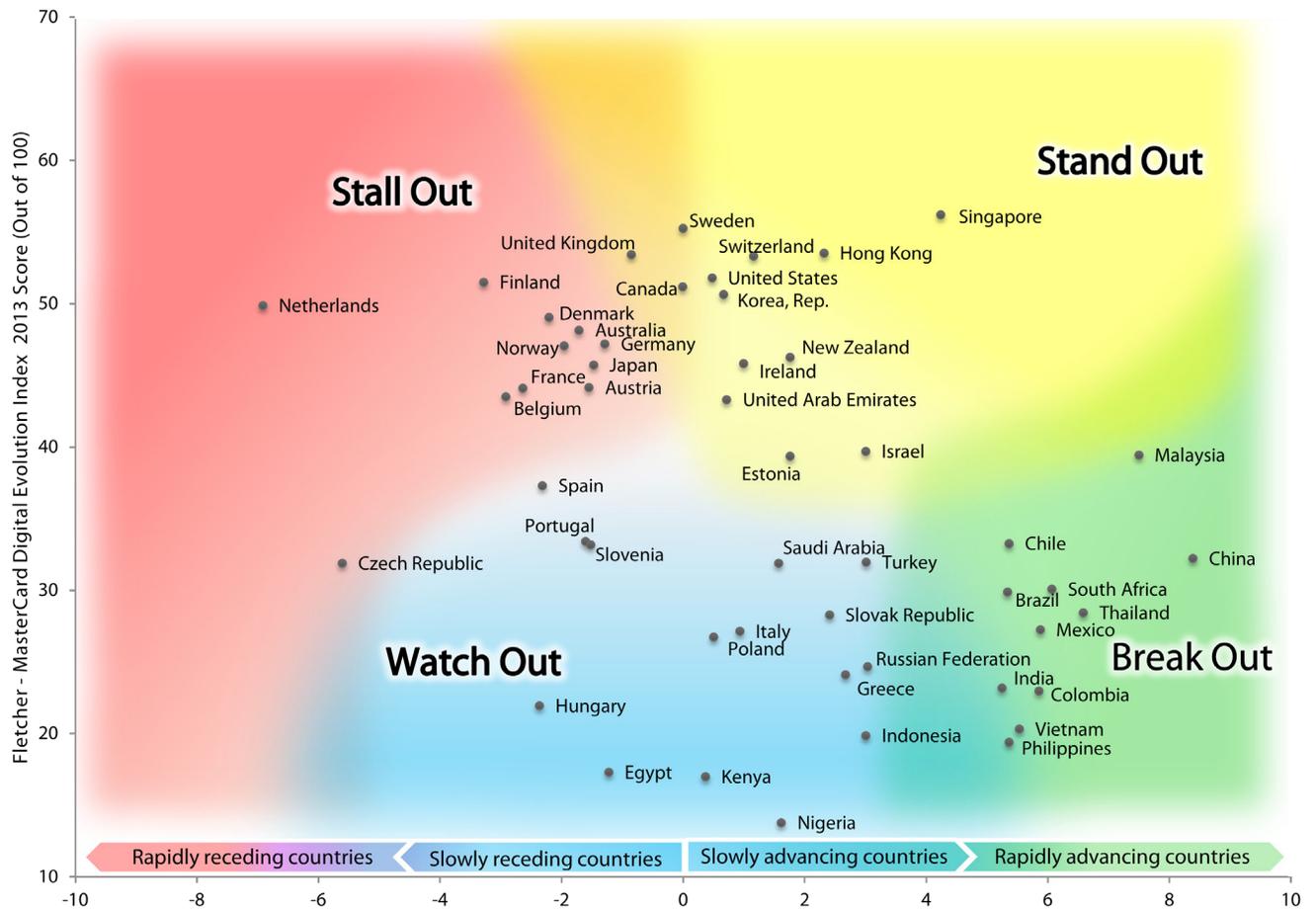
**Stand Out** countries do not merely have highly developed digital ecosystems, they are also continuing their upward trajectories. It is difficult for countries to sustain high improvement rates at this level; it requires continual innovation and market expansion. Those unable to maintain their momentum risk becoming **Stall Out** countries.

In spite of their high scores in 2013, most parts of Northern and Western Europe are losing momentum. They straddle the Stall Out and Stand Out zones, reflecting the challenges Europe has faced since the start of the credit crisis and particularly the loss of focus on innovation. The United States, despite its role in the global financial crisis, has managed to keep its head above water, while Singapore, South Korea and Hong Kong have been consistently pushing the frontiers of digital readiness.

**Break Out** countries have low current scores but are evolving rapidly. If their evolution continues at this rate, these developing countries will grow into strong digital economies. Though highly attractive to investors, their development is being held back by limitations in infrastructure, the absence of government policies and initiatives and a lack of adequate sophistication in consumer demand. Of great interest are the trajectories of Malaysia, China, Chile, South Africa and other leading Break Out nations: They are prime candidates for becoming the Stand Out nations of the future.

**Watch Out** countries face both significant challenges and opportunities, with low scores on both current level and upward motion of their DEI. Some of these countries are showing remarkable innovation in the face of serious infrastructural gaps and institutional constraints, creating clever stopgaps to overcome and work around these limitations. The rest seem to be stuck or receding and risk being left behind as others embrace digital opportunities.

FIGURE 6: TRAJECTORY CHART



**Stall Out** countries are losing momentum. While these countries have achieved a high level of development in the past, they run a serious risk of falling behind.

**Watch Out** countries face both significant opportunities and challenges. Some may be able to overcome limitations with clever innovations and stopgap measures, while others seem to be stuck.

**Stand Out** countries have shown high levels of digital development in the past and continue to remain on an upward trajectory.

**Break Out** countries have the potential to develop strong digital economies. They have displayed a consistently impressive upward trajectory in improving their state of readiness and are well poised to break into the Stand Out ranks in the years to come.

## 3. Patterns, Insights and Surprises

### 3.1 The Rest evolve differently from the West

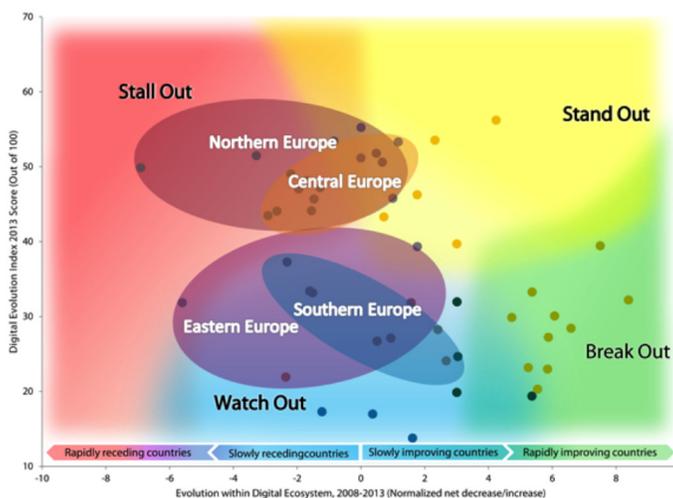
It is tempting to conclude that countries progress in a defined pattern — moving from Break Out to Stand Out and then to Stall Out — given that many developed markets, formerly Stand Out countries, are Stalling Out today. However, our research shows that countries, particularly emerging economies, are following unique paths and that *there is very little about the digital past and present of the West that instructs us about the digital present and future of the Rest.*

The momentum and direction of countries over time result from the interplay of the many systemic elements (in at least 83 categories spanning four drivers) that govern their digital transition. While there isn't one grand pattern, to the extent that the four drivers are correlated, the evolution follows a linear path. When drivers are not correlated — as is often the case in emerging markets — the trajectory is nonlinear and tends to be a random walk. Demographics and innovation factors may push these countries ahead, while institutional and contextual factors often slow them down.

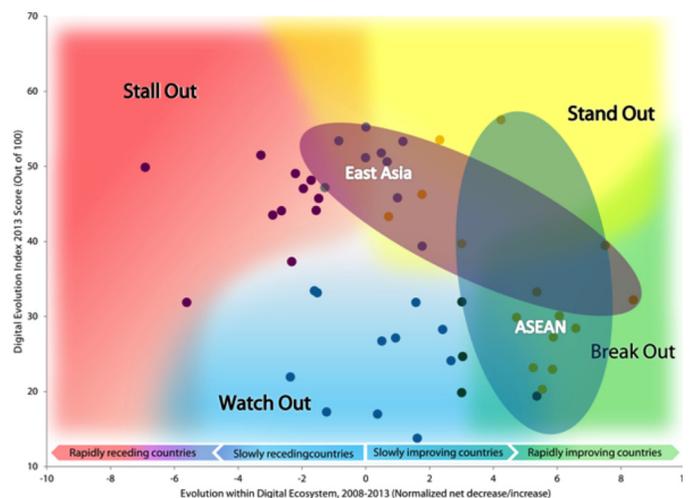
### 3.2 Neighborhoods matter

While the DEI reveals no predetermined path of digital evolution, geography clearly matters: countries are more likely to grow and change with their neighbors. Shared cultural norms; similar social, political and economic environments; and demonstration effects could all play a role.

**FIGURE 7: TRAJECTORY CHART REGIONAL VIEW - EUROPE**  
European countries clustered by subregions



**FIGURE 8: TRAJECTORY CHART REGIONAL VIEW - ASIA**  
Most ASEAN and East Asian countries are tightly grouped, with Singapore and China as outliers.



Though Europe as a whole is spread over three evolution zones, Northern (especially the Nordics), Central, Eastern and Southern Europe display comparable rates and states of digital development within their subgroups (see Figure 7).

Elsewhere in the world, a similar pattern emerges (see Figure 8). Countries within East Asia have moved forward together, as have members of the ASEAN. The African countries in the Index are clustered, as are those in South America, the Middle East, North America and Australasia.

Thus, we can reasonably infer that a country's position on the Trajectory Chart is partly affected by its regional location, which presents both opportunities and challenges: A country can be pushed forward or held back by its neighbors. Regional economic groupings and related harmonization of institutions and supply chains have had a positive impact on some individual country scores over time, as seen in Poland, Estonia and Malaysia. The countries that are likely to evolve differently from their neighbors are those in the Break Out zone, gearing up to leave many of their neighbors behind.

### 3.3 Innovative Hybrids: Combining cash and e-commerce

In some innovative emerging economies, hybrids combining two or more elements of the digital commerce value chain — access, marketplaces, transaction and delivery — are springing up to bridge infrastructure gaps. Cash on delivery where electronic payments are thin; tablet-toting vendors where access is patchy; and delivery personnel doubling up as sales persons to cross-sell or upsell are but some of the strategies showing great success in these markets.

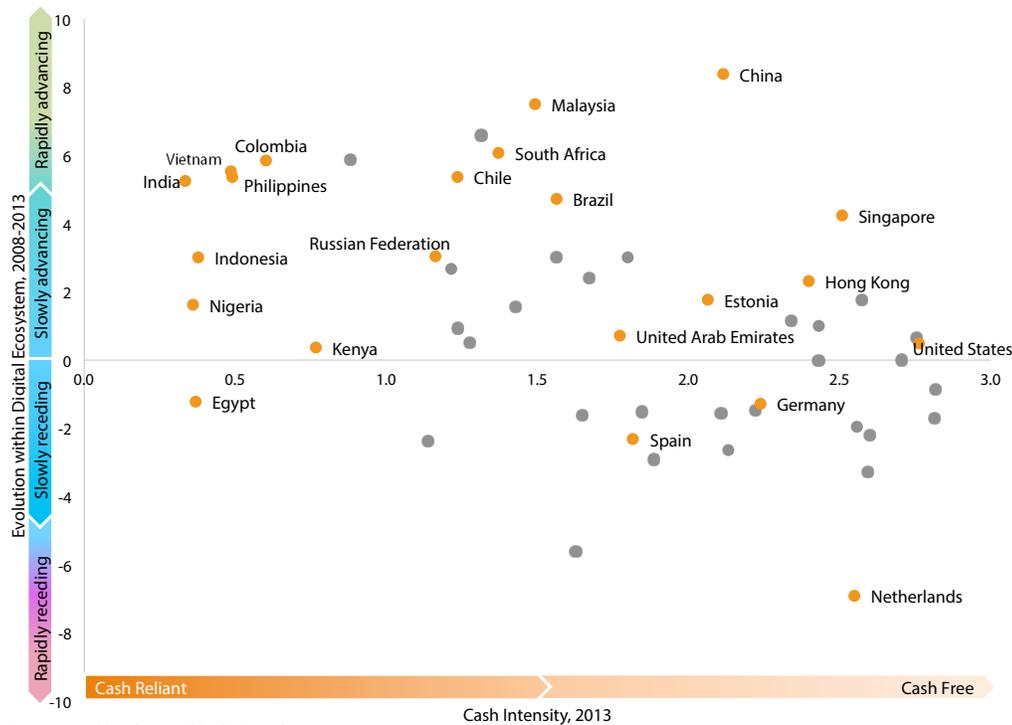
#### The Rest pay differently than the West

Conventional wisdom suggests that the digital economy requires a population able and willing to conduct financial transactions online. After all, developed economies have created efficient e-commerce models by relying on strong electronic payment networks: Amazon's success in the West was built on consumers' willingness to transact online and on its ability to make payments with credit, debit or prepaid cards to purchase goods and services.

The Western experience would suggest that countries with a heavier reliance on cash over electronic transactions in retail purchases would have a longer path to travel before achieving high levels of digital commerce activity. However, data from the Index points to the contrary. A combination of fledgling infrastructure, cultural preferences and distrust of electronic payments have entrenched cash into emerging digital ecosystems without necessarily slowing their evolution. Figure 9 shows countries' speed of digital evolution plotted against their level of cash reliance (which takes into account savings and credit profiles, digital money footprints, interactions with formal financial systems, prevalence of debit and credit cards, and the amount of Internet retailing). Countries on the upper left of the graph such as India, Indonesia and Colombia all have high cash dependence and indeed preference, yet digital marketplaces in these countries have been innovating at a remarkable pace. E-commerce players are simply working with and around the persistence of cash.

**FIGURE 9: CASH IN THE DIGITAL ECONOMY**

Persistence of cash in fastest growing digital economies. All 50 countries are plotted, labeled countries are in orange.



Sources: WorldBank, Digital Evolution Index component scores

Innovative companies in these countries have been crafting solutions that accommodate society’s predilection for cash.

Indian businesses lead this trend: They have found that allowing consumers to touch and feel the product before paying up helps build consumer trust in e-commerce.<sup>6</sup> Gaining this trust at an early stage becomes particularly important in a country with a young population that has yet to reach the height of its purchasing power. Indian companies such as Flipkart and Snapdeal offer cash on delivery (COD) options. In fact, 50 percent of Snapdeal’s transactions use this payment method.<sup>7</sup> Amazon also localized its approach in India to offer COD as a service. Startups such as Delhivery that offer fulfillment and last mile services across India, including COD reconciliation and remittances<sup>8</sup>, have been garnering investor interest.<sup>9</sup>

Other companies outside India offer similar services. Kaymu, an online marketplace in more than 20 countries in Africa and Asia and Lazada, an online retail giant in Philippines, both offer COD as a mode of payment.<sup>11</sup> Indeed, consumers have a high preference for the COD mode in many of the fastest-moving economies in our index.

Cash on delivery is not the only alternative payment model. The Indian Internet and technology company Sify allows customers to pay cash offline for e-commerce transactions at its browsing centers; 90 percent of the center's transactions are paid for in this way.<sup>12</sup> In Indonesia, bank transfer via ATM is emerging as the preferred payment method. To accommodate this, a majority of online portals allow a 24-48 hour payment window, after which the transaction is automatically cancelled.<sup>13</sup>

Cash is here to stay for the short to medium term in many emerging economies and digital marketplaces that make room for cash in their models will gain market share and consumer trust. Investors are funding startups that are innovating around cash in e-commerce, to shorten the cash cycle for merchants and to make cash transactions faster and safer.<sup>14</sup> Such innovations will reinforce consumer preference for dealing in cash, entrenching cash further in the digital economy of the emerging world.

### By contrast, fast-moving China is embracing digital money.

Third-party payments are becoming increasingly competitive, partly thanks to the proliferation of phone apps. Alibaba, Baidu and Tencent, China's three tech giants, are continuing to add features to their online payment systems that link finance, e-commerce and social media.<sup>15</sup> As a result, China's total m-commerce revenue was estimated at \$3.7 billion in the second quarter of 2014 alone.<sup>16</sup> Thus, while India, Indonesia, Vietnam and other fast-moving markets are entrenching cash in their digital economies, China is moving firmly in the other direction.

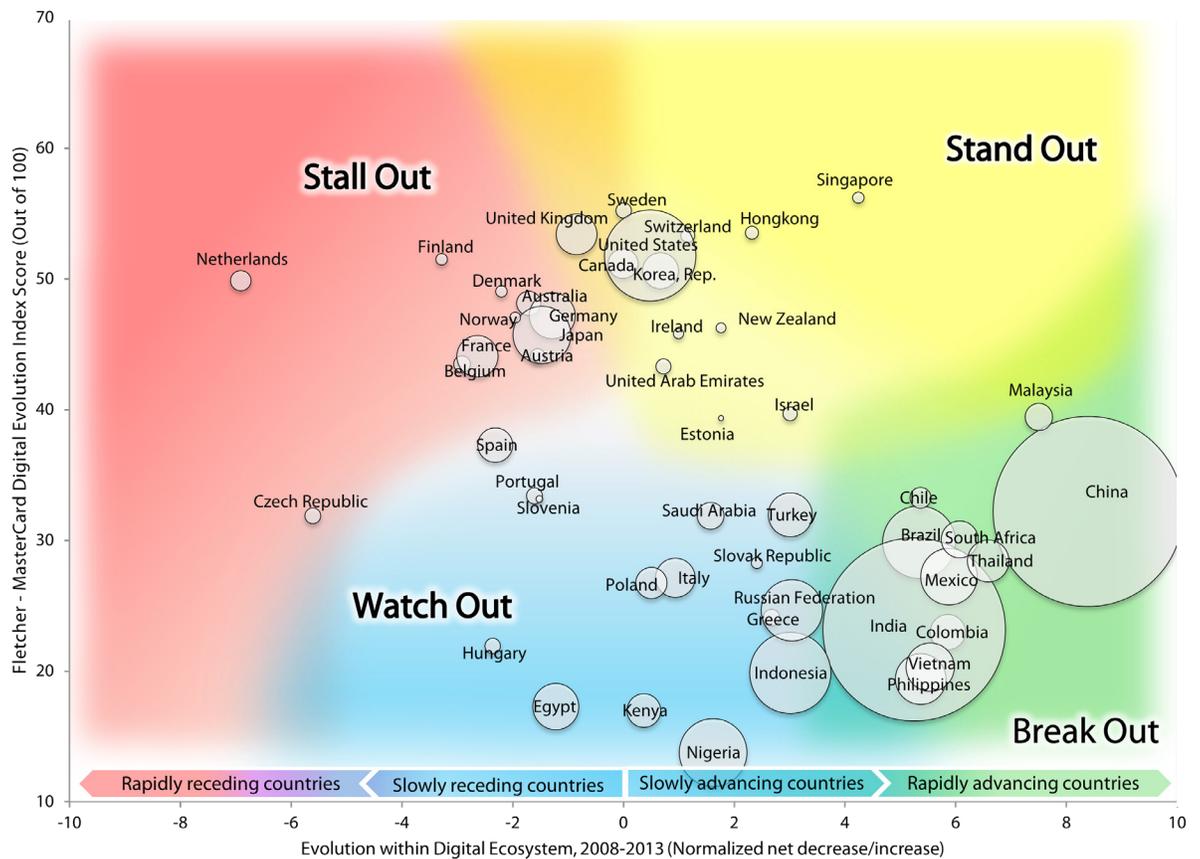
### 3.4 Untapped potential: attractive demographics and underinvestment

#### Young, large and growing

Some of the countries that appear in the Break Out zone and on the cusp are also some of the world's most populous nations, including China, India, Mexico, Indonesia, Brazil and the Philippines. Figure 10 shows the relative population size of these countries. Since all our components that measure demand are calculated on a per capita basis to allow for comparability, the growing per capita demand score multiplied by the size of populations reveals immense demand potential. The existence of this potential begs a key question: Are investment dollars chasing these attractive demographic segments?

**FIGURE 10: TRAJECTORY CHART AND POPULATIONS**

*Almost half of the Index's population lives in Break Out countries*

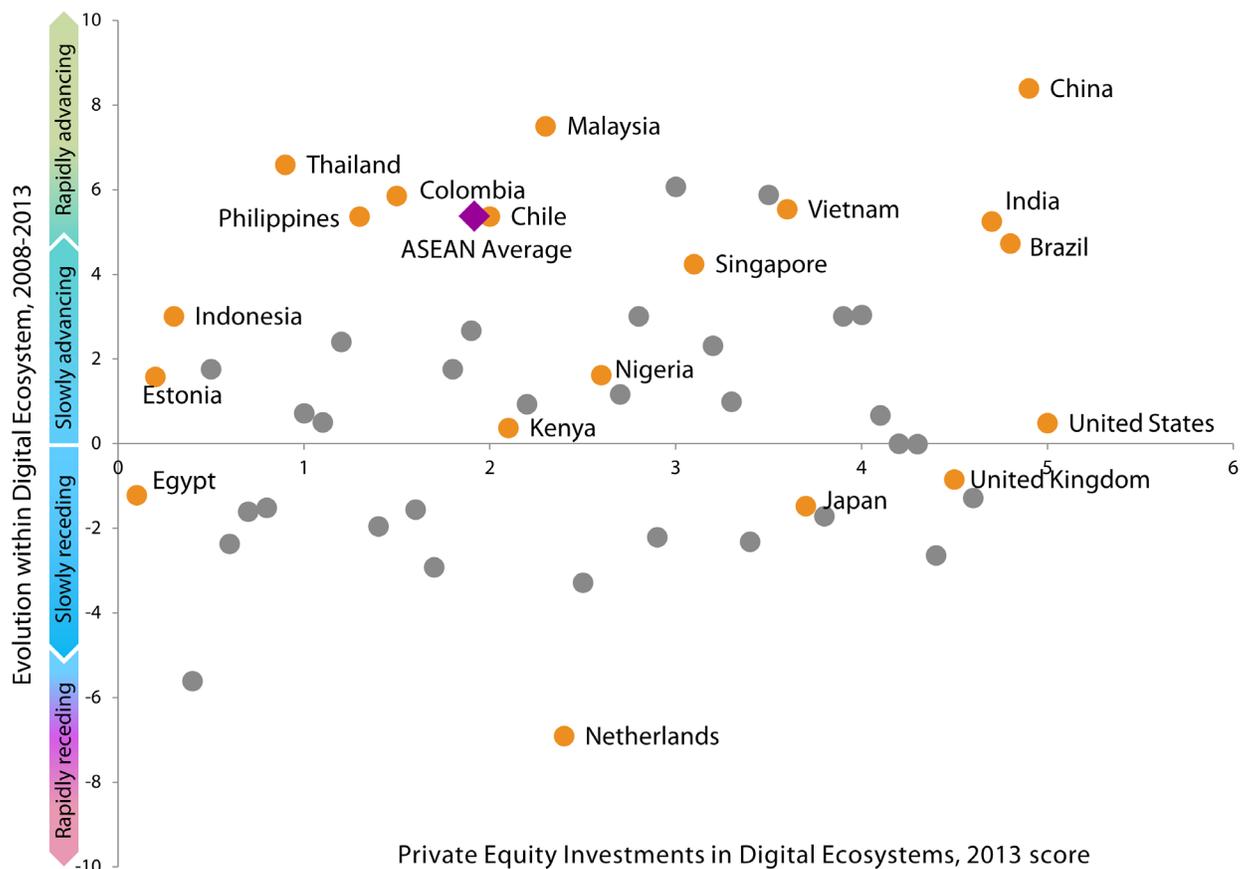


### Under-invested high momentum markets

The analysis of private equity investments in digital ecosystems, our proxy for the overall state of investment in a country's digital economy, reveals that the most populous nations such as India, China and Brazil are attracting the highest share of investment dollars. At the same time, mid-sized and smaller countries that are evolving quickly and have a young, growing population are left underinvested. As shown in Figure 11, countries such as the Philippines, Chile, Colombia, Thailand and Malaysia are evolving quickly despite much lower investor interest. The ASEAN nations should be particularly attractive to investors due to growing opportunities associated with their increasingly integrating common market and their high momentum.

**FIGURE 11: PRIVATE EQUITY INVESTMENT IN DIGITAL ECOSYSTEMS**

Countries with low private equity investment but high trend score represent big future opportunities for investors. All 50 countries are plotted, labeled countries are in orange.



Sources: Dow Jones VentureSource and EMPEA

### Growing demand sophistication driving digital growth in South America

South American countries in the Index have witnessed remarkable growth in digital services and usage. With 85 percent of the population expected to have a mobile connection by 2015, Brazil is a Break Out country ranked as the 11th fastest-moving economy in our Index. Today, Brazil is the center of e-commerce in the region, representing 59 percent of Latin American e-commerce revenues.<sup>18</sup> Further, Brazilian consumers are more likely than those in other South American countries to join social media and to use it for making online purchasing decisions.

While Brazil has attracted investor interest largely because of its population size, other Latin American countries are not drawing their fair share of investments. In spite of low private equity investment, Chile (another Break Out market) is ranked as the eighth fastest evolving country in the Index, due to strong growth in the Innovation and Demand drivers. Chileans, like Brazilians, are e-commerce veterans. More than 70 percent of Chileans have used a laptop or personal computer to buy online. 17 percent of online shoppers have been doing it for more than six years and 77 percent have been using it for more than two years. There is no need to acquaint these users with online markets; they already transact there.<sup>19</sup>

### Sparks of innovation amid political unrest in Africa

The four African countries in the DEI are among the most attractive consumer markets in the region. However, they represent some of the lowest scores in the Index, making the future prospects for e-commerce growth uncertain. Nonetheless, there are reasons for hope as well. Egypt, having gone through a tumultuous political period since the Arab Spring, has fallen 7 percent in its DEI score since 2008. However, it has strong growth in its Demand driver, backed by a young population. With businesses and consumers eager to exploit online opportunities, Egypt may have a bright digital future both in its domestic market and as a regional hub for the wider Arabic speaking Levant and North African region — if it is able to improve government policies, encourage innovation among its entrepreneurs and attract investors to improve its supply infrastructure. Businesses that are keen to take advantage of Egypt's pent up demand must be poised to act as the country stabilizes and find ways to operate with resilience and redundancy as the political situation changes. Egyptians themselves are becoming more digitally savvy, as displayed by the extensive use of social media during the Arab Spring.

Kenya, another Watch Out country, has also had economic and political challenges. It shows slow digital evolution despite important innovations, such as its M-Pesa mobile payment system that has become a benchmark for the rest of the world. M-Pesa, whose customer base accounts for more than two-thirds of Kenya's population,<sup>20</sup> lets people without links to formal banking systems conduct financial transactions via mobile phones.<sup>21</sup> Mobile is clearly a part of Kenya's digital future: In 2013, more than 31 percent of Kenya's GDP was spent through mobile phones. For businesses, this growth in mobile usage is an immense opportunity. With local businesses and consumers already comfortable with transacting on mobile phones and given its strong mobile payments network, Kenya's digital commerce prospects look bright.

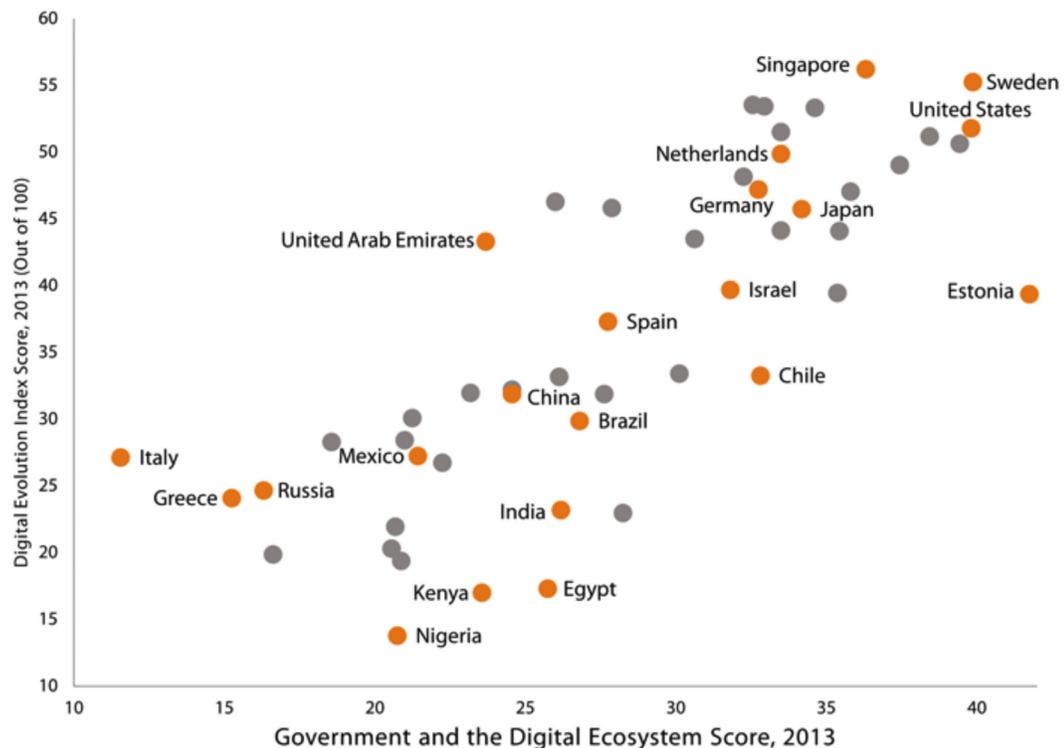
### 3.6 Institutions: Boosters or bottlenecks?

Policy and regulatory environments can have a disproportionate effect on e-commerce growth. Environments that promote rather than restrict the digital economy are a competitive advantage: Chile, Malaysia and Estonia are reaping the benefits of their forward-looking governments. By contrast, the lack of effective institutions can stymie the growth potential of e-commerce in some of the biggest emerging economies, including China, India and Brazil.

Figure 12 illustrates the impact of the “Government and the Digital Ecosystem” component, which measures government interaction with and regulation of the e-commerce and ICT sectors. This component correlates strongly with composite 2013 DEI score, though it is only one of three components in the Institution Driver (and each Driver is weighted 25 percent of the composite score). Countries such as Singapore, Sweden, the United States, the Netherlands, Germany and Japan have all promoted competition and innovation and made many government services available online. All of them perform well on the “Government and Digital Ecosystem” component and score well overall. On the other end of the spectrum, countries such as Nigeria, Kenya and Egypt all perform poorly on this component and have a corresponding low composite score.

**FIGURE 12: GOVERNMENTS AND THE DIGITAL ECOSYSTEM**

*Governments that promote digital growth do well in their overall DEI score.*



Estonia's careful government stewardship showcases the positive role that institutions can play in digital advancement. Since regaining independence in 1991, Estonia's government has promoted the latest technology, choosing to integrate IP telephony instead of cheaper switchboards, adding chip identification to national ID cards and expanding WiFi and mobile Internet to cover the entire country. It has managed to develop an integrated and seamless digital health record system that surpasses that of the UK. As a result, Estonia now ranks 11th in Institutional Environment score and 24th overall.

### Outliers

Even though the Institutional Environment driver as a whole is relatively stable or improving in many countries, there are notable exceptions. While Egypt has declined the most — unsurprising given its recent political challenges — some developed Stall Out countries have also experienced worsening institutional environments. For example, Denmark's and Austria's scores decreased slightly in both the "Government's Digital Ecosystem" and "Government Policy Toward Businesses" components.

Interestingly, some countries remain in a Break Out trajectory, with strong increases in digital evolution, despite restrictive institutions. China is particularly notable; it is the most rapidly evolving country in the Index, yet has a highly limiting digital content regime, ranking 37th on the Institutions driver. China has seen profound growth of domestic Internet companies, while proving a hostile environment for foreign companies such as Google that want to follow Western digital content conventions. So far, China has succeeded in remaining attractive to foreign companies because of its significant demand growth, making some companies willing to deal with its restrictive regulations. Still, China typifies the challenge that countries with restrictive governments must face: By making themselves less attractive to foreign companies and investments, they must carefully grow their own domestic companies to meet and nourish the appetites of their citizens.

To date, it does not appear that the world is converging on a particular model of digital governance. Ongoing global e-governance discussions reveal that governments are generally pursuing three different approaches: the Chinese model of "orderly flow of information," the Russian model of "network control" or the Western model of "free flow of information" — or some combination of the three. It remains to be seen which, if any, of these models becomes dominant.

### Regional institutions matter as well

Institutions are not just important within a country's borders: Regional cooperation can allow countries to pool resources and expand both their digital capacity and reach. This goes beyond the "neighborhood effect" discussed earlier, in which some neighbors appear to have comparable evolution trajectories due to demonstration effects and shared cultural norms. The formation of the European Union has allowed the continent to move ahead on contentious issues where wider international agreement remains lacking. The EU has been a world leader in digital policy in the realm of cybercrime and consumer privacy, partly because of the strength of its coalition. Further, the European common market has provided smaller local markets with access to a wider consumer base and increased investment. While European states are evolving at varying speeds, there remains an important role for collaboration.

Similar patterns of collaboration are taking root in Asia. ASEAN's steps toward a liberalized economic zone within its 10-member bloc would create the world's seventh largest economy — ahead of India — with a combined GDP of \$2.4 trillion and a combined population of more than 620 million.<sup>22</sup> This promise of freer flow of goods, services, skilled labor and capital opens up opportunities for businesses and investors seeking an investment counterweight to India and China.

## 4. Emerging Implications

The Digital Evolution Index is a comparative framework that reveals how Supply, Demand, Institutions and Innovation Drivers are shaping the digital economy. Governments, entrepreneurs, businesses and investors would all benefit by considering the entire ecosystem rather than focusing on a single silver bullet. Businesses of all stripes — the players directly involved in the digital commerce ecosystem and the intermediaries and technology firms that cater to these players — tend to seek out opportunities to fill gaps between supply and demand: here they have the greatest leverage and payoffs in the short run. It is their ability to innovate and navigate institutional constraints — where their leverage is lower and the payoffs more distant — that will determine their economic success in the long run. For their part, governments and policymakers would do well to look to the best performers on the Index as models for improving their own institutional and infrastructural environments. Below are some of the observations for each of the evolution zones and actionable implications for actors — public and private — that emerge from our research.

### 4.1 Break Out Countries

**Break Out** countries such as India, China, Brazil, Vietnam and the Philippines are evolving rapidly. If their evolution rates sustain, these countries will emerge as strong digital economies. However, the next phase of growth is harder to achieve and requires a concerted effort across drivers by all actors concerned. The greatest challenges to growth and opportunities for improvement in the medium term in these markets lie in improving supply infrastructure and in nurturing sophisticated domestic consumers.

- **National Governments:** Easing bottlenecks in supply conditions ought to be a top priority. Policymakers and regulators would do well to create conditions favorable for private and foreign investors to step in and compete to improve the quality of digital and physical infrastructure. Upgrading ICT infrastructure and reach, deepening access to financial services and building transportation facilities that can cater to the needs of a growing population will help sustain high evolution rates.
- **Businesses:** Significant opportunities exist for businesses engaged with components of the supply driver, especially for telecom and ICT enterprises, financial services organizations and infrastructure firms. At the same time, entrepreneurs and businesses involved in consumer-facing digital commerce need to create, nurture and improve the quality of demand. Businesses in China and India offer an interesting contrast in demand sophistication and approaches to payment methods. In China, digital commerce players such as Alibaba and WeChat have made great strides in integrating mobile payment systems into their businesses, whereas in India, Snapdeal and Flipkart cater to the consumer's predilection for cash.

- **Investors:** Break Out markets are home to 3.35 billion people in some of the fastest moving countries on the DEI and provide a wide range of opportunities for institutional investors to improve supply conditions. The vibrant digital commerce space in these markets is ripe for private equity and venture capital investments. Owing to their large size, China, India and Brazil have garnered the highest interest from private equity players, while the increasingly integrating ASEAN economies, most of which are Break Out markets, have received relatively little private equity investment. ASEAN's integration and tariff harmonization will generate opportunities for the creation of regional marketplaces and delivery networks.
- **Regional and International Organizations:** With the exception of Singapore, most of the ASEAN members are in the Break Out zone. The ASEAN Economic Community, due in December 2015, will facilitate the free flow of goods, skilled labor and capital and is crucial to the overall development of the region. Rising protectionism in Indonesia could derail progress, however. The most populous nation in the region, it is lagging behind its neighbors on the DEI and has implemented measures in the recent past to restrict the free flow of labor and skilled workers. Collaboration at a regional level and a commitment to shared regional prosperity are paramount.
- **Areas for Public-Private Collaboration:** Financial inclusion remains a challenge in most of the Break Out markets. This is an area ripe for public-private partnerships. PPPs can also help plug the gaps in inadequate infrastructure, freeing up government budgets to attend to other pressing priorities.

## 4.2 Stand Out Countries

**Stand Out** countries have highly evolved digital ecosystems, with very competitive e-commerce markets supported by cutting-edge infrastructure and sophisticated domestic consumers. Sustaining upward trajectories at this level is difficult. To remain Stand Out markets, these countries need to continue to fast-track innovation and seek markets beyond their borders.

- **National Governments:** To remain on the cutting edge of digital innovation requires a highly skilled talent pool. Thus, governments of Stand Out countries would do well to invest in education and open their doors to highly skilled immigrants. Estonia leads on both counts. First graders learn coding skills in public schools and well before it joined the EU, talent from neighboring Denmark and Sweden collaborated with locals to set up Skype in the country. The United States, though a Stand Out nation, risks losing its edge given its lack of commitment to immigration reforms.

- **Businesses:** Digital commerce companies based in Stand Out nations operate in highly sophisticated and competitive home markets, but their domestic consumers number only 500 million. Hence, these businesses must seek out new markets to export their digital innovations. Israel, a nation famous for startups, leads the way on this. Israel's Waze Mobile, a geographical navigation app that can be used anywhere in the world, was bought by Google in 2013 for \$1.3 billion.<sup>23</sup>
- **Investors:** Given their sophisticated domestic markets, these countries are also home to investment funds that can and do invest in regional and global digital ecosystems, giving a boost to e-commerce globally. GIC and Temasek, Singapore's two investment funds, lead on this front, investing a combined \$3 billion into digital ecosystems and e-commerce firms during 2013–2014 in India, China and other markets.<sup>24</sup>
- **Regional and International Organizations:** It is in the best interest of these economies and their businesses to seek deeper regional economic integration with their neighbors, particularly in the case of businesses based in city-states and entrepôts such as Singapore, Hong Kong and Dubai. Stand Out countries would do well to take the lead in strengthening regional institutions and promoting the free flow of goods, services, labor and capital.
- **Areas for Public–Private Collaboration:** Staying in the Stand Out zone requires a tremendous amount of stamina. Private enterprise cannot do this alone, nor can governments — it requires collaboration between these groups. Businesses, governments and academics can and must create thought-leading initiatives on sustaining digital commerce ecosystems to avoid Stalling Out.

### 4.3 Stall Out Countries

As of 2013, most Western and Northern European countries, Australia and Japan have Stalled Out. The only way they can jump-start their recovery is to follow what Stand Out countries do best: redouble on innovation and continue to seek markets beyond domestic borders. Stall Out countries are also older and aging: attracting highly talented young immigrants could help revive innovation.

- **National Governments:** There is a tendency for Stall Out countries to lean toward protectionism. This is a mistake. Governments must renew their commitments to investing in the education of domestic talent and attracting highly skilled immigrants who can take advantage of the high quality ecosystems to restart the innovation engines. Reforming immigration laws and enabling businesses to hire foreign talent would help; it could also attract investors back into these countries.

- **Businesses and Investors:** Stall Out nations are home to an aging population of under 500 million. While language divides many of these countries, businesses could take advantage of increased regional integration and shared cultural norms to expand their markets beyond domestic borders. Common language and shared history could make it easier for businesses and investors in these economies to expand into former colonies that are emerging and frontier markets today.
- **Regional and International Organizations:** Stall Out countries generally score highly on institutional quality. These countries would do well to lend their institutional expertise to Watch Out and Break Out markets on creating and sustaining enduring institutions.
- **Areas for Public – Private Collaboration:** Jump-starting these Stalling Out economies cannot be the job of private enterprise or governments alone. These countries, more than any others, would do well to draw on the best minds from the fields of policy, academia and business to develop strategies to regain their Stand Out status.

### 4.4 Watch Out Countries

**Watch Out** countries are home to 2.5 billion people. The biggest among them — Indonesia, Russia, Nigeria, Egypt and Kenya — have in common institutional uncertainty and a low commitment to reform. The other distinguishing aspect of Watch Out countries is that they possess one or two outstanding qualities — predominantly demographics — that make them attractive to businesses and investors. These countries expend a lot of energy innovating around institutional and infrastructural constraints. Unclogging these bottlenecks would enable these countries to direct their innovations where they matter most.

- **National Governments:** A commitment to political stability and reform and to easing bottlenecks in supply conditions ought to be top priorities for these markets. Policymakers and regulators would do well to create conditions favorable for private and foreign investors to step in and improve the quality of digital and physical infrastructure. Upgrading ICT infrastructure and reach, deepening access to financial services and building transportation facilities that can cater to the needs of a growing population will help these economies move into the Break Out zone.
- **Businesses:** Significant opportunities exist for businesses that are involved with the components of the supply driver, especially for telecom and ICT enterprises, financial services organizations and infrastructure firms. Entrepreneurs and businesses will want to create, nurture and improve the quality of demand. Transparency of local businesses is a big concern for investors. Businesses in these markets would do well to learn from successful enterprises in Break Out markets on how to make themselves attractive to investors.

- **Investors:** The wide range of opportunities for improvement in supply conditions offer a great play for institutional investors. The nascent digital commerce space in these markets is ripe for private equity and venture capital investments. However, transparency and rule of law are major concerns that need to be addressed by governments before investors can step in.
- **Regional and International Organizations:** Despite their own institutional gaps, countries based in volatile neighborhoods, such as Egypt, Nigeria, Kenya, Russia and Saudi Arabia, are relatively better off than their neighbors. Each of them has the potential to be the anchor for a regional organization — some already are, albeit more implicitly than some others. Given the neighborhood effect, taking a leadership role in regional cooperation would benefit them and their neighbors. Some of these countries are already active in their regions in different ways. Nigeria is in ECOWAS and member of a West African monetary union. Saudi Arabia is a power broker in the Arab world and a member of the GCC. Egypt is the leading international player in its region — even brokering peace talks between Israel and Hamas. Kenya is the hub of all things digital in East Africa. Russia ... enough said.
- **Areas for Public–Private Collaboration:** Access to financial services remains a challenge in most of the Watch Out markets. This is an area ripe for public-private partnerships. PPPs can also help plug the gaps in the inadequate infrastructure, freeing up government resources to attend to other developmental priorities.

The Digital Evolution Index provides a deeper understanding of how the shifting digital landscape affects e-commerce growth and reveals surprising patterns and actionable insights. As we consolidate this initiative, we will continue to incorporate new countries and additional data points that capture the complexity of digital ecosystems, in order to share with stakeholders the insights we glean from digital evolution as it happens.

# Appendix

## Methodology

### 1. Structure of the Index

The Index uses 83 indicators to measure the state and quality of the digital ecosystem in a country. It is structured at four levels: indicators, clusters, components and drivers. Indicators are data points that answer a specific question. Clusters are a statistical grouping of indicators; they combine and capture information from several indicators to illuminate a particular aspect that impacts the digital economy. Combinations of clusters roll up to form components, which are the building blocks for the drivers. Components are built to provide a comprehensive understanding of factors that shape and define the drivers. Lastly, the four drivers encompass forces that influence a country's digital economy: Supply Conditions, Demand Conditions, Institutional Environment and Innovation and Change. The table below explains the structure of the Index with specific examples from the Demand driver and Financial Savviness component.

**FIGURE 13: SAMPLE OF INDEX STRUCTURE**

Question Answered	Indicators	Cluster	Component	Driver
How much formal credit is each consumer using, on average?	Consumer credit (per capita, pop. age 15+, PPP)	Savings and Credit Profile	Financial Savviness	Demand
Are people using formal financial institutions? If so, more likely to be willing to make and capable of making online payments.	Saved at a financial institution in the past year (% age 15+)			
Are people using formal financial institutions? If so, more likely to be willing to make and capable of making online payments.	Account at a formal financial institution (% age 15+)			
Are people making electronic payments?	Electronic payments used to make payments (% age 15+)	Digital Money Savviness		
How often are people using the Internet for retail purchases?	RATIO: Internet retailing/ total retailing			

### 2. Indicator Selection

**We chose each indicator based on two major criteria:**

- a) Relevance: How vital is this data point in understanding the drivers of a country's digital economy?
- b) Data validity:
  - We chose variables from well-established data banks such as The World Bank and Euromonitor.
  - It was also essential that the data was available for all 50 countries across the six years in order to maintain a high level of data integrity.
  - We prioritized original data, instead of using data that had already been processed, analyzed and cited by other individuals and organizations.

Despite our best efforts, it was impossible to collect original, raw data for all 50 countries across all variables. In such rare cases, missing data points were statistically estimated.

### 3. Data Collection and Standardization

After collecting the raw data, we transformed these variables into a 0.1-to-5 scale in order to allow for the comparability of each indicator under the same cluster. For every country, each indicator was assigned a value between 0.1 and 5, based on the relative performance of that country as compared to the others on the Index.

Higher scaled scores (i.e., toward "5") indicate positive contributions to the digital performance of a country, but do not necessarily correspond to a higher raw data score. Example: For the indicator "Number of ATMs/100,000 people," a higher number of ATMs would indicate a better supply infrastructure and better digital performance for a country (thus a higher scaled score), whereas for the indicator "Time required to enforce a contract (days)," a higher number of days required to enforce a contract would reduce a country's ease of doing business and would thus impede digital performance, translating to a lower scaled score.

For certain variables, categorical 1-2-3-4-5 scaling was used instead of 0.1-5 scaling for two reasons. First, this reduced the bias from vast differences in raw data among countries by assigning countries with similar performance to the same category. Hence, countries with a range of scores that resulted in a similar performance for the indicator in question could be assigned the same categorical score. Second, a categorical scale allowed us to scale variables with qualitative answers. For example, for the Internet censorship variable, the values 3, 4 and 5 were applied to quantify survey responses that indicated "not free," "partly free" and "free" for the Internet transparency of a country.

All missing data was estimated prior to being scaled.

#### 4. Score Computation and Variable Weighting

After scaling and standardizing the indicators, we aggregated the scaled scores to the next level — a cluster score. Cluster scores were further cumulated to provide scores for components, which were again cumulated to provide the final driver scores. The four driver scores were then aggregated to provide the final score for each country. The countries were ranked relative to each other according to their final scores.

We used weighted arithmetic aggregation for each level of score computation. This procedure weights each of the variables that are being aggregated (indicator, cluster, component) and then combines the scores according to the weights. This had two primary benefits.

First, it reduces the possibility that any shortcoming in the value of one variable could affect the score at the next level or the final score of the Index; because multiple variables are aggregated to calculate the next level score, values of other variables compensate for any possible shortcomings in one variable. This allows us to track the behavior of countries according to a broad trend rather than according to the value of a single indicator. For example, to test how evolved a country is in spending money digitally, we track the behavior of that country through several indicators (percentage of electronic payments made, ratio of Internet retailing to total retailing and purchases made via smartphone) that contribute to a broader trend, in this case the cluster named “Digital Money Savviness.”

Second, a weighted arithmetic aggregation reduces the redundancy of the weighting process. All variables at each level (except for driver) were assigned a weight of either 0.5 or 1 through Pearson Correlation. Variables with a correlation coefficient over 0.5 (i.e., variables that were highly correlated with each other) were assigned a half weight instead of a full weight of 1. Hence, variables that were theoretically similar and demonstrated statistical correlation were assumed to be capturing similar information and were each assigned a half weight of 0.5 so that the score at the next level would not be inflated due to double counting the same information. For certain variables where a larger amount of missing data had to be estimated, a 0.5 weight was assigned to minimize concerns of data reliability. For some specific variables that were estimated, we assigned a quarter weight of 0.25.

Drivers were each weighted equally to determine the final score, because conceptually, all four drivers of Demand, Supply, Institutional Environment, and Innovation and Change represented different (but equally important) aspects that contributed to the evolution of a country’s digital economy.

### 5. Robustness Check

We validated the robustness of the model by running a Monte Carlo simulation. We verified the accuracy of the weighting process and determined how the weighting process affected the final index scores and rankings.

The Monte Carlo simulation comprised 10,000 runs, each corresponding to an assigned set of weights to variables at all levels (indicator, cluster, component). The weights were randomly generated from uniform continuous distributions centered in 0.5 and the range for the weights' variation was (0.1, 1) because the weighting systems used had a scale "0.5-1."

In general, the ranking of all the four drivers showed robustness while running the Monte Carlo simulation. Specifically, for the demand driver, the correlations between the ranks generated by using the assigned weights and the Monte Carlo simulated weights were around 95 percent (2008 to 2013). However, the behavior of Korea in the demand is greatly affected by the weights. The range of rankings calculated using the assigned weights and the simulated weights is as wide as 16. For the supply driver, the correlation coefficient is as high as 98 percent; the rankings of this driver were robust at the application of different weights. Similarly, we also found the other two drivers, Institutional Environment and Innovation and Change, to be robust during calculations using assigned and simulated weights.

### 6. Model Limitations

The model we created captures data from secondary sources only. The lack of primary data is balanced by second-hand sources that are of high credibility and ones that have publicly established their data collection methodology.

The Index showcases the progress of whole countries, rather than cities or urban agglomerations. While the availability of country-level data makes measuring digital evolution at a national level possible, cities are known to evolve faster than other rural areas in the country and tend to offer higher growth opportunities for businesses and investors. Unfortunately, owing to paucity of data at a city-level, this dynamic of urban progress is not captured in our index.

As with any model and despite our best efforts, the Index is not all encompassing. We chose indicators that addressed certain questions we asked ourselves about the digital economy of a country; however, as this is a developing landscape, there is always scope for additional questions. For example, under the Supply Driver and the Fulfillment component, the indicators we chose only address questions of product delivery, not of product storage and packaging.

Despite our best attempts to find data for indicators across all 50 countries and six years, there were instances where data was incomplete or unavailable. In such cases, we had to estimate data for the missing years and countries. In general, indicators that had missing data were weighted less (0.5 or less) to mitigate the effect of estimation on our final results and to reduce inaccuracies. This limitation is particularly relevant for the Innovation and Change driver of the Index, as described below.

The Innovation and Change driver (and specifically the Extent of Disruption component) comprises data from Google that was largely incomplete. Data was only available for the years 2012-2013. Because much of the data was missing and estimating data for 4 years would have diluted our data integrity and accuracy, these indicators with missing data were left out in score estimations of earlier years. The theoretical rationale behind this is that by definition the Innovation and Change driver should capture improvements in ways of capturing information and that adding new indicators and data as they become available is a true representation of the changing digital landscape of a country. However, this addition of indicators from the year 2012 is reflected clearly in the Innovation and Change driver score; from 2012 onward there is a slight dip in the score of the Innovation and Change driver across all 50 countries. This dip in the driver score is also mirrored in overall scores since the Innovation and Change driver is the most volatile of all drivers and the final index score is sensitive to volatility (i.e., movement in scores across time).

Therefore, although users of the Index will notice a slight dip in Innovation and Change driver scores and overall scores from 2012, this is due to the addition of a new indicator (and a better way of measuring extent of disruption) rather than any worldwide external factor causing a deterioration of the digital economy globally. Furthermore, the reflection of this dip in driver scores in the overall score is due to the sensitivity of the Index score to the most volatile driver (i.e. the driver that changes its score most across the 6 years). We expect that as we continue to collect data for future years, the scores will level out and look smoother.

- 1 "Number of Internet Users (2014) - Internet Live Stats" < <http://www.internetlivestats.com/internet-users/>>
- 2 Ibid
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