Harnessing the Power of Connectivity

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Mapping your transformation into a digital economy with GCI 2017

global connectivity index

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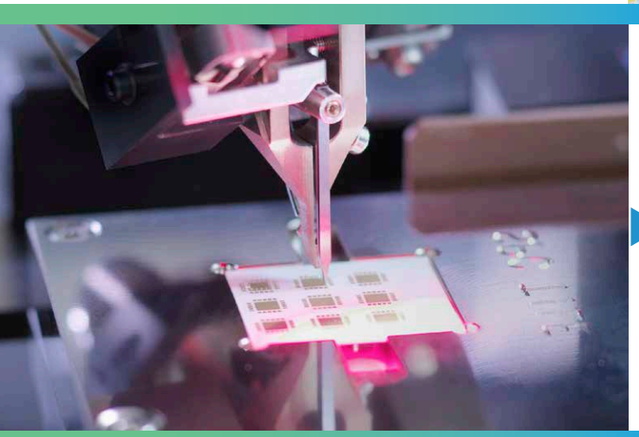
ICT Infrastructure, with Cloud, triggers a chain reaction to sustainable growth



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Foreword

A Roadmap to the Digital Economy

For policy makers and industry leaders who are new to the Global Connectivity Index (GCI), it is an annual, comprehensive report that gauges nations' status in ICT Infrastructure investment, adoption, experience and future potential as they work toward the Digital Economy. This well-recognized tool compares the progress of 50 nations across three stages of development: Starters, Adopters, and Frontrunners.

As the Global Connectivity Index (GCI) 2017 report goes to press and the web this year, we are seeing government policy makers and industry leaders around the world scramble to develop a roadmap to the Digital Economy.

Their sense of urgency is understandable. This year is shaping up as a time of uncertainty. Talk of protectionism and trade wars naturally rattle anyone responsible for developing long-term ICT plans for even the smallest company, no less a national economy.

In its fourth year of publication, what is different in 2017 is the investors' perspective. Today's conventional wisdom on Digital Transformation is that broadband connectivity is no longer the ultimate goal. Broadband was the path to fast internet access and moving business into global e-trading. But it is now viewed as simply the first step to build ICT Infrastructure, a platform to deploy the other four core technologies namely: Cloud Services, Datacenters, Big Data and the Internet of Things. ICT Infrastructure, especially due to the fact that it enables Cloud capabilities, is the gateway to the Digital Transformation reshaping a nation's industries, companies and the way people live and work.

Another key focus of this year's report is global inequality. This year could conveniently be characterized as a meeting of "digitally-developed and digitally-developing" nations – an evolution from the "digital have and have-nots" of previous years. The idea can be explained by the "Matthew Effect" where "the rich get richer and the poor get poorer".

The growing gap among nations at the top and bottom of the GCI rankings will have significant consequences in future if not dealt with today. At the cutting edge of the Digital Economy, nations with access to advanced ICT are innovating new business models and prospering as developing nations lag behind and struggle to stay competitive. But the research also makes clear that opportunities remain for nations at all stages of development. Those that make even modest investments to expand broadband use and gain access to Cloud capabilities have the potential to create innovative new business models, products and services.

With that in mind, the GCI provides policy makers with intelligence and actionable insights on how best to leverage ICT Infrastructure to help their nations develop innovative approaches to build sustainable economic growth in a hyper competitive global market. Our hope is that policy makers at every stage of the Digital Economy will find the GCI 2017 report a valuable benchmark and guide to develop a roadmap for Digital Transformation.

Executive Summary

THE GLOBAL CONNECTIVITY INDEX: Every GCI Point Matters

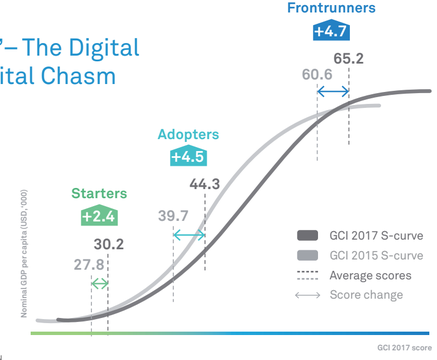
Today, we are witnessing the fastest pace of change the world has ever seen. The global economy is being transformed and that change can be daunting. But this is also a moment of great opportunity to thrive. ICT Infrastructure, especially connectivity, plays an increasingly critical role in driving sustainable growth and prosperity. With that in mind, the annual Global Connectivity Index (GCI) 2017 is designed to provide policy makers with a 360-degree view of the Digital Economy, supported by useful data and actionable insights needed as they transform toward the Digital Economy.

Benchmarking and tracking the progress of 50 nations in the Digital Economy, the index analyzes 40 indicators, and points to progress made by the interplay of investment, adoption, user experience and future potential of ICT. As such, the movement of even a single GCI point is a significant reflection of a nation's progress toward a Digital Economy.

THE CHALLENGE

The "Matthew Effect"– The Digital Divide Becomes a Digital Chasm

The GCI's S-Curve plots 50 nations' progress in Digital Transformation, grouping them into three clusters based on their GCI scores: Starters, Adopters and Frontrunners. **This year, a three-year observation of the GCI data reveals a widening S-curve, indicating deepening inequality.**



The numbers tell the story: In GCI 2017, Frontrunners pulled far ahead, improving their GCI scores by 4.7 points, and Adopters by 4.5 points. But the Starters lagged farther behind, improving their GCI score on average by only 2.4 points. We are witnessing an ICT version of sociology's "Matthew Effect," where the "rich get richer and the poor get poorer" based on accumulated advantage over time. **Policy makers in the Adopters, and especially in the Starters, must consider the growing inequality as it will have continued consequences on their ability to compete and sustain economic growth.**

Digital Economy Heatmap

Top Four Movers
GCI 2015 – GCI 2017

Malaysia ▲ 5

Promoting the Digital Maker movement and incubating a startup ecosystem called Malaysia Digital Hub.

New Zealand ▲ 3

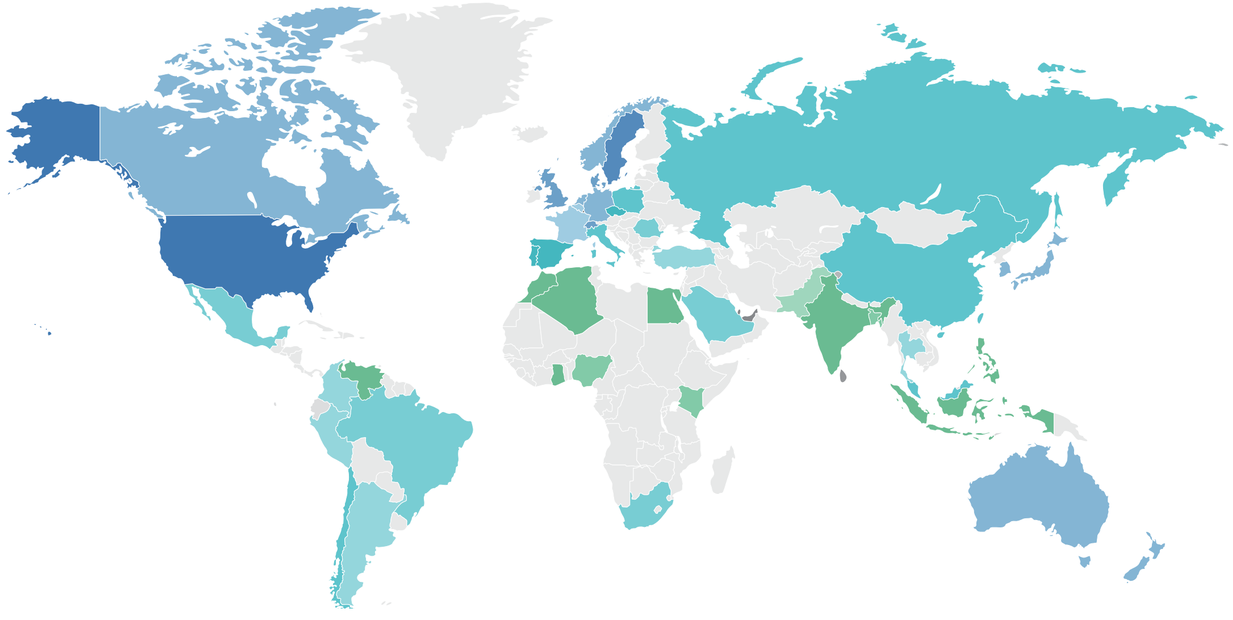
Fiber optic and 4G coverage continue to grow at a remarkable rate. National ICT plan is to be 'digital by default' in 2017.

Chile ▲ 3

4G LTE will account for over 60% of all mobile connections by 2020, creating opportunities for Datacenters and Cloud Services for industry.

Argentina ▲ 3

A large-scale National Broadband Plan is currently underway, focusing on extending broadband services to 1,200 rural communities.



STARTERS ■ ADOPTERS ■ FRONTRUNNERS ■

20 35 56 85

Average GDP Per Capita: US$3,000 | GCI score: 20-34

These countries are in the early stage of ICT infrastructure build-out. Their focus is on increasing ICT supply to give more people access to the Digital Economy.

Average GDP Per Capita: US$15,000 | GCI score: 35-55

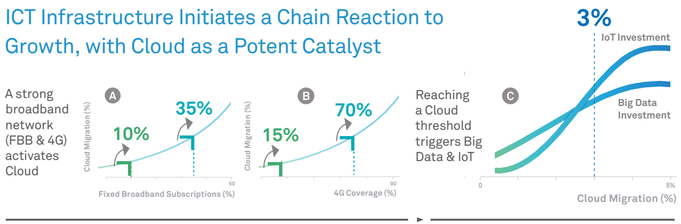
Nations in this cluster experience the biggest GDP growth from ICT Infrastructure. Their focus is on increasing ICT demand to facilitate industry digitization and high-quality economic growth.

Average GDP Per Capita: US$50,000 | GCI score: 56-85

These nations are mainly developed economies. They continually boost user experience, and use Big Data and IoT to develop a smarter and more efficient society.

THE SOLUTION

ICT Infrastructure Initiates a Chain Reaction to Growth, with Cloud as a Potent Catalyst



The Frontrunners' growing advantage is based on a head start in ICT Infrastructure deployment as well as expertise in five core technologies: Broadband, Datacenters, Cloud, Big Data and IoT. The GCI data show that investment in ICT Infrastructure initiates a chain reaction leading to Digital Transformation, with Cloud as a catalyst for that reaction.

Cloud adoption first requires a strong and accessible broadband network to be in place. Through correlations of GCI data, the following thresholds are observed:

A **Fixed Broadband Subscriptions**: As Starters' **fixed broadband subscriptions reach 10%**, they compete with Adopters' Cloud capability. As Adopters' **fixed broadband subscriptions reach 35%**, they reach the level of Frontrunners' Cloud adoption rate.

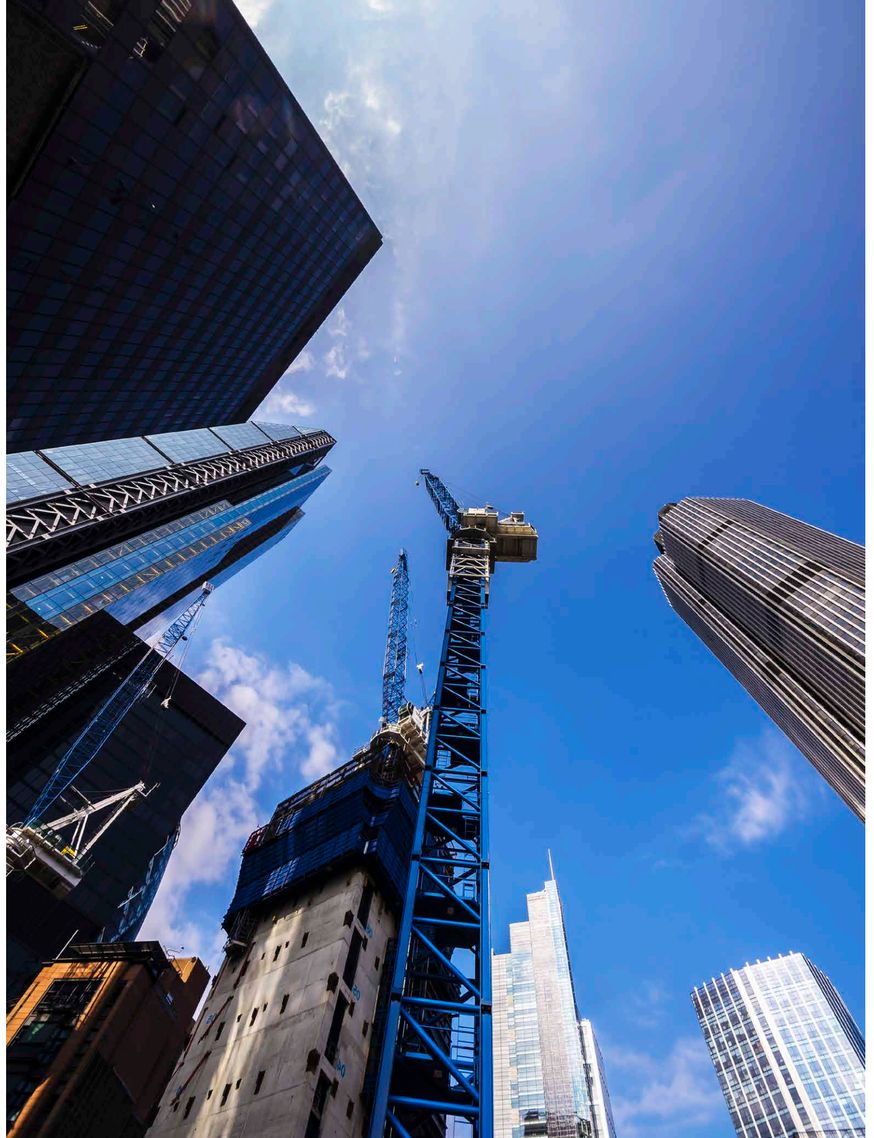
B **4G Coverage:** As Starters achieve **15% 4G coverage,** they can compete with Adopters' Cloud adoption rate. At **70% 4G coverage,** Adopters can compete with Frontrunners' Cloud adoption rate.

C Once deployed, Cloud acts as a catalyst accelerating the time for a nation to tap the economic benefits of Big Data and IoT – ultimately leading to growth and prosperity. **According to GCI data, when a nation reaches 3% of its total IT spending on Cloud it begins to effectively use Big Data and IoT capabilities.** This is a threshold that separates the Frontrunners from the rest.

THE IMPACT

Law of Increasing Returns for ICT Infrastructure Investment – Every Additional US$1 Invested Could Yield Up to US$5 in GDP Growth by 2025

A nation that makes an additional 10% investment in ICT Infrastructure, from 2016 to 2025, can benefit from a multiplier effect on that investment. Using this economic impact model, we find that every additional US$1 of ICT Infrastructure investment could bring a return of US$3 in GDP at present, US$3.70 in 2020 and the potential return increased to US$5 in 2025. This equates to an accumulative US$17.6 trillion in GDP to boost the global economy by 2025. In real terms, the potential impact is equal to about the size of the European Union's GDP in 2016.



COUNTRY RANKINGS

50 nations and how they rank in a connected world

Country Rankings

	Frontrunners	SCORE
1	United States	77
2	Singapore	75
3	Sweden	73
4	Switzerland	69
5	United Kingdom	67
6	Denmark	66
7	Netherlands	64
8	Japan	64
9	South Korea	64
10	Norway	62
11	Australia	62
12	Germany	62
13	New Zealand	61
14	Canada	60
15	France	59
16	Belgium	58

	Adopters	SCORE
17	Spain	52
18	United Arab Emirates	52
19	Portugal	51
20	Czech Republic	50
21	Italy	49
22	Qatar	48
23	China	47
24	Malaysia	46
25	Chile	46
26	Russia	45
27	Poland	45
28	Romania	44
29	Saudi Arabia	44
30	Brazil	43
31	South Africa	41
32	Mexico	41
33	Thailand	39
34	Colombia	39
35	Turkey	38
36	Argentina	37
37	Peru	36

	Starters	SCORE
38	Philippines	34
39	Egypt	34
40	Indonesia	33
41	Vietnam	33
42	Venezuela	33
43	India	32
44	Morocco	31
45	Algeria	31
46	Ghana	30
47	Kenya	28
48	Nigeria	28
49	Bangladesh	26
50	Pakistan	23

GCI Scores Improve Overall, But Some Nations See Uneven Results

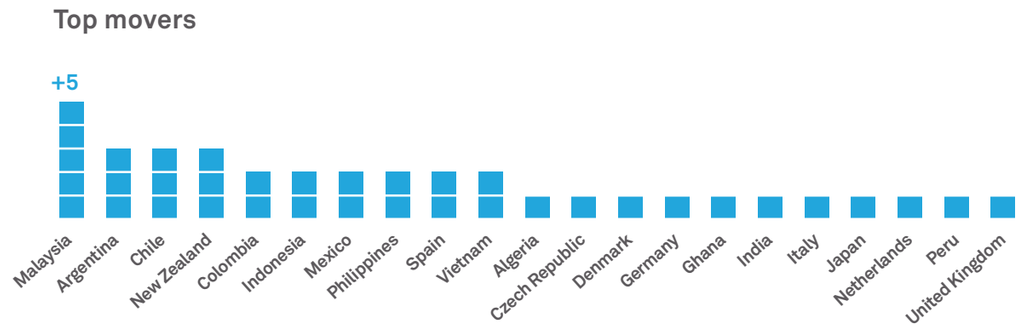
A comparison of GCI reports over the three-year period from 2015 and 2017 shows significant changes in country rankings. In the GCI 2017 report, most of the 50 nations in the rankings saw overall GCI scores improve. Frontrunners' scores held steady. The US continued to lead in ICT Infrastructure investment and held onto its top position in the rankings, with a score of 77 points. Singapore and Sweden trailed close behind the US, and over the past year closed the gap in rank with the US by two GCI points each. Among the Adopters, Qatar, China and Malaysia improved their GCI scores in part due to roll-outs of national ICT initiatives. Over the past three years, the GCI scores of all the Starters also improved, with the Philippines, Indonesia and Vietnam leading the Starters' cluster in 2017.

At the same time, nations such as Australia, Brazil, Egypt, Poland, Romania, Russia and Thailand were able to reverse negative trends evidenced in the GCI 2016 report, in which they dropped in the rankings.

Overall, some 21 nations improved their rank from the GCI 2015 to GCI 2017. Malaysia made the most impressive showing during that time, climbing five positions. Other nations that showed progress were Argentina, Chile and New Zealand. Each of those nations moved up three positions in the rankings, while Colombia, Indonesia, Mexico, the Philippines, Spain and Vietnam all climbed up two positions.

Venezuela stands out as the nation that dropped 10 positions down the GCI ranks over the three-year period, due to that nation's ongoing political and economic crisis. Other nations that saw a significant drop in the GCI were South Korea, dropping four positions, as well as and Morocco and Romania, which each fell by three positions.

The Top Movers: Where ICT Infrastructure Pays Dividends



Top movers on the GCI share common attributes: Strong ICT Infrastructure investment, enhanced user applications and experiences, and a government policy environment that incentivizes national ICT development. Among all the top movers, the GCI data observes high performance in 4G coverage, broadband download speed, and notable progress toward deploying Cloud. From a policy perspective, governments of the top movers are prioritizing initiatives that aim to enhance citizens' experience with ICT.

Malaysia: A Rising Star in ICT Infrastructure

Malaysia's climb of five ranks should come as no surprise. The government has invested aggressively in improving its international broadband bandwidth, 4G coverage and Cloud over the past three years. The Federal Government has also worked closely with telecom service providers to improve network coverage and affordability. Malaysia's significant improvement can be attributed to citizens' increased usage and improved experience with ICT.

Additionally, Malaysia has also prioritized initiatives to encourage development of smart cities that encompass a broad range of Digital Transformation activities including: government services, education and transportation. At the same time, policy makers have initiated a range of programs that target local enterprises to promote the use of Cloud computing.

The overall ICT strategy that brings these activities together has enabled Malaysia to increase the contribution of its Digital Economy sector to account for 17% of its national economy in 2016, one of the highest in the world, according to the Department of Statistics of Malaysia[i].

Argentina: National ICT Initiatives to Promote Governance, Transparency and Inclusion

Argentina's broadband penetration is the second-highest in Latin America after Chile. In 2017, its score in 4G coverage and broadband subscriptions, both mobile and fixed, increased to meet the global average of all GCI nations. Argentina is promoting ICT deployment across the nation, with the goal of putting the state at the service of the people and encouraging "agile administration" – saving time and simplifying daily life for all citizens through simple online procedures. Multiple telecom service providers are investing in broadband for 1,200 rural communities to further strengthen the nation's economic outlook through connectivity.

ICT demand and experience aspects of Digital Transformation are central to Argentina's national strategy. Argentina aims to allow its citizens to leverage open data, collective knowledge and collaboration through an open, transparent and accountable government.

Chile: Significant Improvements in Broadband and Cloud Adoption

In Chile's case, major improvements were made in its international broadband bandwidth, 4G coverage, fiber optic and Cloud, as driven by priorities in its National Digital Plan and government collaboration with telecom service operators to expand coverage.

As part of the plan to advance digitalization, the government is aiming for full e-procurement and e-invoicing for all companies and citizens by 2018. This enables companies to upload monthly documents to a government e-portal sitting on a government Cloud Service, creating a volume of valuable data and making Chile an attractive location for Big Data services.

With Chile being one of the most technologically advanced nations in Latin America, it is becoming an attractive base that help create opportunities for local start-ups to develop apps and ICT solutions. This is an example of how investing in ICT supply enhances business' experience, productivity and global economic participation.

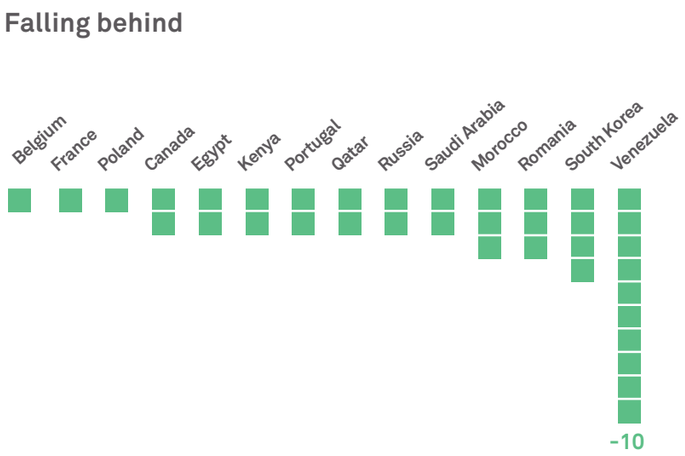
New Zealand: Monetizing Data Assets and Driving Innovation

In New Zealand, another fast climber up the GCI ranks, policy makers' focus has been on improving the nation's mobile broadband coverage through deployment of 4G, while at the same time driving Cloud migration and use of Big Data. Investment in these initiatives has resulted in significant improvement of New Zealand's GCI score thus improving its ranking by three positions.

The nation has also developed an experience-focused ICT vision for 2017 that covers building a more robust Digital Economy, in which all services will be delivered digitally and where information will be managed as an asset with economic value. As international broadband bandwidth and network reliability have been identified as potential bottlenecks for the program, network quality is a key area of focus.

New Zealand's efforts in digitalization of services have generated a significant amount of valuable data, which is proving to be fertile ground for businesses to monetize data assets and drive innovation.

Inadequate Growth Pulls Down GCI Ranking



Among nations seeing a drop in GCI rankings, the data identifies progress in investment in ICT fundamentals and build-out, but these nations are not yet investing, adopting and capturing the potential of advanced technologies including Cloud, Big Data and IoT.

- **Venezuela's** broadband expansion has remained relatively flat while others have moved ahead. Thus, Venezuela's mobile and fixed broadband subscriptions rates are below the Latin American regional average.

- A surprisingly slow mover in GCI 2017 is **South Korea**. Despite its impressive broadband, South Korea's performance in Cloud, Big Data and IoT has not grown as fast as nations at the forefront of the Frontrunner cluster hence the drop in ranking. This represents South Korea with opportunities to harness these technologies to drive growth through industry digitalization.

- Despite **Romania's** ICT Infrastructure scoring lower than the global average, it has made great improvement in broadband. This is an opportunity for Romania to shift focus to Cloud adoption to help businesses reduce heavy upfront investment in IT systems.

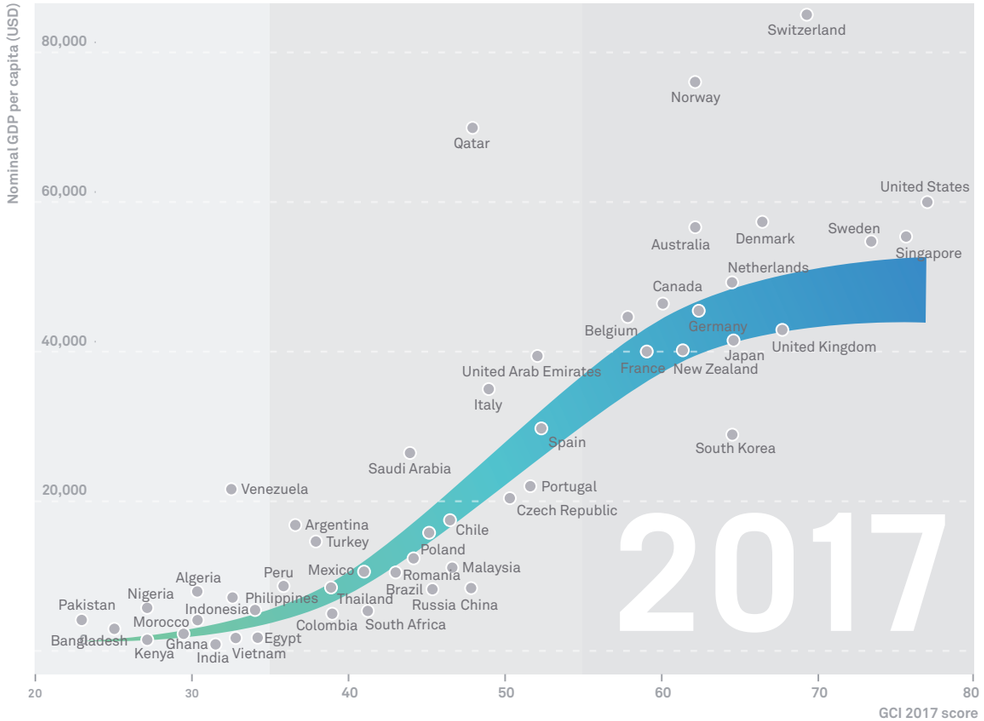
- Although **Morocco** has improved its GCI score in mobile broadband subscriptions and broadband download speed, it dropped three ranks since GCI 2015. Amidst ICT developmental challenges, the nation can expand citizens' broadband access – emphasizing knowledge teaching and supporting local telecom service providers to develop IT markets and potential.

THE CHALLENGE

A Digital Economy with growing inequality

The Challenge

Mapping the Digital Economy progress of 50 nations, the GCI 2017's unique data has turned up several issues we believe economic planners should give priority to in 2017. The 50 nations ranked in the GCI are plotted along what we call the GCI S-curve, illustrating the relationship between GCI score and a nation's GDP. Delineating development stages along the path to the Digital Economy, the S-curve illustrates three clusters of nations: Starters, Adopters, and Frontrunners.



STARTERS

Average GDP Per Capita: US$3,000
GCI range: 20 - 34

These nations are in the early stage of ICT infrastructure build-out. Their focus is on increasing ICT supply to give more people access to the Digital Economy.

ADOPTERS

Average GDP Per Capita: US$15,000
GCI range: 35 - 54

Nations in this cluster experience the biggest GDP growth from ICT Infrastructure. Their focus is on increasing ICT demand to facilitate industry digitization and high-quality economic growth.

FRONTRUNNERS

Average GDP Per Capita: US$50,000
GCI range: 55 - 85

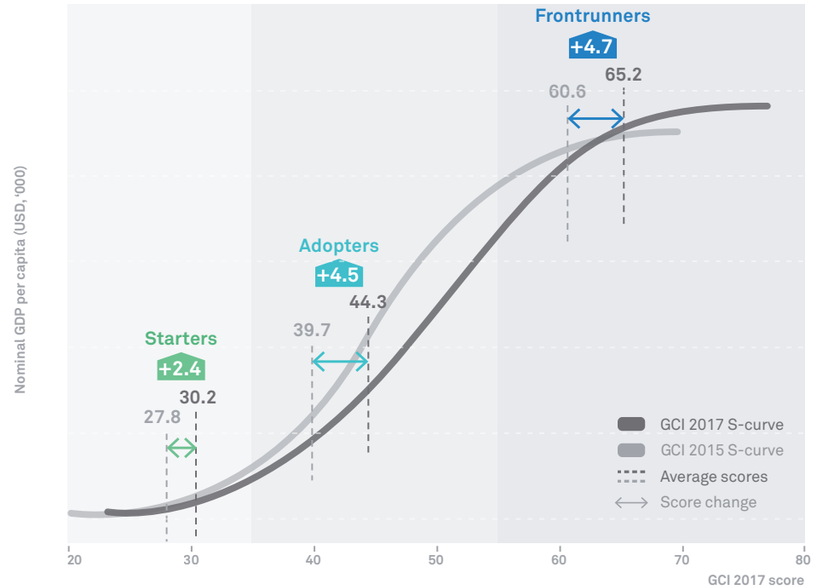
These nations are mainly developed economies. They continually boost user experience, and use Big Data and IoT to develop a smarter and more efficient society.

The Digital Divide Becomes a Digital Chasm

The challenge identified in the 2017 report is a growing GCI score gap among these clusters. That growing gap could have serious long-term consequences for nations that fall behind in ICT development necessary for Digital Transformation. It is well accepted today that Digital Transformation of government, industry, companies and society will have strong ties to innovation, productivity, economic growth, and education – in short, a nation's future success.

Along the S-curve we see that the gap between the US at the top and Pakistan at the bottom has expanded by 7.46% from 50.25 GCI points in the GCI 2015 report to 54 points in GCI 2017. That same time period saw average GCI scores climb from 43.3 to 47.3, representing a 9.26% GCI score growth. The expanding S-curve confirms an alarming trend of growing inequality among the three clusters.

An expansion of the S-curve (GCI score vs. GDP) shows the widening inequality between Starters, Adopters, and Frontrunners



The "Matthew Effect": The Rich Get Richer and the Poor Get Poorer"

By examining three years of GCI data, we see growing inequality, an ICT version of the "Matthew Effect" – the sociology theory that states: "the rich get richer and the poor get poorer." As the "Matthew Effect" suggests, groups or individuals that have an accumulated advantage over time not only succeed, but leverage their initial advantage to pull farther ahead of competitors.

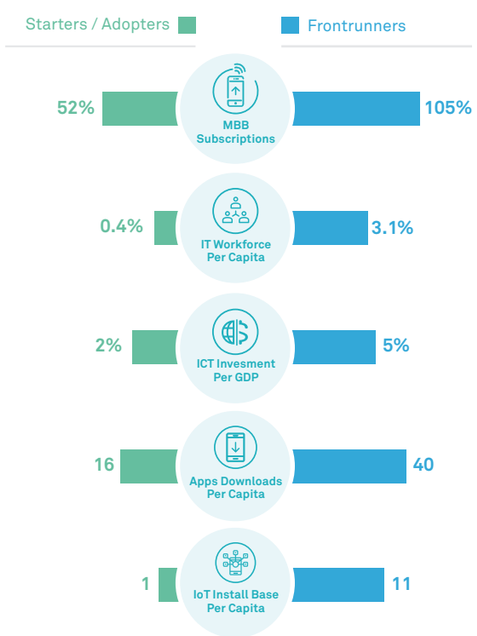
Policy makers need to understand that this widening digital divide will impact every sector of the economy and society. Nations that cannot build sustainable economic growth may also have difficulty in feeding, educating and providing job opportunities for their people. That raises questions of ICT Infrastructure's impact on global and regional stability, poverty, and a range of other downstream issues for nations that cannot adapt and compete in the Digital Economy.

Frontrunners' early and more extensive investment in ICT Infrastructure including Broadband, Datacenters, Cloud Services, Big Data and IoT has allowed them to build a solid platform for leveraging the power of these advanced ICT tools. This affects the rate of Digital Transformation for government, social institutions, and every sector of the economy. Leveraging the capabilities of Cloud Services, Big Data and IoT helped Frontrunners achieve an increase of 4.7 GCI score points from GCI 2015 to GCI 2017.

Following closely behind, Adopters experienced a lift of 4.5 points on average. While the top two clusters made important advances, the slower Starters fell farther behind in their ability to compete in the Digital Economy, with only a 2.4 point improvement in overall GCI scores.

Apart from the GCI scores, a look at the 40 indicators of the GCI 2017 report confirms that inequality among the three clusters remains a prominent issue for key areas including mobile broadband subscriptions, IT workforce per capita, ICT investment per GDP, apps download per capita and IoT installed base per capita.

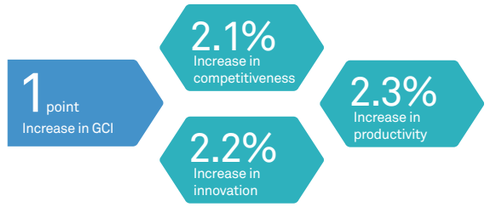
Inequality among the three clusters remains a prominent issue for key indicators



GCI Scores Link to Real World Effects

Government policy makers should be aware that GCI scores are not abstract numbers, but have a real-world effect on economic growth. If the change in these scores seems less than dramatic, consider that a movement in GCI score[ii] of only 1 point equates to: a 2.3% increase in productivity, a 2.2% rise in innovation and a 2.1 % increase in national competitiveness.

The significance of ICT Infrastructure investment



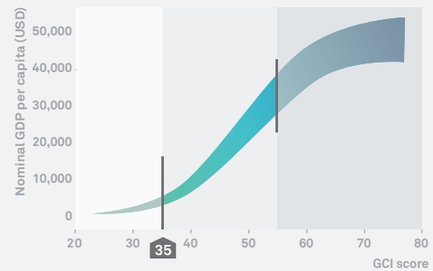
Improving GCI scores should be an important benchmark for policy makers, as development in ICT Infrastructure to achieve Digital Transformation influences every aspect of government, economic and social activity. In the future, successful policy makers will aim to reduce the inequality gap between their nation and the rest of the world by increasing ICT investment, formulating a more robust ICT policy, developing a more conductive regulatory framework and improving workers' digital skills.

A Silver Lining for Starters

The Frontrunners' accumulated advantage is based on a head start in investment capital and other resources that enabled them to deploy ICT Infrastructure earlier. Yet Starters at the low-end of the GCI S-curve should not be discouraged as GCI data confirms that when a nation's GCI score[iii] breaks through 35 points they yield a higher GDP improvement proportionately as they boost ICT investment. The 35 mark is the tipping point when Starters make the jump to the Adopter cluster.

What sets ICT investment apart from other investments is that the development can be revolutionary rather than evolutionary. Simply put, nations do not necessarily need to modernize their mobile networks from 2G to 3G, then from 3G to 4G to achieve the speed and bandwidth of 4G networks. They can simply modernize their 2G networks by leapfrogging – investing in a 4G build-out. Starters that invest more aggressively in ICT fast track Digital Transformation and improve their chances to move up to the Adopter cluster.

A multiplier effect



35 As the gradient of the curve shows, each point of increase in GCI beyond 35 has a greater effect on GDP than it does in the first or third cluster.

THE SOLUTION

ICT Infrastructure, with Cloud, triggers a chain reaction to sustainable growth

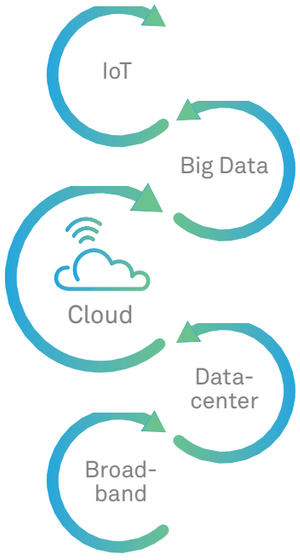
The Solution

ICT Infrastructure Initiates a Chain Reaction to Digital Transformation, with Cloud as a Potent Catalyst

In the last chapter, we saw the growing inequality that separates Frontrunners from Adopters and Starters as they move toward Digital Transformation. The GCI data shows that investment in ICT Infrastructure initiates a chain reaction leading to Digital Transformation, with the ability to level the playing field for all nations. By definition, ICT Infrastructure is comprised of five technology enablers: Broadband, Datacenters, Cloud Services, Big Data and IoT.

Each nation will face a unique set of local constraints, but the GCI observes that ICT Infrastructure can play various roles in reducing the impact of this inequality, as well as help realize the full potential of the nation's local resources and inherent advantages.

The Interplay of The Five Enablers in ICT Infrastructure



According to a nation's development stage, policy makers typically increase emphasis on different aspects of the ICT Infrastructure to maximize synergy among them, and reap the economic benefits of their interplay.

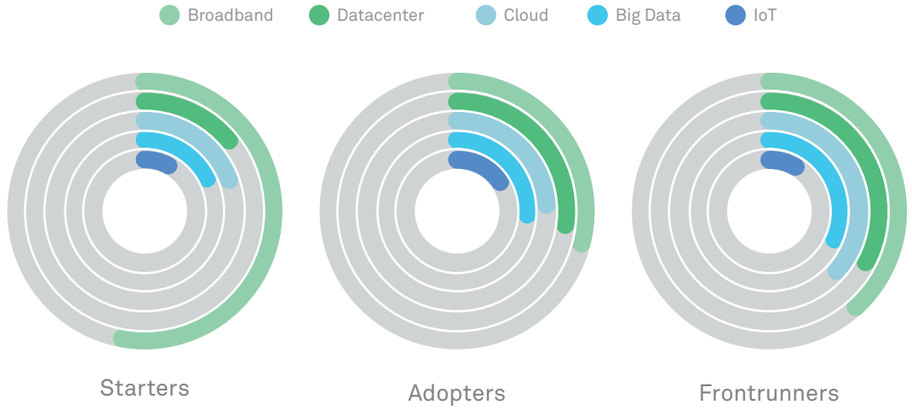
If we think of these technologies as the five steps to Digital Transformation; then broadband is the base. It's the first step to building an ICT Infrastructure. Broadband's original goal was to deliver high-speed internet connections for companies and individuals to engage in e-trading businesses and share information. Now broadband has taken on a broader roll: it is a platform for Cloud Services.

Broadband is the First Line of Defense Against the Inequality Gap

Broadband or high-speed broadband is the means to greater economic growth. For Starters, deploying broadband is a critical first step to ensuring economic viability in a hyper-competitive world. Broadband enables Starters to connect to the global market place to identify niche market opportunities suited to local conditions, ultimately to maintain growth. Whereas broadband capabilities enable Adopters to begin working with the Cloud to open a new range of economic opportunities. Both Starters and Adopters need to ensure that they have a robust broadband network in place to stay competitive. If broadband speeds are too slow, or access is limited, a nation is less likely to make progress toward the Cloud adoption that is the critical tipping point to achieving Digital Transformation.

Taking Frontrunners as an example, it's clear that they place high priority on high-speed broadband. Many Frontrunners have already deployed Gigaband as part of a national broadband network strategy. According to VIAVI's Gigabit Monitor,[iv] which tracks the state-of-play of gigabit internet around the world, more than 350 gigabit networks have been deployed. In the same vein, the private sector also sees broadband as one of the most impactful technologies. For instance, over 50% of Starters believe that broadband will have the biggest potential impact on business according to last year's GCI 2016 Industry Digitalization Survey which surveyed 3,000 firms across vertical industries. Similarly, Frontrunners continue to see broadband playing a vital role.

Technologies that companies believe will impact their business the most



The Real Payoff of Broadband Comes with Cloud Adoption

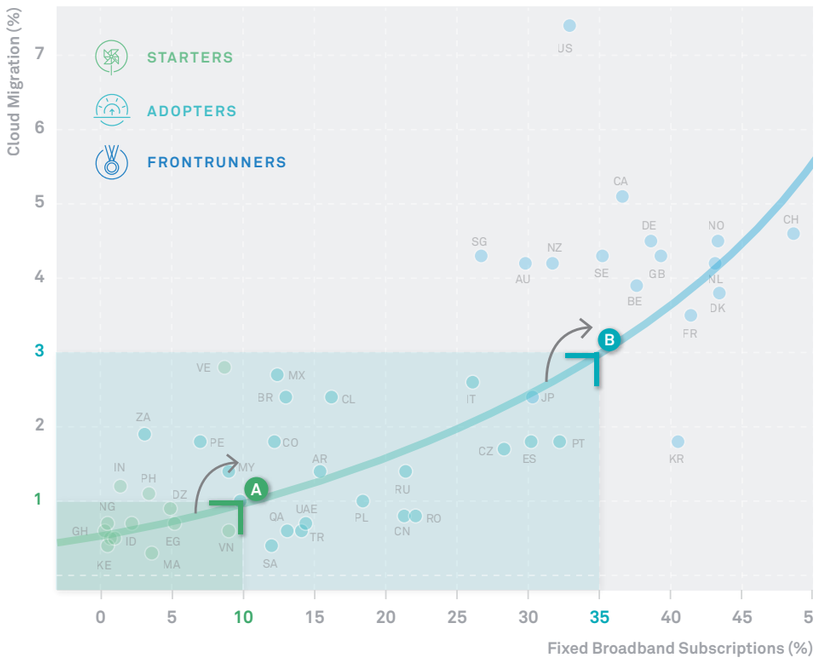
For Adopters and Starters, Cloud opens the door to innovation and sustainable growth. Compare this to the 1990s and early 2000s when internet access was the great equalizer igniting innovation and new business models. Cloud takes that to a whole new level. Yet, as we have seen, Cloud adoption requires a strong and accessible broadband network, fixed and/or mobile, to be in place.

In this year's GCI report, we identify tipping points based on specific goals tied to broadband capabilities and access. When reached, nations are enabled to effectively access the power of Cloud. Policy makers in the Starter and Adopter clusters need to be aware of the tipping points they need to reach to make Cloud accessible and a practical choice as they plan their ICT strategy.

Fixed broadband subscriptions:

- **Starters:** Reaching a threshold of 10% fixed broadband subscriptions enables them to take the first steps to incorporate Cloud use in their economic activities and compete with Adopters.
- **Adopters:** Reaching a threshold of 35% fixed broadband subscriptions enables them to enhance their first outings in the Cloud and develop more sophisticated Cloud-based businesses to compete with Frontrunners.

Increasing fixed broadband subscriptions encourages Cloud adoption



A **Threshold A:** When Starters reach a threshold of **10%** fixed broadband subscriptions, they could compete with Adopters' Cloud capability.

B **Threshold B:** Adopters reaching a threshold of **35%** fixed broadband subscriptions could be on par with Frontrunners' Cloud adoption rate.

4G coverage: In addition to fixed broadband subscriptions, GCI 2017 identifies 4G coverage as another indicator to encourage Cloud adoption. 4G has been shown to play a role in raising demand for Cloud use and Cloud based platforms across industries, companies and society.

- **Starters:** When Starters reach a threshold of 15% 4G coverage (as a proxy for wireless download speeds), they begin to compete with Adopters' Cloud adoption rate.
- **Adopters:** When Adopters reach a threshold of 70% 4G coverage, they move up to begin competing with Frontrunners' Cloud adoption rate.

Increasing 4G coverage encourages Cloud adoption

A **Threshold A:** When Starters reach a threshold of **15%** 4G coverage, they compete with Adopters' Cloud adoption rate.

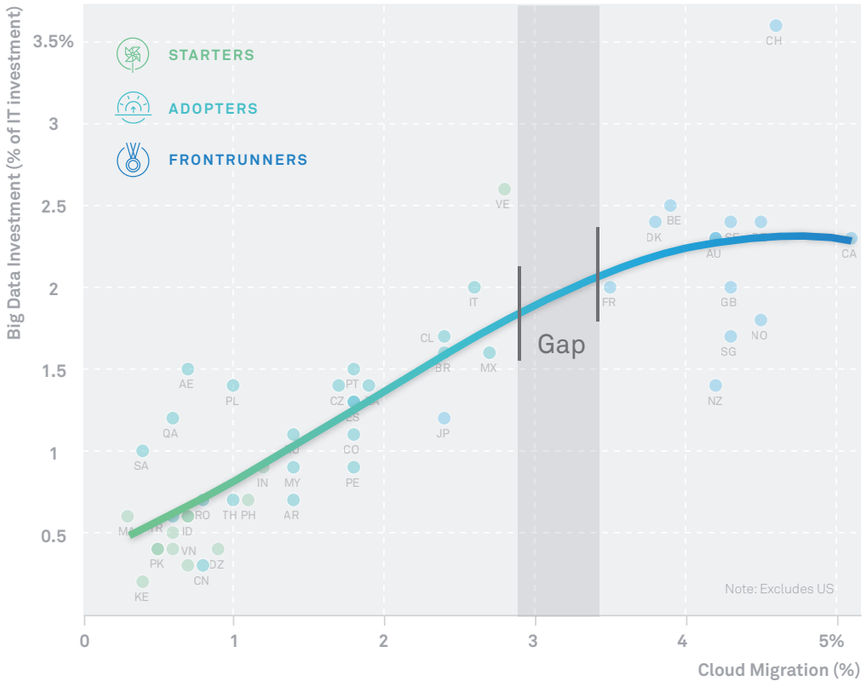
B **Threshold B:** Adopters reaching a threshold of **70%** 4G coverage could compete with Frontrunners' Cloud adoption rate.

Along the Five Technologies Stack, Cloud is a Potent Catalyst, and the Gateway to Big Data and IoT

As mentioned previously, GCI data shows that investment in ICT Infrastructure initiates a chain reaction leading to Digital Transformation. **Cloud is a key catalyst in the chain and opens the way to the business benefits of Big Data and IoT.** As with fixed broadband and 4G, GCI identifies a tipping point at which Cloud will drive the use of Big Data and IoT.

- **Cloud:** When Cloud adoption reaches more than 3% of total IT investment, a nation typically has reached the point where its government and industries can seize the full potential of Big Data and IoT capabilities. This is also the threshold where a Frontrunner separates itself from other clusters. This pronounced gap also echoes with a recent study[v] about IoT adoption barriers which discovered that 95% of government authorities rated "lack of funding" as a "major" or "very major" barrier to IoT adoption in nations across all the development stages.

Cloud adoption encourages Big Data investment



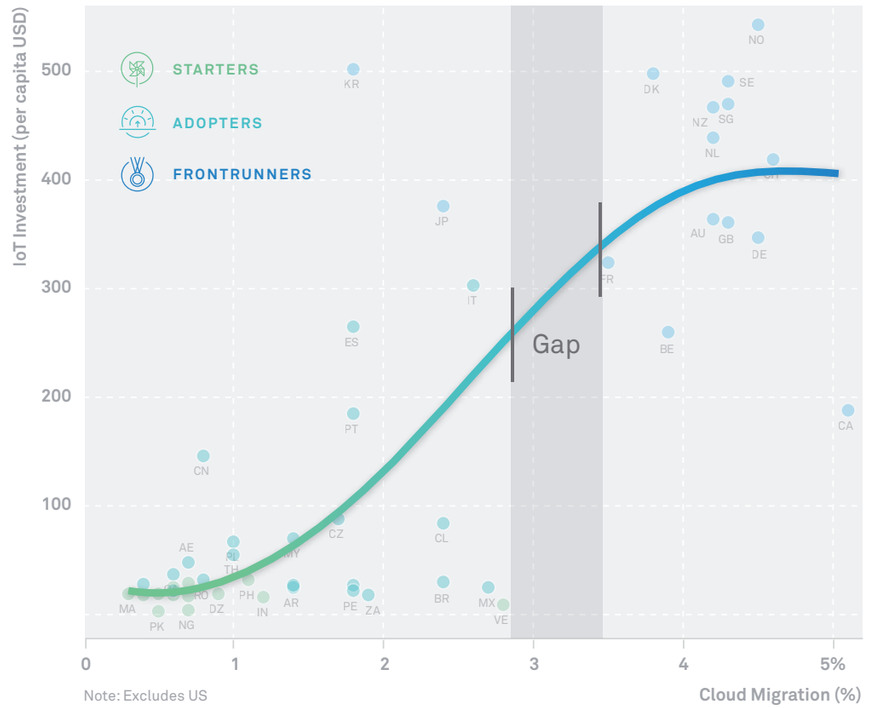
Once Cloud migration reaches a threshold of more than 3% of total IT investment, nations can seize the full protential of Big Data capabilities.

Cloud Enables Leapfrogging Along the Technology Stack

While Cloud capabilities support activation of advanced ICT Infrastructure, particularly Big Data and IoT, it is not just Frontrunners that can leverage that Cloud capability. In the face of the expanding chasm of inequality, Cloud's promise is to enable all nations, especially Starters and Adopters to innovate, and identify and create niche markets and opportunities. Cloud adoption removes significant obstacles for industries or companies from the Starters and Adopters to tap capabilities that allow them to punch far above their weight. Long-term forecasts are too often simply "guesstimates." What the GCI data shows us is that:

- **Starters** need to develop an ICT strategy to survive and drive economic growth. Policy makers need to prioritize investment in broadband and Cloud– if they have not already done so they need to move quickly. Both technologies will enable new business opportunities the Starters need to rely on to compete and grow. Policy makers must also be aware that broadband is not the end goal; it is the first step to access Cloud and the eventual promise and benefits of Digital Transformation.

Cloud adoption encourages IoT investment



Once Cloud migration reaches a threshold of more than 3% of total IT investment, nations can seize the full protential of IoT capabilities.

- **Adopters** must invest to enhance their broadband infrastructure to support Cloud adoption to remain competitive. Policy makers should not underestimate the important benefits of Cloud adoption for Adopters. The availability of Cloud Services without incurring significant up-front costs makes it that much more attractive in the near term. Cloud capabilities can be accessed without the need to set up local datacenter facilities. Software and services can be purchased on a pay-as-you-use basis. Employing Cloud Services will open the way for Adopters to transform their economies, to innovate and develop new business models and to deliver higher-level products and services to global markets.

- **Frontrunners** will go "all in" in investing in, and developing the power of Cloud, Big Data and IoT. In the foreseeable future, they will continue to dominate global markets based on their accumulated advantage in installed ICT Infrastructure, availability of investment capital, expertise and experience.

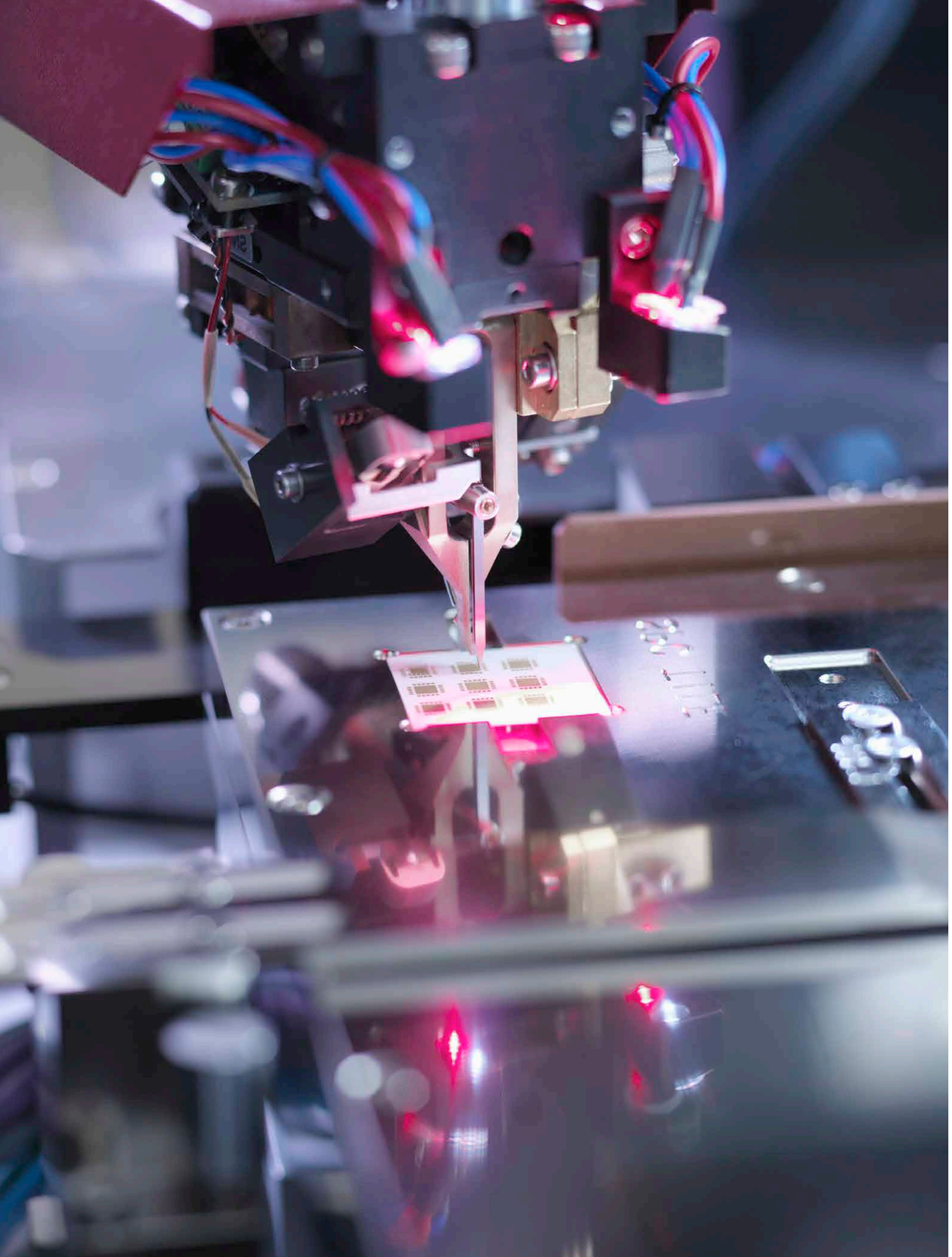
How the Cloud Delivers Benefits for Nations in All Three GCI Clusters

The impact of Cloud differs at various development stages: it promotes socio-economic benefits, enhances user experience and growth potential to create a sustainable growth cycle. This can be seen as the fuel that energizes a nation's industry, companies and people.

For **Starters** with a basic installed broadband infrastructure, most of that growth will stem directly from expanded access to broadband as companies increase their engagement with the global economy, create innovative business models, and gain access to new markets. Investing and rolling out broadband in a timely manner will be a key driver of economic growth.

The ideal strategy for **Adopters** is to focus on enabling wider access to Cloud Services across the economy. As Cloud adoption reaches the threshold to effectively deliver Big Data and IoT capabilities and benefits, it will have a profound impact on the global economy. Leveraging the multiplier effect that Cloud Services deliver, companies and people can innovate and transform into a knowledge-based economy and earn Frontrunner status.

Thanks to increasing investment, deployment and integration of Cloud Services, Big Data and IoT, **Frontrunners** are empowered to move faster and farther ahead to the cutting edge of innovation in 5G, artificial intelligence, smart cities, e-government, and smart manufacturing. These advanced technologies also help Frontrunners innovate, transform industries, launch companies and create jobs.



THE IMPACT

The road to increased returns through 2025

The Impact

The Law of Increasing Returns for ICT Infrastructure Investment to 2025: Every Additional US$1 Invested in ICT Infrastructure Over Time Can Yield Up to US$5 to GDP

Stagnant growth and deepening inequality are clouding the global economic outlook in 2017. In the last chapter, we pinpointed investing in broadband as the first step to tap Cloud capabilities. Once Cloud comes into play, it can deliver a chain reaction of Digital Transformation benefiting nations' industries, companies and individuals.

Some economists take a more cautious view. They argue that the impact of ICT Infrastructure investment on economic and industrial growth is more intangible as the effects may vary. Without solid economic growth indicators, there is little doubt that justifying a national ICT investment strategy poses one of the toughest challenges policy makers face.

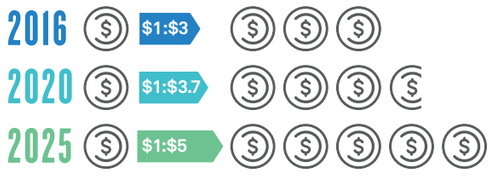
With that in mind, we have established a powerful correlation by examining the GCI 2017 data and numerous global economic forecasting models. The answer is here.

As global economies evolve over time, the economic dependence on ICT Infrastructure will become greater each year. ICT Infrastructure will increasingly evolve from a support system to a platform that enables better decisions and inspires new models. As ICT Infrastructure penetrates into core traditional industries and breathes new life into their legacy business models, industries and companies will be energized by their significant improvement in productivity, innovation and economic benefits. Such growing importance brings a multiplier effect in ICT Infrastructure investment as time passes.

Using this economic impact model (refer to the GCI Methodology section) we find that every additional US$1 of ICT Infrastructure investment could bring a return of US$3 in GDP at present, US$3.70 in 2020 and the potential return increases to US$5 in 2025.

If policy makers incorporate an additional 10% ICT infrastructure investment each year into their economic master plans starting now, they could bring an accumulative figure of US$17.6 trillion in GDP to boost the global economy by 2025. In real terms, the potential impact is equal to about the size of the European Union's GDP in 2016.

Every additional US$1 invested in ICT Infrastructure over time can yield up to US$5 in GDP growth by 2025



An additional 10% investment in ICT Infrastructure each year generates increasing returns to 2025

The New Conventional Wisdom

The relationship between ICT investment and GDP growth is generally accepted in government and industry today. Policy makers around the world today see ICT investment as one of the most important strategies in the economic planner's toolbox.

Once a nation's ICT Infrastructure platform is in place, it plays a critical role in energizing a nation's economy. ICT Infrastructure underpins the three domains of a Digital Economy. ICT Infrastructure:

1. **Energizes industries** by activating local resources to help nations move up the value chain.
2. **Energizes companies** by increasing their ability to participate in the market place, innovate and create new demand.
3. **Energizes people** by powering inclusive employment through creating new job opportunities and preparing workers with the digital skills needed for work of the future

The value a nation receives from the Digital Economy depends in large part on its own investment strategy. Policy makers who understand the value of ICT Infrastructure for economic growth, will choose to invest aggressively. The benefits of ICT investment for GDP growth are evident. But those benefits inpact other sectors as well – social development for example – can be substantial.

THE BENEFITS

Energizing industries, companies and people

The Benefits

ICT Infrastructure Energizes a Nation's Industries, Companies and People

A look at the GCI data shows that investment in ICT Infrastructure initiates a chain reaction of Digital Transformation. Cloud is a potent catalyst in that chain and thus a gateway to the power of Big Data and IoT. We have seen how ICT Infrastructure effectively sets the stage for affordable Cloud Services that enable nations to innovate and compete in the global market place. Policy makers who aggressively invest in ICT Infrastructure to deliver access to Cloud Services should find that their nation can achieve economic growth and succeed with niche market business opportunities based on their own available resources and talent, no matter where they sit on the GCI S-curve.

In this chapter, we will explore how some nations are investing in ICT Infrastructure to accelerate Digital Transformation, and are leveraging the power of Cloud to create new opportunities and growth potential for industries, companies and people.

ICT Infrastructure energizes industries by activating a nation's local resources to help nations move up the value chain

ICT Infrastructure energizes companies and entrepreneurs by increasing their ability to participate in the market place, innovate and create new demand

ICT Infrastructure energizes people by powering inclusive employment by creating new job opportunities and preparing workers with the digital skills needed for work of the future

ENERGIZING INDUSTRIES

ICT Infrastructure energizes by activating local resources to help nations move up the value chain

Nations that have developed ICT Infrastructure have been able to transform their industry from lower-value manufacturing to higher-value information services. Building out a broadband foundation enables nations to tap into the power of Cloud. Cloud has greatly reduced the high capital cost of starting a company that provides labor-intensive services for higher-cost economies. The trend is more evident among the Adopters and, to a smaller extent, in some of the leading nations in the Starter cluster.

One of the most common ways for Starters to participate in the global Digital Economy is through e-trading of goods in both domestic and global markets. According to the World Development Report[vi], an increase of 10% in internet usage will include merchandise trade by 0.4% between two nations.

The proliferation of e-trading also poses ample opportunities for local entrepreneurs to start their own businesses and boost domestic trade. Many businesses are launched by innovative entrepreneurs hoping to launch the next Amazon or Taobao. A few notable examples of these regional stars include Jumia.com in Africa, Souq.com in the UAE and MercadoLibre.com in Latin America. There is also a trend for e-trading businesses to operate via mobile phones, as these have become the low-cost computing devices of choice by the masses in emerging markets.

In 2016, over one-third[vii] of e-trading transactions were conducted via mobile devices, and this phenomenon is growing at twice the rate of non-mobile e-trading. To participate in the Digital Economy through e-trading, policy makers in the Starter cluster who aim to energize the economy and promote global participation should first improve smartphone adoption rates and mobile broadband penetration. At the same time, these nations need to make mobile broadband more affordable.

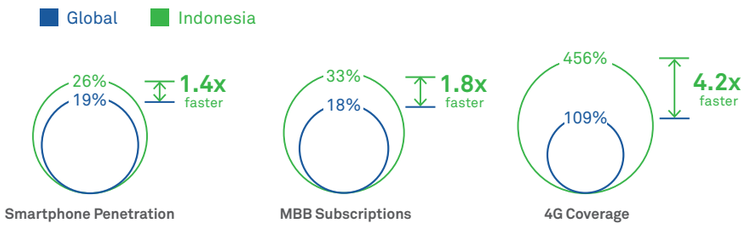
Indonesia: Expanding e-trading Through ICT

With a widely dispersed population of about 250 million people, Indonesia's e-trading potential is tremendous, as it currently accounts for less than 1% of the nation's retail volume. According to a 2016 survey DI-Marketing[viii] almost two-thirds of shoppers in Indonesia used their mobile phones to shop.

To capitalize on this business potential, the Indonesian government in its latest masterplan for Acceleration and Expansion of Economic Development declared that ICT is a critical enabler and announced that it will be a major investment area. Indonesia is focused on building the largest e-trading market in Southeast Asia, and is seeking to build and expand its national broadband networks. In addition, the government is introducing computing devices to companies and helping them sell online to promote global participation and Digital Transformation.

Indonesia has seen considerable improvements in its 4G, mobile broadband and smartphone penetration over the last three years, which has driven explosive growth. Its mobile broadband users have grown to two-thirds of the population, which is at the rate of 1.8 times faster than the global average. With over 12% of users on 4G broadband networks, Indonesia is growing at 4.2 times faster than the global average. Indonesia's smartphone penetration is now close to reaching 50% of its population, a result from CAGR of 26%.

Indonesia: Expanding mobile computing to become the largest e-trading nation in Southeast Asia



Indonesia's 3-Year average CAGR for smartphone penetration, mobile broadband subscriptions, and fixed broadband subscriptions vs. global average

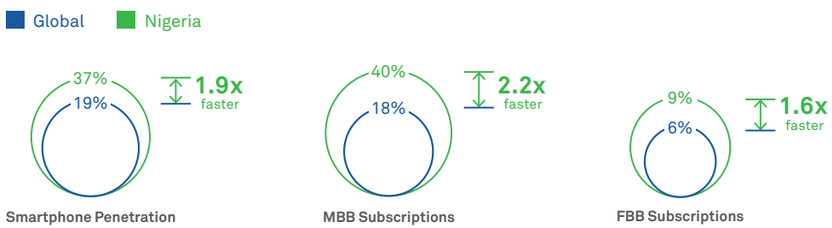
Nigeria: A Rising Star in Africa

To break its long-term dependence on oil production, Nigeria is currently pushing e-trading hard as a key economic driver. Recently, Nigeria's Minister of Communications Technology revealed that e-trading in Nigeria was estimated to be worth US$600 million[ix] in 2014, but that market has seen significant growth and is now forecast to reach US$10 billion by 2025. Some highly successful homegrown e-trading companies for instance Jumia.com and Kongo.com have already made themselves household names throughout Africa.

The following figure illustrates Nigeria's growth in smartphone penetration as well as mobile and fixed broadband subscriptions over the past three years, compared to average global speed that helped drive e-trading activities to grow into the Digital Economy.

While there is improvement, the nation is relatively low mobile broadband availalability with 4G coverage under 1%, and smartphons are only used by only one-third of the population. If Nigeria can improves its ICT Infrastructure, it will be able to accelerate its progress to the Digital Economy.

Nigeria: Expanding mobile computing to increase Digital Economy participation



Nigeria's 3-Year average CAGR for smartphone penetration, mobile broadband subscriptions, and fixed broadband subscriptions vs. global average

India: From ITO to KPO

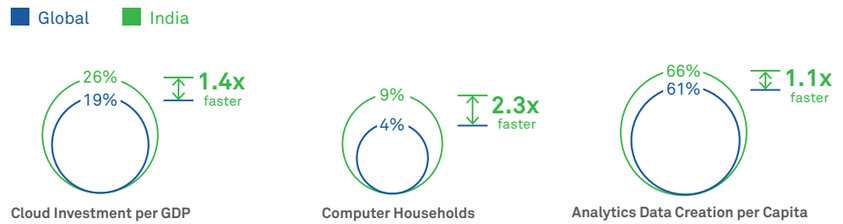
In the GCI data, we see a strong correlation between Cloud and indicators of a knowledge economy. This includes Cloud investment and fixed broadband penetration's impact on IT workers and higher-skilled IT developers in Adopter and Starter clusters.

Touted as the global leader in IT Outsourcing (ITO), India's industrial transformation has been made possible in part by its increased international internet bandwidth. This has enabled the export services sector to upgrade and transform itself from labor intensive programming work and helpdesk support (ITO) to Business Process Outsourcing (BPO) and Knowledge Process Outsourcing (KPO).

Although ITO is considered of higher value than manufacturing, taking advantage of low labor cost is still the prevalent business model in India. However, as nations start to offer BPO, the requirements and remit will change significantly, as BPO requires a sound understanding of business operations for example, finance, procurement and HR. As KPO involves the export of expertise, for instance engineering and R&D functions, it is generally considered to be of higher value than BPO and viewed by many to be the ultimate stage of outsourcing.

In short, while ITO relies on good quality broadband networks and datacenters for data storage and communication, BPO and KPO require data processing and sophisticated computing capabilities, ever higher bandwidth and greater storage. Cloud, supported by sufficient bandwidth, will thus become an important enabler for nations considering BPO and KPO services as they transform their industries in the Digital Economy. The following figure illustrates India's Cloud investment, computer households' penetration and analytics data creation per capita growth rate over the past three years, compared to global average speed.

India: Performs high on the key indicators of a knowledge economy



India's 3-Year average CAGR for Cloud investment per GDP, computer households, and analytics data creation vs. global average

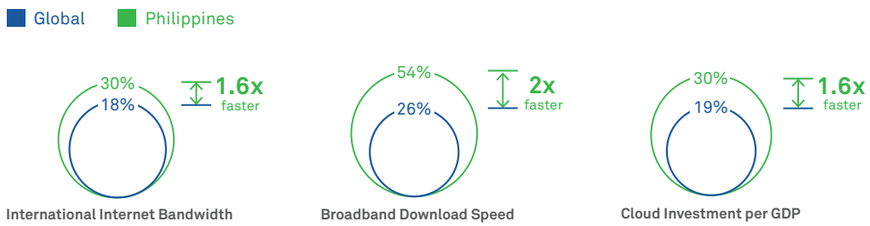
The Philippines: Cloud Leads to an IT-BPO Bloom

In the Philippines, ICT Infrastructure has been used to leverage the nation's large population of English speakers and its ties with the US to create a thriving knowledge-based industry. Improvements in its international bandwidth, broadband download speed and Cloud initiatives have combined to enable the Philippines to create a thriving IT-BPO sector. In 2015, according to the IT and Business Process Association of the Philippines (IBPAP),[x] IT BPO contributed US$22 billion to the economy and supported 1.2 million knowledge-based jobs. More importantly, the

Central Bank of the Philippines projected that, by 2017/2018, revenue from this sector will surpass the value of annual remittances of overseas Filipino workers, which is a vital source of revenue for the nation.

As shown in the following Figure, the Philippines has accelerated its Cloud investment, broadband download speed and international bandwidth, which have helped to develop a knowledge economy.

Philippines: Transforming into a knowledge-based economy through Cloud and broadband



Philippines' 3-Year average CAGR for international internet bandwidth, broadband download speed, Cloud investment per GDP vs. global average

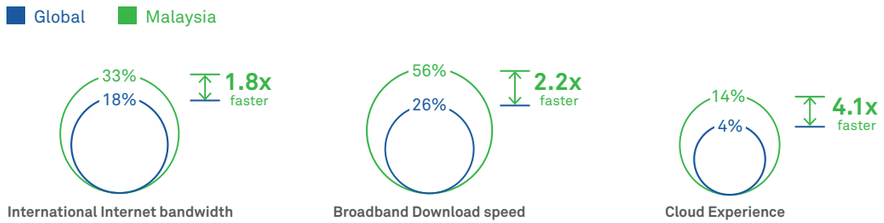
Malaysia: Moving Up the Value Chain

Malaysia managed to transform its industry from low-cost manufacturing to higher-value services through a persistent ICT master plan implemented vigorously over the past 15 years.

The Department of Statistics of Malaysia (DOSM)[xi] reported that the Digital Economy now accounts for 17% of the nation's economy – a high level considering that most nations are at a single digit share. The ICT Services sector which includes ITO, BPO and KPO, has grown to become 40% of the ICT sector, contributing more than manufacturing to the national economy. Relative to overall GDP performance, ICT Services have grown at a CAGR of 9%, contributing from 4.8% in 2010 to 5.4% in 2015

Malaysia has managed to build a substantial ICT sector through its policy makers' focus on ICT investment transforming the whole economy. As shown in the following figure, Malaysia's improvements in international bandwidth, and download speed are impressive and are the building blocks for its successful transformation to a Digital Economy.

Malaysia: Riding on Cloud to build a Digital Economy



Malaysia's 3-Year average CAGR for international internet bandwidth, broadband download speed, and Cloud experience vs. global average

ENERGIZING COMPANIES

ICT Infrastructure energizes companies and entrepreneurs by increasing their ability to participate in the market place, innovate and create new demand

Digitalization of companies especially the SMEs not only diminishes local market constraints, but also enables contribution to a global Digital Economy on a macro level. SMEs create 60-70% of jobs in most nations and are essential to the "path out of poverty" for many nations in the Starter and Adopter clusters. Today, SMEs already make-up more than 90% of businesses worldwide. Digitally-connected SMEs have 22% higher revenue and grow 2-3 times faster, according to McKinsey Global Institute.[xii]

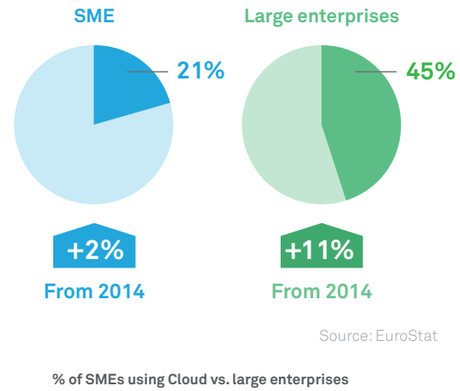
To achieve sustainable growth during the transition to the Digital Economy, it is important to encourage entrepreneurs and SME growth. These are two forces capable of driving the business and job creation needed to keep an economy on track as it goes through Digital Transformation. The availability and quality of ICT Infrastructure is a critical resource for SMEs and entrepreneurs for their ability to participate in the market place and create demand at scale. The main ICT Infrastructure obstacle, however, is the low rate of Cloud adoption. Cloud Services significantly impact SME innovation, productivity and business agility. To break the bottleneck, some nations have launched national digital initiatives aimed at making Cloud services more accessible and affordable.

Previously, we discussed how Cloud can provide entrepreneurs and SMEs access to advanced technology without heavy upfront investment in IT infrastructure. Affordable access to Cloud explains how in many cases entrepreneurs and SMEs can benefit from productivity software, for instance, Cloud-based SaaS (Software as a service), customer relationship management (CRM) and enterprise resource management (ERP) platforms. Various policy makers worldwide have used Cloud as an industry-wide platform to support SME innovation and business agility.

The European Commission: Connecting and Revitalizing the Fashion Industry

According to EuroStat,[xiii] **only 21% of SMEs use Cloud which is a 2% improvement over 2014.** Large enterprises, on the other hand, have increased Cloud use from 34% to about 45% across the 28 EU nations. As a result, the EU has

Only 21% of SMEs use Cloud, whereas 34% - 45% of large enterprises across the 28 EU nations use Cloud



% of SMEs using Cloud vs. large enterprises

initiated several initiatives to increase Cloud adoption for SMEs.

EU initiatives to encourage Cloud adoption have spurred large-scale business migration to the Cloud, improving productivity and competitiveness. Europe's Cloud adoption rate, which today stands at 2.9%, compares favorably to 1.9% in the rest of the world. One story that stands out in the EU's Cloud initiatives is the European Commission's eBIZ, a public-private program promoting use and greater interoperability of e-business in the fashion supply chain. Using the eBIZ Cloud platform, Europe's fashion houses and supply chain vendors collaborate more easily, and have improved productivity, design and innovation.

Prior to the eBIZ launch, Europe's fashion supply chain had long been under pressure from lower-cost regions. Their competitiveness was hurt by high order management costs, and long response times. All of these issues impacted their bottom-line and time-to-market. But with the Cloud-based eBIZ platform,[xiv] order management costs were reduced by 65% in one year, while the average response time for an order dropped 50%. To date, over 150 small companies in textiles and footwear from 20 European nations have benefitted from eBIZ.

Colombia: Cultivating Companies to Build a Vibrant App Economy

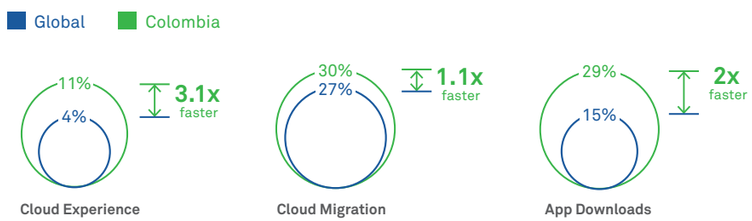
ICT Infrastructure provides a solid foundation for nations to cultivate new companies and ecosystems never before imagined. The rise of the App economy shows how new industries can be created through the spread of smartphones with GPS-based services and the expansion of 4G networks. In 2007, virtually no app revenue existed and this emerging market is expected to be worth US$101 billion by 2020 according to App Annie's[xv] statistics.

The App economy runs from the Cloud and is an easy and low-cost way for businesses and entrepreneurs to develop, market and sell their applications through app stores. Many notable entrepreneurs and businesses have emerged in this market with some well-known names including Rovio Entertainment, the gaming company mastermind behind the Angry Birds franchise. Although much of the App economy is based in Frontrunner markets, there are still plenty of business opportunities emerging for nations in the Adopter cluster.

In the Starter cluster, Colombia is one of the most successful nations to position itself strategically as a Latin American hub for domestic market and export applications development. The Colombian Ministry of ICT[xvi] launched an App platform that leverages Cloud resources and has created 83,000 jobs at SMEs and for individual workers according to a report from the Progressive Policy Institute. The initiative has sparked new ideas, as well as opened new sources of financing and access to computing.

With growing app downloads, improving Cloud experience and adoption, Colombia can innovate and create new consumption models through the App economy. Simply put, the App economy is the economic value created through applications that deliver services via smart mobile devices. Nations like Colombia have developed an affordable and scalable Cloud platform to reduce the cost for SMEs and individuals to develop apps for domestic sales and exports. This creates a new market for consumption, but has also created new SMEs and individual wealth. By moving into the Cloud, nations in the Adopter stage can drive local economic transformation through providing computing resources at a competitive price to individuals and SMEs. Cloud is thus a critical trigger that opens new areas of the Digital Economy beyond e-trading and offshoring of services.

Colombia: Cultivating companies to build a vibrant app economy



Colombia's 3-Year average CAGR for Cloud experience, Cloud migration, and app downloads vs. global average

ENERGIZING PEOPLE

ICT Infrastructure energizes people by powering inclusive employment by creating new job opportunities and preparing workers with the digital skills needed for work of the future

In the era of ultra-high-speed broadband, pervasive Cloud, and Big Data supported by IoT, the Frontrunners are creating opportunities to export high-level expertise for instance legal advice, engineering design, R&D, architecture, medical consulting, and work from a variety of other professions. In the past, export of services was limited to lower value skills including Call Center services and some middle management functions. With a more developed ICT Infrastructure, even professionals are now able to export their services globally.

ICT Infrastructure has enabled a new generation of freelance and home workers to find opportunities in the 'gig-economy' as it frees people to work from anywhere and do any type of work with added flexibility on working hours. To a considerable extent, Frontrunner markets have benefitted from the export of lower skilled types of work via digital business models, and infrastructure without the physical limitations of proximity. Within the offshoring market export models have been reversed. Services primarily originate in Starters and Adopters that can take advantage of a large skilled population with generally lower labor costs.

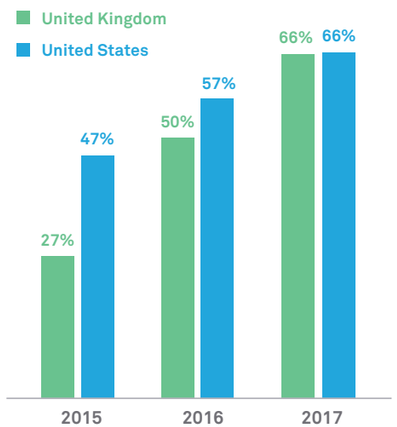
US: Building the US$1 Trillion Gig-economy

Nations including the US and UK have seen growing exports of professional expertise in what is commonly known as the gig-economy. Workers in the gig-economy benefit from ultra-high-speed mobile and fixed broadband as well as Cloud Services at affordable market rates. Frontrunners in contrast to other nations have invested heavily in ICT Infrastructure to ensure availability of these services throughout the nation, and not just limited to urban areas. They have also focused on open competition in the Cloud market, and promoted standards and policy frameworks for Cloud that ultimately make it safer and more secure.

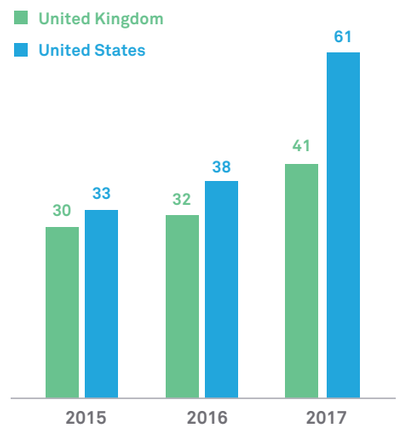
Professionals in these nations are no longer tied to corporate institutions. They are free to start their own small business or work as an independent contractor. The gig-economy is already generating US$1 trillion for the US economy, allowing 55 million people to work as freelancers with increased workforce satisfaction and higher income according to Upwork's[xvii] report titled "Freelancing in America: 2016". Tax and corporate lawyers in the US can consult and advise their clients in Japan or China looking to enter the US market, architects in London can work with firms in the UAE to design the next mind-boggling building, engineers in Germany can guide technicians in Africa to repair power generators and surgeons sitting in the safety of their own nations are able to guide local nurses to perform surgery in armed conflict zones. Even in the US and Western Europe there are areas with low income economies. ICT Infrastructure enables individuals in these areas to upskill themselves and grow their income by providing a service to high income regions within their nation.

Professionals in this category are not freelancing as temporary workers. Instead these highly specialized individuals free themselves from the confines of corporations and offer their services to a wider market. The top paying jobs for freelancers are professional jobs in the areas of legal advisory, IT and engineering. About 78% of freelancers in the US earn a higher income in their new work model than in previous jobs according to Upwork.[xviii]

USA & UK: Improving 4G coverage and broadband download speed year-over-year to support the gig-economy



GCI 2015 - GCI 2017 4G Coverage (%)



GCI 2015 - GCI 2017 Broadband Download Speed (Mbps)

UK: Gig-economy promotes inclusive employment

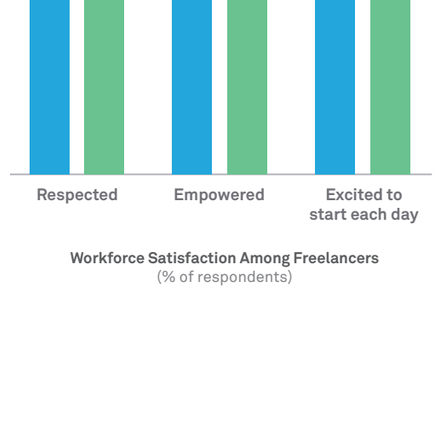
In the UK, the gig-economy has resulted in work opportunities for people staying at home and for older people. Many Frontrunners are faced with the challenge of an ageing population, and a shrinking younger generation and workforce which compels people to work longer until retirement. The gig-economy provides new opportunities for highly qualified older professionals who can work from home.

Such developments are only possible with continuous improvements in ICT Infrastructure and its expanded coverage to the rest of the nation.

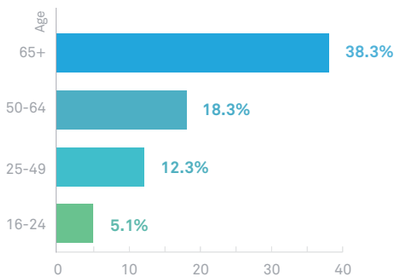
Although these are rather new trends they are significantly changing the structure and productivity of national workforces with a major impact on taxation and legal systems.

Big Data delivered from Cloud will provide individuals with rich data and insights to help them do their work more effectively and provide new work opportunities. There are, for example, online commercial legal analytic tools available which help freelance lawyers manage their legal research. Big Data as a service is today helping engineers diagnose client's problems, an exercise that previously was limited to large engineering consultancies.

UK: When compared with non-freelancers, freelancers report higher workforce satisfaction



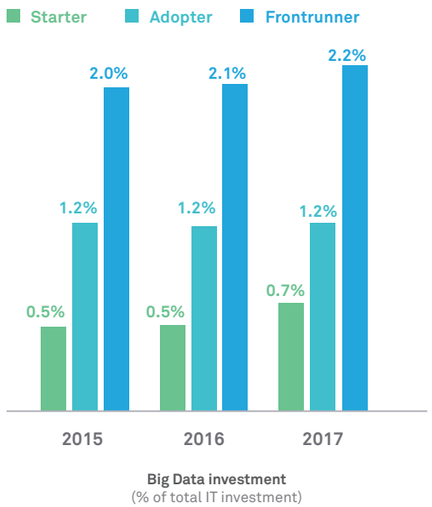
Workforce Satisfaction Among Freelancers
(% of respondents)



UK: High Share of Older People Working from Home
(% of home workers)

In addition to encouraging development of a vibrant gig-economy, ICT Infrastructure is a powerful engine to upskill the majority of a nation's workforce with the digital skills needed for jobs of the future. To put it in perspective, in 2016, the UK Parliament[xix] declared a "Digital Skills Crisis". They observed that 12.6 million adults lack the basic skills required for the Digital Economy. This gap is estimated to be US$78.69 billion (£63 billion) in lost additional GDP for the UK economy each year.

Nations in the Frontrunner cluster have shown the biggest improvement in Big Data scores, making Big Data and Cloud accessible for individuals in the gig-economy



Big Data investment
(% of total IT investment)

Ushering in a New Era of the Digital Economy: Industries, Companies and People

The rise of ICT Infrastructure is proving to have a significant impact on Digital Transformation. It empowers industries, companies and people to participate in a value chain, to transform their business model and innovate for success.

International Data Corporation[xx] predicts that by 2020, over 75% of the top global 500 companies (most of them in the US and Western Europe) will be transformed into digital services providers on top of their traditional non-ICT business, making ICT Infrastructure an important step to move up the value chain. It is also an advantage for the creation of new SMEs and the business opportunities and jobs that they can bring, but the impact may prove even greater on individuals who find new flexibility in the way they work and live.

Empowering labor across the spectrum from lower skilled workers to highly specialized professionals to market their services worldwide via broadband and Cloud Services is causing a seismic shift in the labor market and in society. It is generating high levels of innovation and creativity in every area of human activity.

NEXT STEPS

Policy recommendations for
Digital Transformation

Next Steps

In the GCI 2017 report, we identified trends that have emerged since publication of the GCI 2015 report, and offered policy makers our views on how they can better understand, invest in and utilize their ICT Infrastructure effectively to accelerate Digital Transformation toward a knowledge economy. The complexity of the transformation propels policy makers to wear many hats and balance the interests of different stakeholders. While facing technical issues in decisions on investing in ICT Infrastructure, policy makers also face socioeconomic issues not typically thought of as related to ICT.

Imperatives for Digital Transformation Planning:

- **ICT Infrastructure-related priorities:** Focus on ICT policies as part of a nation's economic development strategy to encourage and incentivize Digital Transformation. Broadband is not just for fast internet access, ultimately its role is to enable Cloud Services and the software that runs on the Cloud – Big Data and IoT
- **Industry and company-related priorities:** Building on each nation's local comparative advantages, policy makers can consider more industry friendly policies to help promote Digital Transformation.
- **People-related priorities:** Collaborate with educational institutions, education ministries in addition to labor departments and technology enablers to ensure that education for building digital access and skills is universally accessible, targeted and fully utilized.

To unlock the opportunities and benefits of ICT Infrastructure, following are actionable recommendations to policy makers at every stage of the Digital Economy.

ICT Policy Priorities for Starters

FOCUS AREAS	RECOMMENDED ACTIONS
ICT INFRASTRUCTURE AREAS Drive fixed broadband subscriptions to over 10%, and 4G coverage to over 15% to ensure Cloud can maximize the transformative power of ICT Infrastructure	**Drive joint ICT development efforts via public-private partnerships in long-term planning:** Nations should fundamentally consider a public-private partnership (PPP) approach for long-term planning. Policy makers should aim to pair ICT initiatives together with efforts for new civil works, for instance, deploying broadban d connections over electricity networks. This approach unblocks funding bottlenecks.
INDUSTRY / COMPANY-RELATED AREAS Optimize business processes of traditional industries through increasing ICT access and basic company digitalization	**Promote entry-level connectivity and digitalization for existing industries & SMEs:** Further build out sufficient broadband coverage, as well as provide a Cloud platform to improve productivity and efficiency of existing industries and SMEs. Consider financial and advisory cooperation with non-governmental organization (NGO) or inter-governmental organization (IGO) grant programs.
PEOPLE-RELATED AREAS Promote digital inclusion by enhancing digital access, skills and education	**Improve basic digital literacy both in schools and universities as well as workplace training:** Focus on improving digital literacy, labor upskilling and job matching to ensure inclusive employment and reduce labor surplus. Basic digital competency should be widespread in the workforce and access to digital literacy education easy and affordable. **Increase ICT exposure through device subsidies:** Subsidize entry-level computing devices (i.e. laptops and feature phones) as it is people's first exposure to the internet.

ICT Policy Priorities for Adopters

FOCUS AREAS

ICT INFRASTRUCTURE AREAS

Drive fixed broadband subscriptions to over 35%, and 4G coverage to over 70% to ensure Cloud can fully maximize the transformative power of Big Data and IoT

INDUSTRY / COMPANY-RELATED AREAS

Focus on supporting key industries by providing priority access to ICT resources and reliable infrastructure

PEOPLE-RELATED AREAS

Continuously elevate and make use of acquired digital skills to generate local value in the nation's emerging Digital Economy

RECOMMENDED ACTIONS

Expand broadband coverage by introducing incentive programs and civil infrastructure sharing policy: Establish incentive programs and civil infrastructure sharing policy among public and private entities to create synergy for broadband deployment. This infrastructure sharing policy requires orchestration across different public ministries and private sectors at the national level.

Establish a favorable policy environment based on a strong base of understanding of industry-specific needs: Work with key industry leaders to gain a basic understanding of what is specifically needed for structural transformation. Based on industry-specific needs, establish policies and regulations that create a favorable environment for transformative innovation, competitiveness and future productivity.

Centralize ICT resources for local entrepreneurship and enterprise innovation via digital hubs: Establish digital hubs (i.e. tech parks) and incubation programs to facilitate growth of start-ups, and concentrate access to high-quality broadband.

Encourage "digital-first" education: With a focus on science, technology, engineering and mathematics (STEM) education. Prioritize advanced ICT skills and coding in fundamental curricula.

Build up advanced human capital and local digital content, inclusively: Equip workers with basic skills required for a digital workplace by creating digital skills training programs, enabling them to create value and content for the local economy. As Adopters evolve into a Digital Economy, there is an opportunity to shape its participants from the onset. When creating training programs, ensure there is adequate representation and consultation from respective groups including, but not limited to women's, disability-focused, and aging population organizations.

ICT Policy Priorities for Frontrunners

FOCUS AREAS

ICT INFRASTRUCTURE AREAS

Accelerate fiber optic network deployment, including Gigaband networks to drive continued Big Data and IoT penetration which leads to transformative business models and innovation

INDUSTRY / COMPANY-RELATED AREAS

Transform industries to innovate future business models and opportunities using Big Data and IoT

PEOPLE-RELATED AREAS

Foster future-proof talent by emphasizing advanced ICT skills and workforce retraining

RECOMMENDED ACTIONS

Well-planned civil works and broadband deployment through collaboration: A closer collaboration between public and private entities can be done by using Big Data. A robust database with real-time updates of information such as pipe position, capacity, or path details can help to minimize civil disruption and even minimize deployment cost.

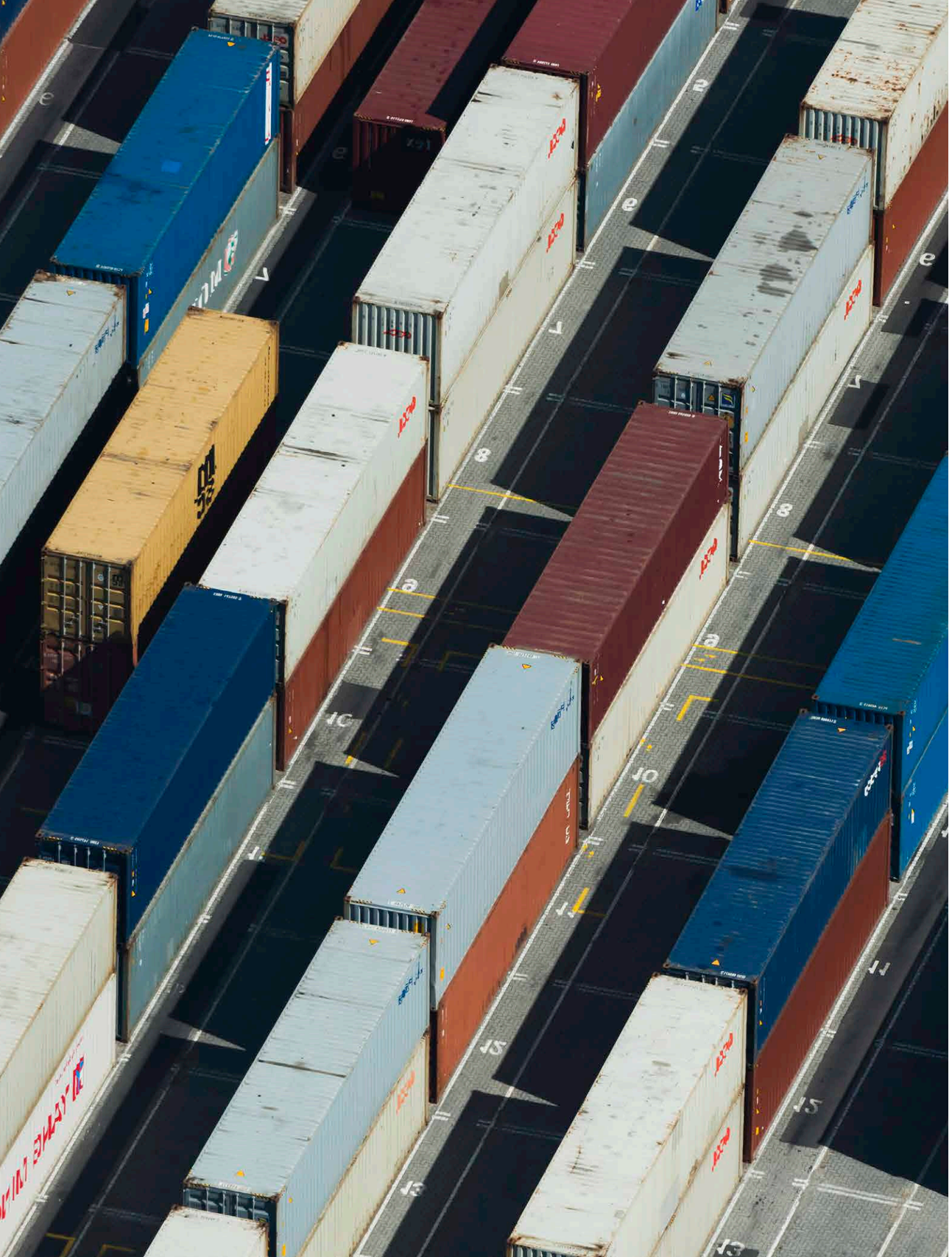
Accelerate adoption of Big Data and IoT: Increase investment in Big Data and IoT to enhance competitveness, innovation, and productivity. Encourage data openness and sharing for improved performance.

Develop industry ecosystems that promote open collaboration toward transformative industrial innovation: Develop industry ecosystems that enable cross-industry collaboration to produce new IoT ideas, products, and services that can change how business is conducted.

Accelerate growth by applying Big Data and IoT while improving governance: Improve efficiency with the use of Big Data and IoT through data integration. Foster collaboration with industry players to make Cloud security and data privacy top priorities.

Upskill and retrain to close the digital skills gap, and prepare the future workforce: Close the digital skills gap, especially among individuals facing job obsolescence. Digital skills would be fundamental in all industries moving forward.

Leverage ICT platforms to create new forms of employment, for instance the freelancer economy: Tap into underleveraged talent and open more employment options through monetization of free time and skills in the gig-economy.



APPENDIX

Methodology & GCI Definitions

GCI Methodology 2017

The GCI analyzes the full spectrum of measurements for connectivity and provides a detailed map of the global digital economy.

The goal of the index is to benchmark 50 countries according to current levels of ICT connectivity and digital transformation, and to act as a leading indicator for future digital development and growth. Combined, these 50 countries account for 90 percent of global GDP.

Research Framework

The GCI analyzes digital transformation from basic levels of connectivity to supplementary, advanced technologies. These advanced technologies – Broadband, Datacenters, Cloud Services, Big Data, and IoT - are key enablers that will drive the next wave of economic benefits resulting from ICT investment. They are built on a foundation layer of technologies like telecom infrastructure, e-commerce, and the overall adoption of computers, smartphones, and the Internet - all of which have been key determiners of the growth and development of digital economies over the past two decades. GCI also includes forward-looking factors such as ICT patents and R&D.

The research framework thus covers a complete combination of advanced and fundamental technologies, enabling us to analyze how yesterday, today, and tomorrow intersect.

The Four Pillars: SDEP

The four pillars encompass the entire chain of ICT development and digital transformation to provide a 360-degree view of the digital economy. Each pillar has a set of 10 data indicators.

Four Pillars

SUPPLY	DEMAND	EXPERIENCE	POTENTIAL
Measures current levels of supply for ICT products and services used for digital transformation. Supply indicators: ICT investment, telecom investment, ICT laws, international Internet bandwidth, fiber optics, 4G coverage, data center investment, cloud investment, big data investment, and IoT investment.	Gauges demand for connectivity in the context of users and activities relating to digital transformation initiatives. Demand indicators: app downloads, e-commerce transactions, smartphone penetration, computer households, fixed broadband subscriptions, mobile broadband subscriptions, data center equipment, cloud migration, analytics data creation, IoT installed base.	Comprises variables for analyzing the experience of connectivity for endusers and organizations in today's digital economy. Experience indicators: government services, telecom customer services, internet participation, broadband download speeds, fixed broadband affordability, mobile broadband affordability, data center experience, big data experience, cloud experience, IoT experience.	Comprises a forwardlooking set of indicators that point towards the future development of the digital economy. Potential indicators: R&D expenditure, ICT patents, IT workforce, software developers, and market potential Index calculations for broadband, data centers, cloud services, big data, and IoT experience

The Five Technology Enablers

The index allows the horizontal analysis of five technology enablers that are crucial signposts to help benchmark the relative strengths, weaknesses, opportunities and challenges facing digital economies: broadband, data centers, cloud, big data, and IoT.

Each horizontal layer includes at least one variable from each of the four pillars: supply, demand, experience and potential.

Thus, the GCI can be analyzed both vertically (supply, demand, experience, potential) and horizontally (broadband, data centers, cloud, big data, and IoT).

This allows an extremely detailed analysis on the relative strengths and weaknesses of individual countries to pinpoint the areas in which additional investment is needed to advance connectivity and economic benefits.

Additionally, this structure enables the detailed analysis of correlations between advanced connectivity services like IoT and the key areas of supply, demand, experience, and potential. This reveals the most successful roadmaps for growth and development, and possible areas where leapfrog technology adoption has proved more successful than others.

The GCI is a rich and deep dataset that serves as a blueprint for individuals and organizations to analyze a wide range of factors relating to digital transformation, ICT development, and the economic benefits of connectivity. The overall index rankings provide a snapshot of the current state of connectivity across the global digital economy, forming a leading indicator for the next decade of ICT expansion and evolution.

Four Pillars

Five Technology Enablers	SUPPLY	DEMAND	EXPERIENCE	POTENTIAL
FUNDAMENTALS	ICT Investment Telecom Investment ICT Laws International Internet Bandwidth	App Downloads Smartphone Penetration eCommerce Transactions Computer Households	E-Government Service Telecom Customer Servce Internet Participation Broadband Download Speed	R&D Expenditure ICT Patents IT Workforce Software Developers
BROADBAND	Fiber Optic 4G Coverage	Fixed Broadband Subscriptions Mobile Broadband Subscriptions	Fixed Broadband Affordability Mobile Broadband Affordability	Broadband Potential Mobile Potential
DATA CENTERS	Data Center Investment	Data Center Equipments	Data Center Experience	Data Center Potential
CLOUD	Cloud Investment	Cloud Migration	Cloud Experience	Cloud Potential
BIG DATA	Big Data Investment	Analytics Data Creation	Big Data Experience	Big Data Potential
IoT	IoT Investment	IoT Installed Base	IoT Experience	IoT Potential

The ICT Fundamentals

The five technology enablers need to function on a platform of robust core measurements of ICT fundamentals for a nation to transform into a digital economy and build upon these fundamentals in a self-reinforcing loop.

Examples of these fundamentals and their functions are as follows:

ICT laws are essential for Supply: They set down regulatory boundaries that govern privacy, confidentiality, and safe and legal use. The digital IPs, digital assets, identities, and privacy of businesses and consumers must be protected against abuse and misuse.ICT laws make it feasible for the public and private sectors to invest in supplying ICT products and services to the mass market safely and under regulations.

Applications drive Demand. Delivered on broadband networks, stored in DCs, and distributed via cloud services for mass consumption, they enable technology to produce outcomes. Applications feed data to analytics solutions for processing into information that can effect changes through IoT devices.

Customer experience is driven by quality of service (QoS). It ensures that ICT services meet the expectations and requirements of businesses and consumers in a way that encourages greater use and investment. For example, a country could have strong investment in cloud solutions but poor network performance or reliability, which will hinder the ability of end users to derive economic benefits.

Patents lead to potential. They form the basis that stimulate the innovation of new products and services. High demand coupled with a good experience builds strong future potential to accelerate digital transformation and make economic gains. The five tech enablers require patents for innovation.

A strong IT workforce ensures that a skilled and technology-literate population is available to drive future digital transformation through innovation based on real-world use. A shortage of skilled workers can be a significant inhibitor to a country's potential transformation. Equally an educated workforce is needed to make the most of digital technology.

Other fundamental layer measurements include telecom infrastructure investment, Internet bandwidth, e-commerce, smartphone and computer penetration, e-government, Internet participation, average download speed, R&D expenditure, and number of software developers.

Measurement and normalization

The variables are measured against factors such as GDP PPP, number of households, and total population.

These factors assess the full picture of connectivity for each country, including measurements like app downloads per person or fiber optic penetration against total households.

In emerging economies, connectivity levels in major metropolitan areas tend to be much higher than their national scores, because these nations are still in the early stages of ICT adoption. This provides an important metric for understanding the potential of the increased economic benefits that these emerging economies will probably see over the next decade and beyond, as they close the digital divide through rapid investment and adoption programs.

In all cases, the data inputs are first measured against a normalizing variable like population size, so the index can benchmark countries according to relative levels of connectivity rather than absolute market sizes, which would be more reflective of economy size.

Scoring and Aggregation

For each variable, a country receives a rating of 1 (low) to 10 (high), depending on the data inputted.

Each indicator has a scale based on a realistic target value for beyond 2020, with a score of "10" reflecting that the target value has been reached.

These target values are extrapolated from market penetration projections based on the highest ranked countries, historical market performance, and expert opinions. Each country's score is then determined by its normalized raw data value in relation to this scale. In most baseline cases, a value that is less than 10 percent of the target value will be allocated a score of 1. A value of between 10% and 20% of the target value is allocated a score of 2, and so on. This is shown in the table:

VALUE (% of target value)	GCI SCORE
1-10 %	1
11-20 %	2
21-30 %	3
31-40 %	4
41-50 %	5
51-60 %	6
61-70 %	7
71-80 %	8
81-90%	9
91-100%	10

Where the average values are significantly lower than the median, the formula is adjusted to include meaningful differentiation at the lower end of the scale and avoid excessive clustering of countries with equal (low) GCI scores.

For example, for Fiber Optics, we use a formula that differentiates between a value of 1% to 5% of the Target (GCI Score=1) and a value of 6% to 10% of the Target (GCI Score=2). This reflects the fact that average Fiber Optics penetration rates are much lower than the median value.

These indicator scores are then aggregated to form a total score for each of the four GCI pillars: Supply, Demand, Experience and Potential. These run from a scale of 10 to 100 (where 10 is the lowest possible total score, equivalent to a score of 1 for each of the 10 indicators within a segment).

The final index score is then calculated by aggregating the four segments:

GCI Total = (Supply + Demand + Experience + Potential) / 4
See "GCI Definitions" for a full list of data category definitions and sources.

The Economic Impact Model

The Economic Impact Model was designed to calculate the GDP impact generated by annual additional investment in, and adoption of the five core technologies of ICT Infrastructure: Broadband, Datacenter, Cloud, Big Data and IoT. It is a collation and analysis of academic studies and research firm forecasts (from organizations such as the ITU, OECD, IDC, Imperial College, World Bank, EIU, and individual researchers) which quantify the impact of different technologies on GDP growth.

A key assumption in the Economic Impact Model is that baseline forecasts for GDP already factor in a certain growth rate around the ICT Infrastructure investment from 2016 to 2025. Therefore, the model is designed to create a theoretical view for additional GDP growth resulting from more aggressive ICT investment (for example, 10% additional annual Cloud investment). Aggressive investment coupled with a growing importance of ICT role lead to a stronger impact on GDP over the same forecast period.

The GDP growth impact in this modelling exercise scenario are based on published research studies, but are also adjusted to account for factors such as

- investment time period from 2016 to 2025
- geographic differences
- market and technology development maturity
- interdependency and relationships among the five core technologies
- digitalization rate

An intuitive way to present this GDP growth impact is to illustrate by dollar output. Based on an additional 10% ICT infrastructure investment every year, the Economic Impact Model predicts every additional US$1 invested in ICT Infrastructure could achieve a return of US$3 in GDP today. This return grows to US$3.70 for every dollar invested in 2020 and to US$5 in 2025. This equates to an accumulative US$17.6 trillion in potential added GDP to the global economy by 2025.

Additional Notes

For variables weighted against GDP, we use the GDP at Purchasing Power Parity (PPP) calculation. This is generally the best way to calculate in-country purchasing power after it's been adjusted for cost of living. This measures the relative wealth of a nation in terms of its ability to purchase goods and services within the national economy.

The data is always the most recent that is available, depending on the source. Data sources: OECD, ITU, GSMA, WEF, World Bank, United Nations, Ookla, IDC, Huawei. We've estimated the data for missing values based on geographical cohorts. Numbers in the charts might appear different from direct calculation due to the rounding adjustments. Historical data shown in GCI 2017 may be different from data down in GCI reports of previous years, as it been updated with the most recent actual data to improve accuracy.

GCI Definitions

SUPPLY

measures current levels of supply for ICT products and services.

ICT Investment

Overall size of ICT investment in each nation, as defined by the total amount of end-user investment in IT hardware (servers, storage, PCs, devices, peripherals, and network equipment), software, IT Services, and telecom services. The total market size is measured against the size of the economy, which provides a measurement of market supply maturity.

Calculation: per GDP

Telecom Investment

Investment by Telecom Service Providers (Telcos) in infrastructure. To create the 2017 score, aggregate spending over the 5-year period 2012-2016 was considered, so as to account for cyclical periods and economic wild cards that can affect spending levels in a single year.

Calculation: per GDP

ICT Laws

A World Economic Forum survey on how developed a nation's ICT laws are (e.g., electronic commerce, digital signatures, and consumer protection).

Calculation: N/A

International Internet Bandwidth

Total used capacity of international internet bandwidth in megabits per second (Mbps). This is measured as the sum of used capacity of all internet exchanges offering international bandwidth. If capacity is asymmetric, then the incoming capacity is used. International internet bandwidth (bps) per internet user is calculated by converting to bits per second and dividing by the total number of internet users.

Calculation: per internet User

Fiber Optic

The number of Fiber to the Home (FTTH) subscriptions, measured against the total number of households in each nation. "Fiber to the Home" is defined as a communications architecture in which the final connection to the subscriber's property is Optical Fiber. The fiber optic communications path is terminated on or in the premise for the purpose of carrying communications to the subscriber.

Calculation: per total households

4G Coverage

Percentage of mobile connections that use a 4G/LTE network. Users who haven't subscribed to 4G services but who use a 4G phone aren't counted.

Calculation: % of mobile data connections

Datacenter Investment

Overall investment in servers for all datacenters (on-premise and off-premise). The value of servers is based on total ASP, including processors, memory, disk storage, bundled operating systems, and software. Volume, mid-range, and high-end servers are included.

Calculation: per GDP

Cloud Investment

Total investment by public cloud service providers in infrastructure (servers, storage, and ethernet switches). This variable measures current levels of investment by public cloud service providers in the hardware infrastructure necessary to supply public cloud services. The data is normalized against the overall size of the economy.

Calculation: per GDP

Big Data Investment

Investment in analytical software tools used to supply actionable data to individuals and organizations. These analytical software tools include content analysis tools, CRM analytics, advanced analytics (standalone and embedded), data warehouse generation, data warehouse management, end-user queries, reporting and analysis software, financial performance and strategy management applications, production planning analytics, services operations analytics, spatial information analytics, supply chain analytics and workforce analytics.

Calculation: per total IT spending

IoT Investment

Investment in IoT products including intelligent systems, IoT devices, IoT purpose-built platforms, and IoT-

Calculation: per capita

DEMAND

gauges demand for connectivity in the context of users and activity.

App Downloads

The total number of new mobile application downloads in the calendar year on all major mobile platforms (Android, iOS and Windows phones). This is measured against the overall size of the population, and refers to new app downloads, not the existing installed base.

Calculation: per capita

E-commerce Transactions

E-commerce involves orders placed on the internet (i.e., the buyer clicks an order button on the internet) in a commitment for paid goods or services. Total e-commerce measures the volume of all e-commerce transactions, both B2B and B2C (including volume purchases).

Calculation: per capita

Smartphone Penetration

Smartphone penetration expressed as a percentage of total connections (excluding M2M). A smartphone is defined as a mobile handset with advanced access to internet-based services and computing functions.

Calculation: share of total Connections

Computer Households

The number of households with access to a computer – a fixed desktop computer, laptop, or tablet (or similar handheld computer). Excludes smartphones.

Calculation: % of households

Fixed Broadband Subscriptions

Total number of subscriptions that access the internet through a wireline (including satellite) broadband internet connections.

Calculation: per capita

Mobile Broadband Subscriptions

Total number of mobile broadband services subscribers, measured in relation to the overall size of the population.

Calculation: per capita

Datacenter Equipment

Annual spending on on-premise datacenter hardware and equipment (servers, storage, and network equipment). Excludes cloud infrastructure.

Calculation: per capita

Cloud Migration

The percentage of traditional IT budgets migrated to cloud platforms, thus measuring demand for public cloud services in relation to overall IT spending.

Calculation: per total IT spending

Analytics Data Creation

The amount of data (PB) created in a single year that is non-transitory, target-rich and available for data analysis.

Calculation: per capita

IoT Installed Base

Total installed base of IoT devices and systems (including intelligent systems).

Calculation: per capita

EXPERIENCE

analyzes the experience of connectivity for end users and organizations.

e-Government Service

These scores are sourced directly from the United Nations E-Government Survey, which benchmarks countries according to ratings derived from a survey to assess the e-government development status of all UN member states.

Calculation: index

Telecom Customer Service

Current service levels provided by telecom operators based on previous research and surveys conducted within each nation.

Calculation: index

Internet Participation

The total number of individuals accessing the internet at least once during the 12-month period, via wireline and/or mobile internet access.

Calculation: per capita

Broadband Download Speed

Average download speed for each nation, as monitored and published by ookla.com. These metrics use billions of internet and mobile network tests to provide a current view and analysis of global internet access speeds.

Calculation: N/A

Fixed Broadband Affordability

The price of a monthly subscription to an entry-level fixed-broadband plan. These entry-level plans may include a variety of data and download speed allowances. The calculation is a percentage of a nation's average monthly GNI per capita.

Calculation: per GNI

Mobile Broadband Affordability

The price of a monthly subscription to postpaid handset-based data services with a minimum of 500 MB data allowance. This is calculated as a percentage of a nation's average monthly GNI per capita.

Calculation: per GNI

Datacenter Experience

An index for measuring the datacenter experience of enterprises based on two key inputs: (1) Security, based on enterprise investment in security software to protect the integrity of the datacenters; (2) Quality of Service, based on local market surveys that analyze the quality of datacenter services provided inside the nation. The two inputs are combined into the final index with equal weightings.

Calculation: index

Cloud Experience

An index that measures the quality of service provided by cloud service providers to customers in each nation. This is combined with Broadband Affordability, Quality of Service, and Average Download Speed.

Calculation: index

Big Data Experience

An index that measures the quality of service provided by vendors of big data products and services to customers in each nation. To improve the experience of this technology, the scalability of created data needs to be considered. The index is thus weighted by Analytics Data Creation to provide an overall measurement of Big Data Experience

Calculation: index

IoT Experience

Total spending on analytics software relating to IoT data analysis. These software tools that extract value from the mass of data being created via IoT to improve the experience of a nation or organization with an IoT platform that transforms IoT data into actionable information.

Calculation: per capita

POTENTIAL

comprises a forward-looking set of indicators that point towards the future development of the digital economy

R&D Expenditure

Expenditure on R&D means current public and private capital expenditure on creative work to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development.

Calculation: per GDP

ICT Patents

The total number of patents filed under the PCT in the ICT technology domain in the inventor's country of residence, as measured and tracked by OECD (stats.oecd.org).

Calculation: per million capita

IT Workforce

Total employment in the supply and management of IT for each nation. This includes workers employed directly in the IT industry (hardware manufacturers, software vendors, service providers and channel organizations), and ITstaff employed by end-users in IT departments for the management, deployment, support, and strategic implementation of technology solutions.

Calculation: per Capita

Software Developers

The total number of software developers in each nation. Professional software developers are engaged in employment where the primary activity is constructing software or supervising its construction.

Calculation: per capita

ICT Market Potential

An index derived from local nation survey data on the potential for market development and the economic benefits to be derived from adoption of adopting Broadband, Datacenters, Cloud, Big Data and IoT Solutions

Calculation: index

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