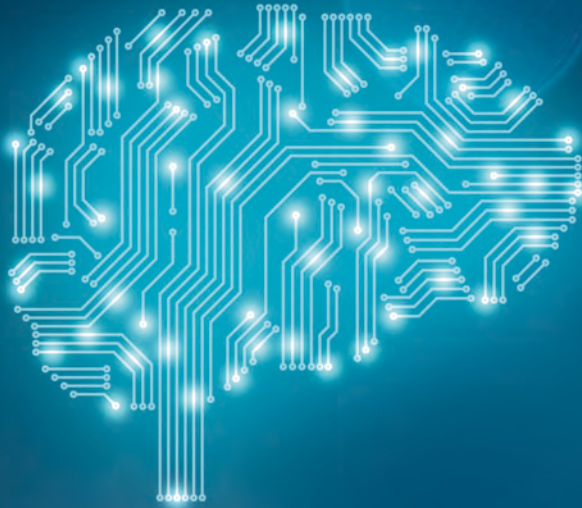


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# The Street View

Actis Macro Forum

June 2019



# Welcome



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# Changing the future

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**Welcome to this edition of The Street View. The Actis Macro Forum, a global grouping looks at trends beyond the headlines that matter to our clients and other investors in emerging economies.**

**In this edition we continue with the theme of changes that deepen economies and provide opportunity for investors in our funds. We believe that Deeper and Stronger-D&S-is a source of real value added for long horizon investors who can afford to accept bouts of shorter term volatility.**

Economies need more power, technology change needs to be housed in specialist premises and more domestic savings help provide effective financing. All 3 areas are linked with the development of Artificial Intelligence ("AI") and its potential productivity gains.

Stuart Jackson based in London looks at the application of AI through the lens of our portfolio companies. Stuart finds that AI is not simply a tool in the technology

sector but is employed in a wide range of industries. Everywhere and anywhere this is a productivity based investment story.

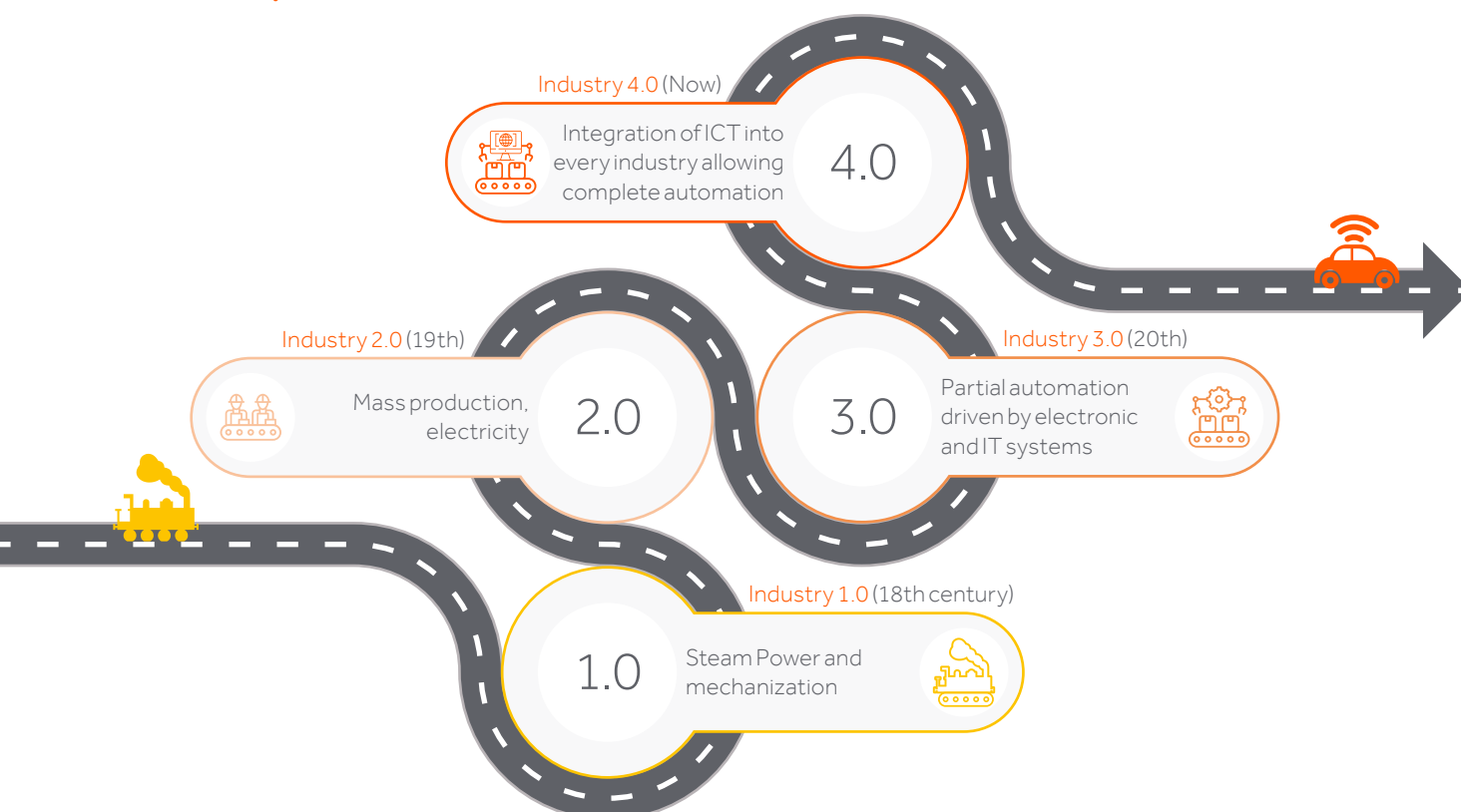
Julian Kim reports from Seoul on how the 4th Industrial Revolution is delivering end user specified products and services. This requires particular industrial, societal and regulatory conditions. 5G technology is central to this revolution along with data centres to process and manage the vast amounts of data used by AI and machine learning. Data centres are a very specialist commercial property sector and our Asian real estate teams are busy in Korea and China in this area.

James Mittell from our Energy Team and Emily Morse from our Private Equity team look at the fast growing potential of off-grid supply. Off-grid solar and Solar Home Systems have huge potential to meet these needs over the next decade reflecting technology progress and declining prices of solar cells and storage solutions. They predict a multi-billion dollar investment opportunity over the next decade with add on potential for mobile based financial services. It's an area Actis is closely evaluating, aware that many pioneer investments in this area have been mispriced and poorly executed.

These initiatives all require capital. Investors in Emerging Markets increasingly provide such capital through cross border portfolio flows. These are often volatile flows where sudden stops raise heart beats and diminish returns within nanoseconds. Stable demand for financial assets from other than foreign investors helps offset some of this volatility. Domestically funded pension systems alongside sovereign wealth funds and life insurers provide this demand in middle income countries. I look at the development of such schemes in this edition helped by Street Views from Nicolas Escallon in our Mexico City office and Funke Okubadejo in our Nigeria office. This article compliments the work we published last year on the importance of migrant remittances in poorer countries. Both flows-domestic savings and inward remittances benefit from improved financial services technology and lower transaction costs.

**As ever the Actis Macro Forum team remain available to answer questions relating to these and other topics and our back library is now available on-line [www.act.is/macro-forum-the-street-view](http://www.act.is/macro-forum-the-street-view)**

Exhibit 1: History of industrial revolutions





# The future starts here:

## Artificial Intelligence in Emerging Markets

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**Artificial Intelligence is here to stay, driving a new age of societal and economic change brought on by technology that replicates human decision making intelligence. We are living in what has been termed the 4th Industrial Revolution. As Klaus Schwab, founder of the World Economic Forum said in 2016, "We stand on the brink of a technological revolution that will fundamentally alter the way we live, work and relate to one another"<sup>1</sup>**

Artificial Intelligence is the broadest description for defining a technological process that is capable of automated decision making. Within AI is "Machine Learning", where machines identify patterns in vast amounts of data for the purpose of drawing conclusions and learning from these in order to enforce behavioral change. The resultant opportunities through increasing innovation and productivity are huge. Recent reports by McKinsey<sup>2</sup> and PWC<sup>3</sup> have predicted that AI could incrementally contribute 14-16% or over \$13trn to current global economic output, a productivity growth of 1.2% between now and 2030 through a combination of labor automation and innovations in products and services.

### AI - A disruptive influencer?

AI is a disruptive influencer and there are therefore far-reaching consequences for all economies. We are already seeing the changes forecast for low skilled, labor intensive jobs across the world, particularly in the retail and car manufacturing industries through the introduction of AI. It is expected that 6% of all jobs in the USA will be lost to AI automation by 2021. McKinsey has predicted that automation will displace nearly 13% of South Africa's current work activities by 2020. The World Bank predicts a loss of 5 million jobs to AI worldwide by 2020.

### An opportunity for Emerging Markets

In Emerging Markets there should be no fear of falling behind but instead we will see in this article examples of how countries are using disruption brought about by AI as an opportunity to bring positive change to such key sectors as finance, energy and education. The differences between Emerging Markets and more developed economies in terms of infrastructure and services could prove to be a positive advantage in that AI provides the opportunity to redefine how economies can work more efficiently without simply replicating long-standing processes and infrastructure from developed economies. Private Equity, as can be seen by rising deal volumes, is recognizing this trend (Exhibit 1)

### Financial Inclusion

Given the fact that Emerging Markets have successfully leap-frogged stages in development in mobile telephony and banking similar growth dynamics could occur with AI. Data derived from digital transactions through the smartphone is a key enabler for AI development. AI is facilitating financial inclusion by developing algorithms that derive value from the vast amounts of untapped data accessible through smartphones allowing services to be offered to people not currently served by financial institutions.

As we will see in Julian Kim's Street View on 5G in South Korea, *High Speed Korea*, the speed and bandwidth becoming available

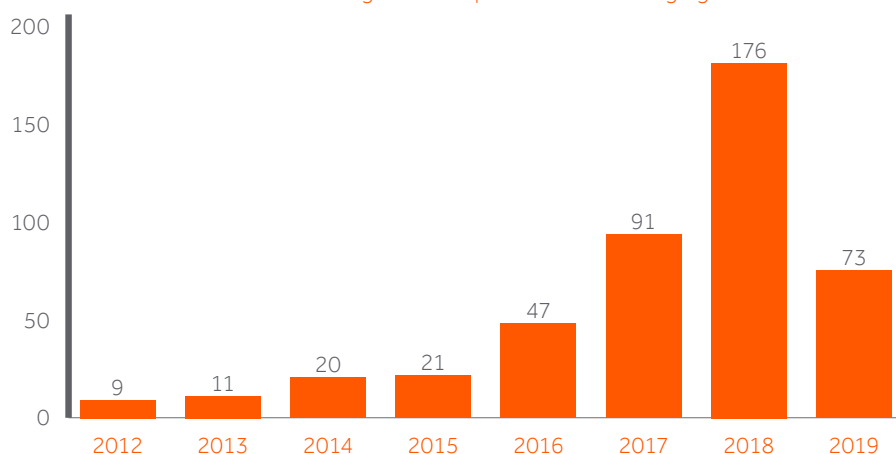
allows huge amounts of data to be transmitted, received and interconnected to multiple devices that can "talk" to each other. When AI is layered on top, this allows rapid and insightful services and decision making.

In the credit industry, artificial intelligence has helped traditional lenders approve loans by using thousands of pieces of individualized data that help assess credit worthiness. Using AI, Grameen Bank in Bangladesh gathered data on who the most likely loan defaulters were likely to be, and by managing this risk felt comfortable in lending billions of dollars of microcredit, as a result achieving a default rate of less than 1%.

Loan Apps are using Artificial Intelligence to transform the lending industry in Africa. Branch and Paylater, in Nigeria, are two of the leading AI players using deep learning technology to review smartphone data extracted from potential customers text messages and address books to make lending decisions based on estimated credit worthiness, eliminating the need for copious paperwork or guarantors. As a result, both have been able to reach millions of customers in Nigeria who are unable to be served by traditional banks.

Pine Labs, our FinTech investment in India offers AI influenced tailor made solutions to retailers and merchant banks globally. More than 75,000 retailers across India rely on Pine Lab's solutions to securely

Exhibit 1: PE Deals in Artificial Intelligence companies within Emerging Markets



Source: Capital IQ

- 1 The Fourth Industrial Revolution: what it means, how to respond; World Economic Forum; Klaus Schwab Jan 2016
- 2 Notes from the AI Frontier: Modeling the Impact of AI on the World Economy ; McKinsey Sept 2018
- 3 Sizing the Prize: What's the real value of AI for your business and how can you capitalize; PWC 2017

and regularly manage their payments. As with Grameen, Pine Labs provides quick business loans with bare minimum documentation and flexible rates.

Earlier this year, Rakbank, a retail bank in UAE teamed up with Pine Labs to develop an innovative and unique payment platform in the UAE that should transform the payments landscape in the region, converting "point of sale" terminals into a "point to acquire and engage", offering customers multiple value added services, such as instant instalments, access to diverse rewards, loyalty programs, top-ups, bill payments and instant discounts. Through one innovative payment process, improving the customer's banking experience by delivering value add and offering choice.

### Energy Benefits

Extracting value from data in terms of renewable energy usage, Azuri Technologies, a leader in pay-as-you-go solar technology has introduced innovative AI solutions into remote communities in Sub Saharan Africa who do not have access to conventional power grids. Using AI, the solar usage of individual users are converted into data and this information is used to teach the solar panels how much personalized solar energy to capture on a daily basis.

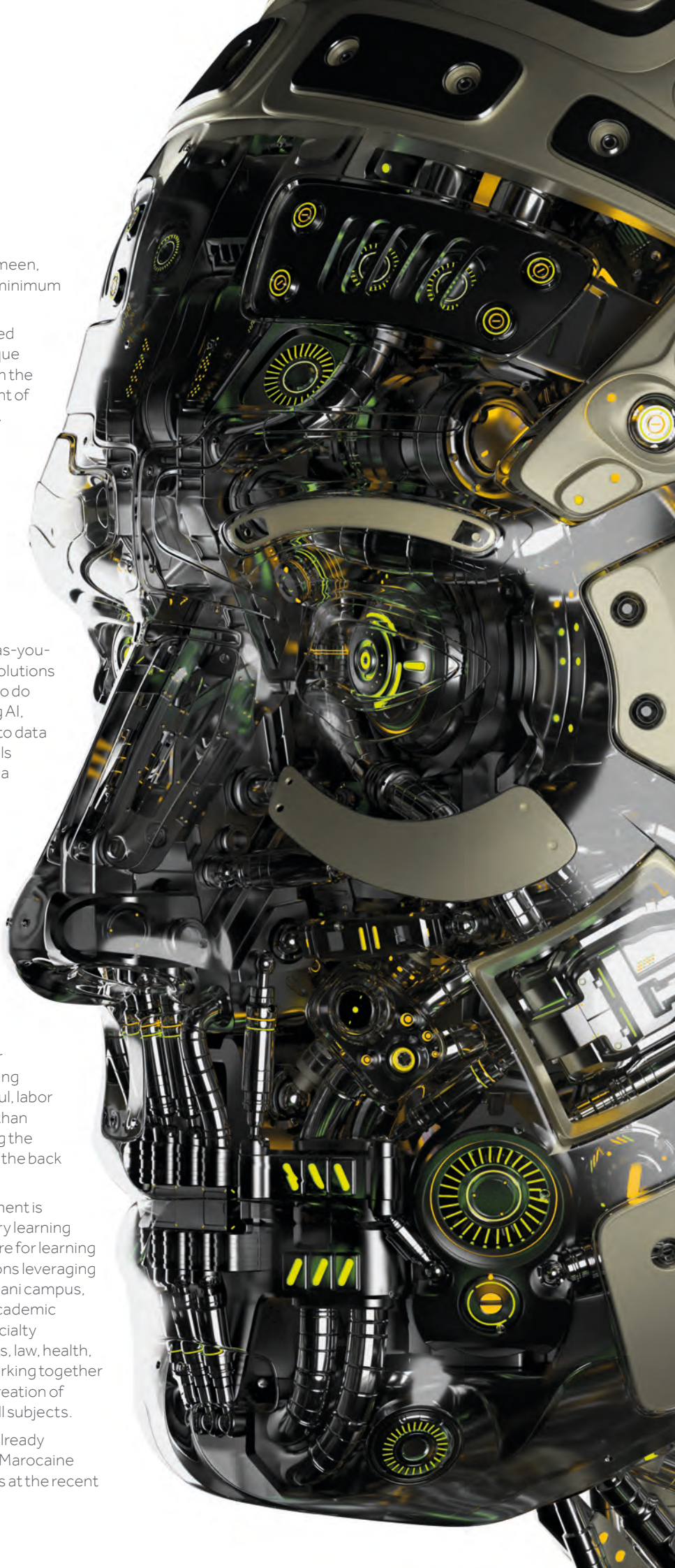
By using machine learning algorithms combined with real time weather data from satellites, ground observation and climatic models, the future requirement for generated electricity from renewable sources can be forecasted that can allow better planning for meeting future customer needs and also improve equipment O&M and predict downtimes, thereby extending the life of equipment.

### Prepare for the opportunity through Education

Such developments in AI only come through a laser like focus on education to increase advanced learning opportunities in new technologies. To be successful, labor needs to up-skill and become an influencer rather than a victim of disruptive technology change, exploiting the opportunities of AI through applying innovation on the back of enhanced knowledge.

Honoris United Universities, our Moroccan investment is leading the way in Africa in developing a 21st century learning environment, firstly by developing the infrastructure for learning and then secondly by developing innovative solutions leveraging off Artificial Intelligence. Honoris has opened Roudani campus, a city center facility that is open to students of all academic disciplines, designed specifically to allow cross specialty fertilization bringing together the school's business, law, health, finance, architecture and engineering faculties, working together on cross-specialty projects. Alongside this is the creation of Honoris Space, an innovation hub for students of all subjects.

Such focus on innovation and cross fertilization is already winning Honoris awards. Two laboratories at Ecole Marocaine des Sciences de l'Ingenieur (EMSI) have won awards at the recent







International Exhibition of Inventions and Technological Innovations held in March 2019. One was for their SmarTraffic innovation, a decentralized system based on radiofrequency identification and image processing that is able to manage traffic in an optimal and intelligent way. It identifies vehicles in a state of emergency, for example, firefighters, ambulances or the police and controls traffic lights dynamically.

Another award was for SmartyPark, an intelligent parking solution using connected object technology implemented to available parking spaces in a city that allows real time positioning and guidance for the driver to a nearest parking space, optimizing real time parking and mobility within the city. This innovation guarantees a direct economic, ecological and social impact on city infrastructures.

Indian and Chinese technology giants such as Paytm, Baidu, Alibaba and Tencent are investing heavily in AI and establishing research labs. In China, the importance of AI is well recognized. The aging population (now 50% middle aged) is likely to fall short of the workforce numbers needed to maintain productivity at current levels. China is looking to use AI to build a new economic growth model that relies less on capital intensity and more on private consumption, services and innovation to drive growth.

In Feb 2019, Microsoft India announced it plans to train half a million young people in AI over the next 3 years and set up AI labs in 10 universities. Going forwards, over 800 higher education institutes in India will be ranked on their success in teaching innovation and entrepreneurship development. Google have created an AI research center in Accra, Ghana, bringing together researchers and engineers to focus on the applications of AI. Google also launched Launchpad Accelerator Africa through which 100,000 developers and over 60 startups have already been supported.

As Julian Kim will highlight in his piece, *The Fourth Industrial Revolution – Are We Prepared?*, the key drivers for success are a highly educated population with the necessary injection of capital to foster industry growth. South Korea is pre-eminent in

technological innovation through decades of Research & Development enabled through focus on education.

AI will be an enabler through introducing web-based training that can teach complex skills to a widening workforce. This educational approach is beginning at school level. Hong Kong company, SenseTime has collaborated with the MOOC center of East China Normal University and middle school teachers in Shanghai to produce an AI textbook for high school students and 40 schools in China will participate in this AI program.

Honoris has launched a masters course in AI within both its IT and business schools and will integrate an introductory course in AI in all engineering qualifications.

In relation to vocational training, the level of teaching can increase in complexity based upon the intellectual and emotional response of each individual worker as they begin to demonstrate an understanding of skills taught. VIPKid in China has collaborated with Microsoft to implement an educational platform that uses the learners' webcam to assess his/her facial reaction to a new concept and sends prompts to the instructor on how well the learner has assimilated the skills taught.

### The future is exciting

According to a recent report by Great Learning, an Indian online and hybrid education company, India has twice as many jobs in data science and machine learning as job seekers<sup>4</sup> Focus must be on the upskilling of potential employees to take on the 97,000 jobs that lie currently vacant in India alone, a 45% jump in open job requirements compared to previous year.

**Unsurprisingly, media attention has focused on the negative impact of AI on Emerging Markets, particularly the resulting job losses. Whilst not minimizing the disruptive effects of AI, which are inevitable, this article has tried to show the opportunity and progress already achieved across Emerging Markets through leveraging AI. However, the challenges of AI should not be under-estimated. How a country manages these disruptive influences goes hand-in-hand with how the positive benefits of AI can be harnessed.**



# The Fourth Industrial Revolution: Are we prepared?

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**An industrial revolution means much more than a technological leapfrog. Breakthrough innovations have to be commoditized for the significant improvement in productivity across industries needed for economic growth. As a global technology leader Korea is well placed for the Fourth, ICT driven revolution, which will accelerate data consumption growth. Demand for specialist commercial property including data centers to store data will keep on growing on the back of this revolution.**

## History of industrial revolutions

The first revolution which spanned much of the 18th and 19th centuries began with agricultural and transport revolutions. Mechanization swiftly followed along with mass urbanization. Britain led the way benefitting from an educated workforce, a well-functioning financial system and a captive imperial market. The second wave based on electricity and oil established

the mass production method we still use today driven by the so-called Fordism. This consists of the Taylor system, conveyor belt assembly lines, and standardization of manufacturing parts. In this case, the United States blessed with ample natural resources, an entrepreneurial infrastructure and a massive domestic market was the leader. The new production method has saved many from a morass of material deprivation, yet it has also resulted in limited choices within product ranges. Revolution 3.0, the digital revolution, opened up new high-tech sectors through electronics and IT applied to the Fordism model, bringing rapid economic growth opportunities for emerging markets driven by enterprises searching for lower production costs.

## Why is the fourth wave different?

The fourth wave integrates Information and Communication Technologies<sup>1</sup> ("ICT") into every industry for a quantum jump in productivity. Dwindling population growth and increased needs in a leveraged financial system for high return capital lite structures are powerful drivers of change. Global manufacturers have

already become ICT based manufacturing companies as witnessed at a recent Consumer Electronics Show in Las Vegas<sup>2</sup>.

What is really interesting about the application of advanced ICT is its potential for shifting the manufacturing paradigm from mass production with a limited variety to small-batch and mixed production with a vast variety of product. Yet improved productivity also comes with challenges. Growing inequality and unmatched growth between productivity and wages are challenges which need to be addressed through a social consensus on redistribution of the excess wealth. The fourth wave poses a new challenge to emerging markets as it will eventually replace cost efficient labor forces with advanced automated production technologies as witnessed by Adidas bringing its production back to Germany known as SPEEDFACTORY and Japanese reshoring initiatives in electronics and autos.

## Winning the Race

The major drivers for a country to lead this race are a solid manufacturing base, advanced ICT infrastructure,



- 1 ICT is a broader concept of IT with a focus on communication technologies (e.g., internet, wireless networks) to provide access to information through telecommunications. Hence, ICT is generally considered a broad term that includes IT, which is the use of computers to store, retrieve, transmit, and manipulate data or information.
- 2 CES is an exhibition owned by Consumer Technology Association (CTA). Enterprises engaging in consumer technologies across the world participate the exhibition.

concentration of a highly educated population with strong spending power, government's active support as a facilitator, and capital to foster industry growth. New entries into manufacturing by ICT players are much more challenging than the other way around due to manufacturers' hands-on production expertise accumulated for generations and capex heavy infrastructures. Improvements in productivity by integrating ICT absolutely depends on analysis of big data<sup>3</sup> including networks for collection, analysis, transmission and storage. Dense populations with strong spending power accelerate the data accumulation critical for operation of smart cities. Highly educated and creative human capital is the core driver for continuing innovation supported by governments promoting social cohesion.

Korea has all these drivers. Competition in its leading industries has been fierce, yet Korea continues to maintain its pre-eminence through constant technological innovations. It has in fact taken a step further to expand into new tech intensive territories including microprocessors, image sensors, foundries, mobile network equipment, rechargeable batteries for all kinds of electronics including electronic vehicles, biotechnology, advanced driver assistance system, construction of smart

factories, robotics, and high-tech materials. The strong presence in these seemingly new territories have not been achieved overnight as corporates put years if not decades of investments in R&D and market development by leveraging technical expertise and capital accumulated in the leading industries. Outstanding growth across these high tech industries over the past several years definitely provided blueprints for a new growth driver in Korea.

### Actis opportunities in this changing industrial landscape

As long term real estate investors we see attractive opportunities arising from this changing industrial landscape. Again, the fourth wave is essentially integration of ICT into every industry and to make a quantum jump in productivity, creation and deployment of big data for analysis is imperative. More gadgets and devices ("Internet of Things") around us in our daily lives are getting connected to the web collecting data all the time. The analytical capability is a whole new frontier but from a physical infrastructure perspective two things are critical to make this happen: (1) next generation networks to allow data to transfer much more efficiently than the current technology and (2) sophisticated

### Global Manufacturing Competitiveness Index rankings by country

#### 2016

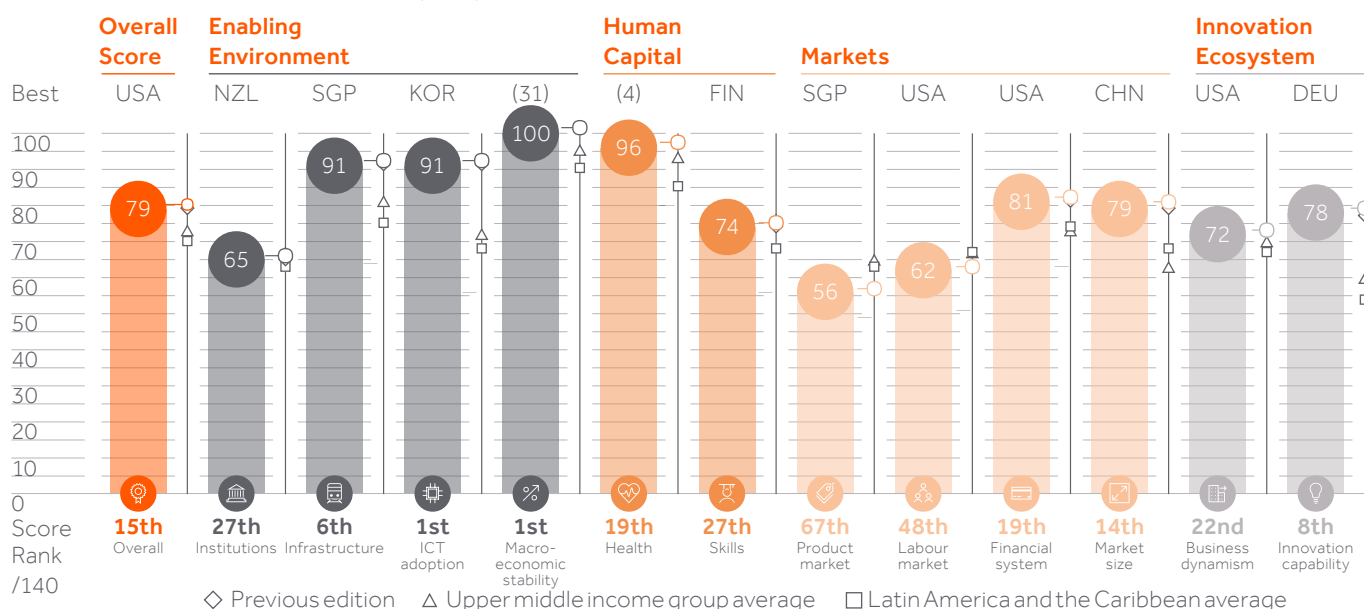
Rank	Country	Score
1	China	100.0
2	United States	99.5
3	Germany	93.9
4	Japan	80.4
5	Korea	76.7
6	United Kingdom	75.8

#### 2020E

Rank	Country	Score
1	United States	100.0
2	China	93.5
3	Germany	90.8
4	Japan	78.0
5	India	77.5
6	Korea	77.0

Source: Deloitte Touche Tohmatsu Limited

Exhibit 1: Global Performance Overview (2018) – Korea



Source: The Global Competitiveness Report 2018 by World Economic Forum

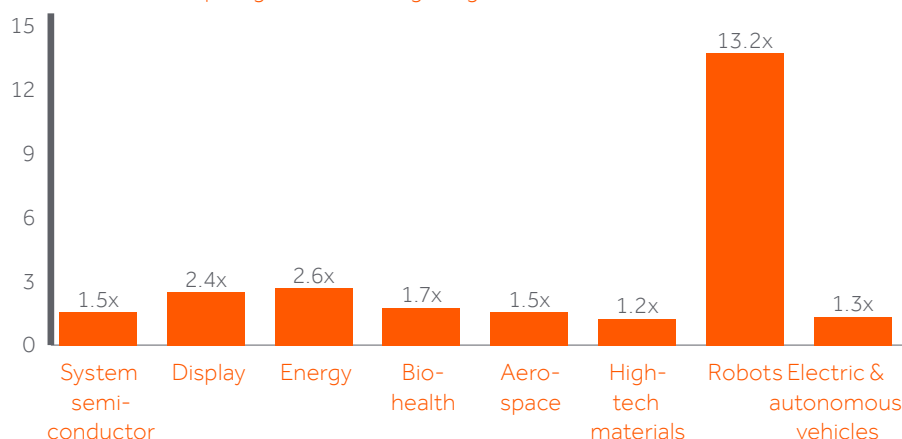
3 There are various definitions on the term big data including a technological term (petabytes – 1,024 terabytes or exabytes – 1,024 petabytes of data). In this article, big data refer to a massive volume of data that are stored in both structured and unstructured manners, and hence are difficult to process with traditional processing techniques.



data centers in strategic areas to store vast amount of data that will keep on piling up.

In our two markets in Northeast Asia - Korea and China data center development opportunities are still in relatively early stage compared to mature markets with de-regulated telecom markets, carrier neutral data centers and leading global operators such as Equinix and Digital Realty. Leading Asian markets such as Hong Kong and Singapore have been following the same path, yet much larger economies such as China and Korea have heavily regulated telecom markets and data center markets dominated by few entrenched players. In the early days, telecommunications was a government driven industry (still the case in China) with a national infrastructure dominated by a handful of large players. For instance, two of the top three players in Korea (SK Telecom, LGU+, KT Corporation<sup>4</sup>) still depend on KT's wired communication networks as KT was a government enterprise that established the networks across the country. Due to this high entry barrier, data centers have been mostly developed by carriers and a few domestic operators for their internal use and colocation businesses. In China, the dominant players are the three large state-owned telecoms, namely China Telecom, China Unicom and China Mobile, which operate across the full spectrum of data center services including development of the asset, leasing white space<sup>5</sup> to operators, operating co-location and managed hosting, and development of value-added cloud services. Most Korean data centers are for corporates' self-use and public services and the remaining commercial data centers are either directly operated by carriers or a few professional operators that are subsidiaries of Korean conglomerates. These few professional operators have recently been paying attention to the carrier neutrality, driven by large cloud service providers demanding more for high quality services. These facilities were also mostly built in the early days of data center development with inferior specs and hence are unfit for sophisticated demand of both cloud and colocation service providers. As of 2018, there are 30 commercial data centers

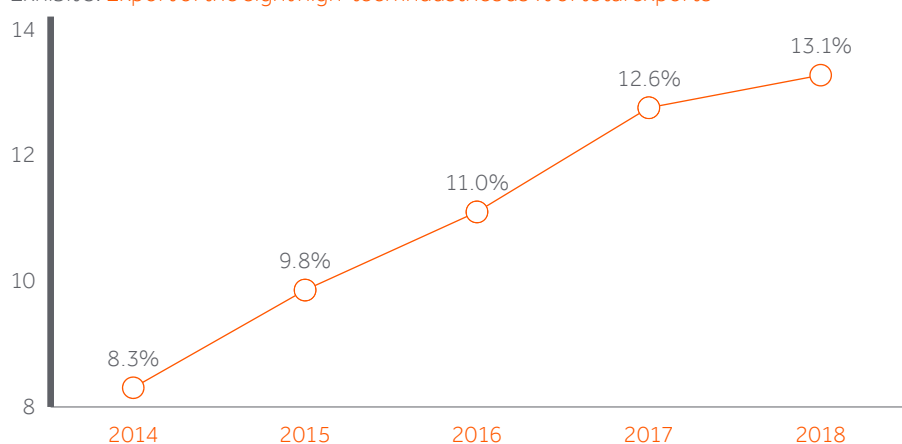
Exhibit 2: Annual export growth of the eight high-tech industries in Korea (2014-2018)



Note: the government has set twelve key industries in 2017 with specific growth targets as they are becoming the new growth driver of Korea. Currently, data of the eight industries are available only.

Source: Korea International Trade Association ("KITA"), Ministry of Trade, Industry, and Energy ("MOTIE").

Exhibit 3: Export of the eight high-tech industries as % of total exports



Source: MOTIE

across Korea of which only 5 can provide IT load greater than 20 MW, which is generally considered a minimum IT load for hosting cloud service providers.

Our institutional development model, which we refer to as "build to core" will continue to capitalize on opportunities in these larger Asian markets with a significant demand and supply mismatch of this relatively new asset class with a greater emphasis on partnership with quality operators. In China for instance, we have partnered with an experienced IDC developer/operator to develop the first hyper-scale carrier neutral IDC campus just outside of Beijing. In Korea, securing

land title is critical in order to secure anchor tenants before construction begins as they require a greater level of certainty around delivery date. Hence, we partner with a major data center operator from the initial land acquisition stage including analysis of adequacy of data center development (e.g., power usage assessment, fiber optic cable connectivity, availability of substations nearby), building designs and specs and assessing a probability of securing permits and approvals. Once we complete the first stage, we are then able to secure quality colocation and cloud service providers as anchor tenants, which will allow us to quickly stabilize the development asset.

4 Established in 1981 as a telecom company, KT was a government entity engaging in construction and operation of wired networks across Korea. The company was privatized in 2002, yet it is still subject to a Korea law under which foreign ownership cannot exceed 49%.

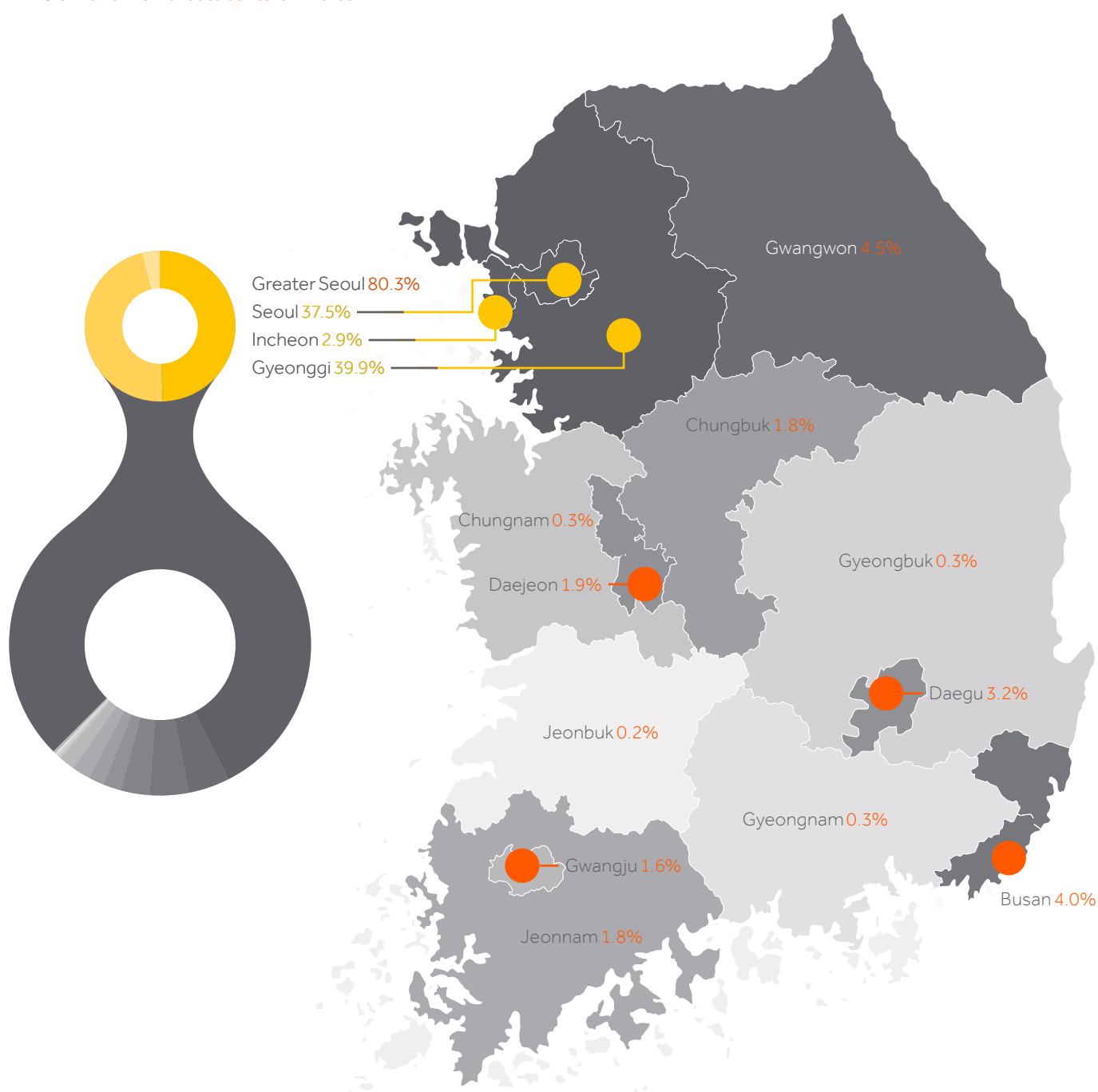
5 White space in data center typically refers to the space to place IT equipment. Gray space in the data centers typically refers to the area for back end infrastructure.

Securing land in prime locations will continue to be our challenge, yet with the advent of the 5th Generation (5G) wireless system, future outlook on demand for data centers is bright. China already has the largest internet/mobile network population on the planet, but the penetration rate is still less than

60%<sup>6</sup> indicating an enormous potential for data growth. Korea as a global ICT leader has advanced network infrastructures with nearly 100% internet/mobile network<sup>7</sup> and smartphone penetration rates. At the same time, it is facing an opportunity for a quantum jump in the once mature

network infrastructure that will vastly improve everyday life by connecting everything around us. The 5G network infrastructure still needs to be further developed for maximum performance, yet once it does data usage will accelerate further with consequential need for specialist facilities.

Exhibit 4: Overview of data centers in Korea



Source: Korea Data Center Council (KDCC), 2018

6 Source: China Internet Network Information Center

7 99.5% of total households are capable of connecting to the internet (as of Sep 1 2018). Source: Korea Internet & Security Agency (KISA). Ministry of Science and ICT



# Street view: High Speed Korea



Please watch this podcast at [www.act.is](http://www.act.is)

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**Every time you use a smartphone you benefit from mobile telecommunication technology we now take for granted. Each generation of the mobile technology has certainly made our lives more mobile, and the market seems to be particularly excited with the next generation known as 5G. Basically, the faster one can transmit and receive data, the greater the functionality. 5G mobile technology's data transfer rate of up to 20 Gbps achieved by utilizing massive bandwidth and ultra-low latency as well as its dense coverage connecting up to a million IoT devices grouped at one square kilometer make it a game changer. At its full potential, 5G technology will interconnect a massive number of IoT devices seamlessly to transmit data and instructions instantaneously. Computers and robots will generate, exchange and process data among themselves with human insight but without human intervention. Affordability relative to today's 4G technology is very competitive with a lower average price of delivery per gigabyte allowing faster growth of data consumption. This obviously leads to a parallel surge of demand for data centers.**

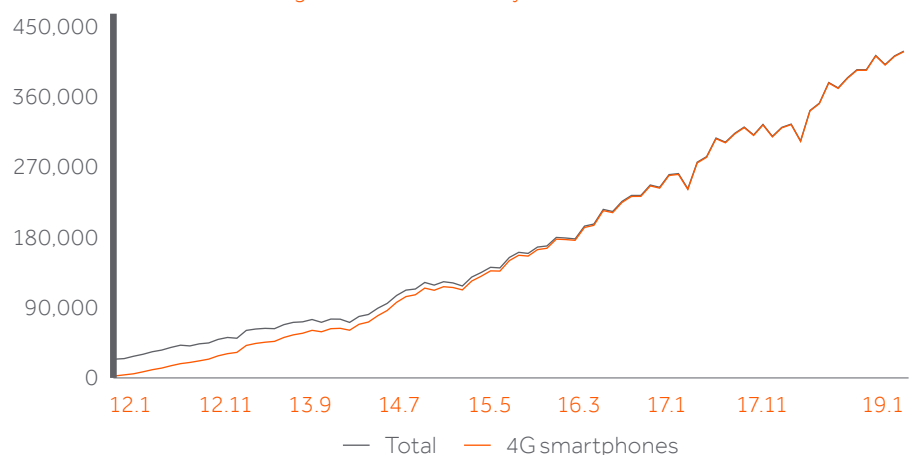
That being said, the promising performance currently exists in theory only as evolution of the 5G technology is still in progress with challenges to be overcome. The latest available 5G modem chips of the top manufacturers are still way below effective performance levels. Densification of radio access networks including base stations, small cells, and repeaters has to be completed across Korea as high-frequency bands where its true performance lies cover much smaller areas compared to low-frequency bands we currently use. As of April 2018, there are roughly 85,000 5G enabled base stations across Korea representing approximately 10%<sup>1</sup> of the 4G stations. Enterprises will need to

- 1 Estimation based on dividing the number of 5G enabled base stations as of 3 April 2019 by the number of 4G base stations as of 20 March 2019 (source: Ministry of Science and ICT)

team up with a competitive telecom service provider to set up necessary network architectures to fully utilize the next generation technology.

**The future of Korea however is still positive. Korean carriers will continue to build 5G network infrastructures across the nation, which will make significant differences in all industries and potentially allow Korea to become the first nation to truly establish a comprehensive commercial 5G network.**

Exhibit 1: Mobile data traffic growth trend (in terabytes)



Note: a terabyte = 1,024 gigabytes

Source: Ministry of Science and ICT

Exhibit 2: Key capability comparison between 4G and 5G mobile technologies

	4G	5G
Peak data rate	1 Gbps	10~20 Gbps
Latency	10 ms	1 ms
Connection density (devices/km <sup>2</sup> )	10 <sup>5</sup>	10 <sup>6</sup>

Source: International Mobile Telecommunication 2020 standards (IMT-2020) of International Telecommunication Union (ITU)

# Beyond the grid

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## Energy access

**Established in 2015, United Nations Sustainable Development Goal 7 ("SDG7") – to ensure access to affordable, reliable, sustainable and modern energy for all by 2030 – signals a recognition of the importance of access to energy services and of the centrality of energy in achieving many of the other development goals.**

In our last edition, we discussed how increased access enables higher value-add economic activities to advance. However, despite some good progress, there remain 1 billion people globally without access to electricity, 590 million of which are in Africa. Development in technology and declines in cost of solar panels and lithium-

ion batteries are unlocking alternative electrification options, including distributed generation and off-grid solar.

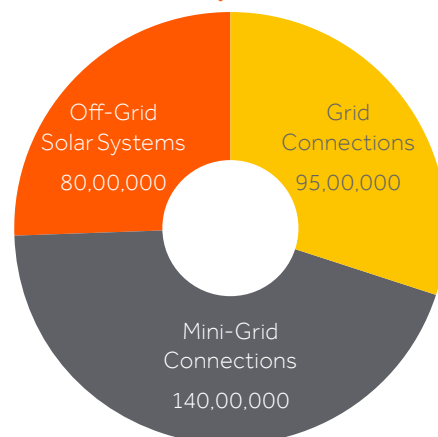
## Off-Grid Solar is the most cost-effective solution for a significant proportion of people lacking electricity access

For the 1 billion people without electricity at a global level, 30% of new electricity access is expected to come from traditional grid extensions, with the remaining 70% coming from off-grid decentralized systems, particularly solar home systems (SHS) and mini-grids. This is the cheapest way to provide power to these people, driven by a combination of factors, primarily distance from the existing grid, population density and intensity of energy demand.

## The Solar Home Systems market today, and the financial services industry emerging behind it

Collectively the 1 billion people off-grid are spending US\$27 billion each year on basic lighting and other energy services from traditional energy sources (kerosene, candles, battery torches, other biomass and fossil fuels). Off-grid solar products are not only cheaper than these conventional

Exhibit 1: Most cost-effective mix of technologies for delivery of universal household electricity access in rural areas



Source: World Energy Outlook, IEA, 2014

solutions; they are also safer, cleaner, and more reliable. Importantly, this means off-grid solar products substitute existing customer spend into unsatisfactory products for the provision of a necessary service, they are not nice-to-have.

The early off-grid market has been dominated by small "pico" solar lanterns to provide basic lighting, led initially by government support and innovative

Exhibit 2: Least-cost electricity access options




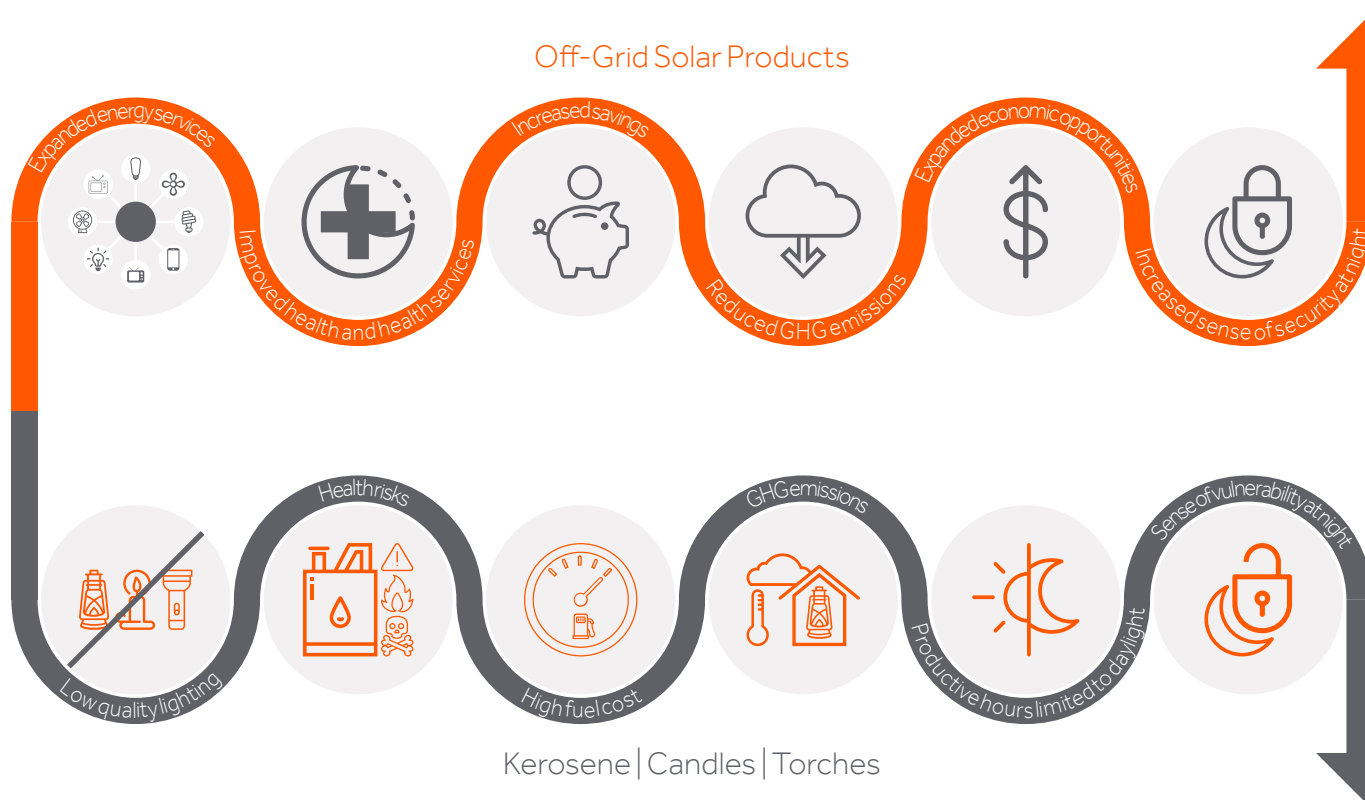
Electrification Choice	Typical Capacity	Description	Comment
<b>Main Grid Extension</b> 	Multiple MWs and GWs	Expansion of existing grid with supply from central power generation	Main grid extension is generally the least-cost option for people who already live close to the grid (such as urban and peri-urban populations)
<b>Mini-Grids</b> 	25kW – 5MW+	Small generation plus distribution grid system providing electricity connections to multiple localized residential & commercial customers	Mini-grids are usually least-cost for people who live a distance from the main grid such that extension costs are higher than installing local generation and storage capacity, but in a location densely populated enough to support the fixed costs of building the infrastructure.
<b>Solar Home Systems ("SHS")</b> 	5 - 300 W	Residential energy solution, generally a small standalone solar panel on a rooftop with system components inside the home	Solar Home Systems are the least cost for everyone else – those living in sparsely populated areas, where running poles and wires from even a local mini-grid becomes expensive.


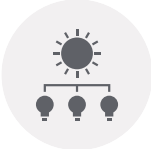



Exhibit 3: Benefits of off-grid solar products vs kerosene/candle



Source: Lighting Global

Exhibit 4: SHS Product Categories and Energy Service Provided

Overall category	Solar module capacity Watt Peak (indicative)	Categorization by services provided by product
<b>Portable Lanterns</b> 	0 - 1.5 Wp	Single Light only
	1.5 - 3 Wp	Single Light & Mobile Charging
<b>Multi-light Systems</b> 	3 - 11 Wp	Multiple Light & Mobile Charging
<b>Solar Home Systems</b> 	11 - 20 Wp	SHS, Entry Level (3-4 lights, phone charging, powering radio, fan etc.)
	20 - 50 Wp	SHS, Basic capacity (as above plus power for TV, additional lights, appliances & extended capacity)
	50 - 100 Wp	SHS, Medium capacity (as above but with extended capacities)
	100 + Wp	SHS, Higher capacity (as above but with extended capacities)

Source: GOGLA

charities like SolarAid. Today larger solar lights and plug-and-play solar home system products are in high demand. These products can not only provide lighting but also power for phone charging, radios, televisions, fans, refrigeration and a variety of other services from highly efficient appliances designed specifically for off-grid.

Solar lights and home systems are now readily available in many hard to reach regions of Africa and Asia, more than 150 million off-grid solar devices have been distributed to customers providing electricity access to more than 400m. The industry is in high growth mode and investors are paying attention, 2018 saw a record \$500+m invested globally in off-grid energy access companies, taking total investment to over US\$2bn to date, including commercial debt and equity players.

Two distinct business models have emerged; cash-sales and Pay-As-You-Go (PAYGo). The PAYGo model allows customers to finance their solar system through a lease-to-own arrangement, with a small down payment and regular affordable installments over a period of 1-5 years via mobile money, airtime or scratch cards, overcoming the issue of upfront cost for the customer. This is driving the growth of the SHS market currently under way.

PAYGo SHS typically incorporate technology that allows remotely controlled shut-off in case of non-payment, helping to minimize default rates but also providing access to interesting and proprietary customer consumption and credit data. This opens up the market to a completely new way of thinking as a route to provide financial services for the first time to hundreds of millions of underserved customers who have never had a bank account or credit rating.

PAYGo companies are monitoring their data closely to cultivate long-term customer relationships that can be leveraged to upsell larger systems and are expanding into other financed-product offerings for appliances and wifi, but also pure-play financial services like insurance and cash loans. We are also hearing of PAYGo companies considering models for on-grid consumer financing.

Further, SHS businesses do not reflect the profiles that we usually see in the energy and infrastructure space. Payments are based on a fixed US\$ amount a month or day irrespective of the electricity produced, rather than a US\$/kWh tariff that we are used to. The distribution and operational model for SHS is sprawling and complex, credit risk is based on basic consumer surveys and diversification rather than single customer offtake contracts with credit enhancement.

As such, most PAYGo SHS companies could (and should) be classified as a consumer finance and services business.

The industry is still working this out, SHS companies don't know how to classify themselves as they approach a broad range of tech, financial services, consumer, energy or infrastructure investors for backing. At Actis we have participated in fundraising pitches from the leading SHS businesses and observed their senior management team disagree live in front of us as to whether they are a consumer finance or an energy business. We have seen some large European utility players investing in the market, such as Engie's backing of Fenix. This is providing credence towards the sustainability objectives of these utilities, whilst providing them early access to the sector's large potential, and helping a continued move towards the global trend of "Utility 2.0"; the Utility

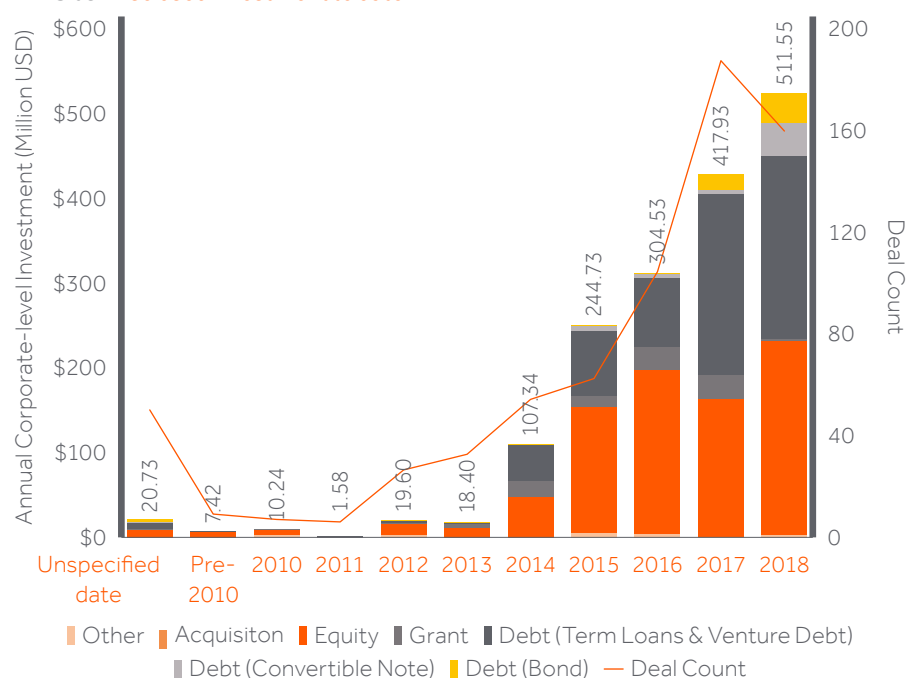
of Future ideal of being an integrated customer-centric service provider rather than a producer and mover of kWh.

### The SHS-led consumer finance sector is set to be a huge market opportunity, but needs careful consideration on how and when to participate

Forecasts are for 80% CAGR in off-grid SHS sales to 2022. With a giant opportunity available across multiple geography and service offerings, SHS businesses are moving in different directions, at different speeds, with different models, and we are seeing the emergence of the industry's first winners and victims as these routes are tested.

The exciting fundamentals and clear impact story of SHS dressed up into crisp PowerPoint presentations led by enthusiastic young entrepreneurs has proved alluring, as shown by the recent influx of investment. However, the sector remains young and the ultimate industry picture is still being determined. Too many well-funded management teams have focused on growth at all costs, rather than profitability and the customer. Some investors may have moved too quickly as demonstrated by the spate of recent SHS company geographical retreats, product recalls due to technology failure, high default rates as a result of poor

Exhibit 5: Disclosed investment to date



Source: Wood Mackenzie - Strategic investments in off-grid energy access



Exhibit 6: Pros and Cons of SHS for a Financial Services investor

Pros		Cons	
<b>1. Obvious commercial offering</b>	<ul style="list-style-type: none"> <li>– PAYGo SHS payments displace existing spend with a cheaper and better product for the consumer</li> <li>– Close relationship with customer enables profiling of lifestyles, needs and demands to offer customized products and services</li> </ul>	<b>1. Capex and balance sheet intensive models</b>	<ul style="list-style-type: none"> <li>– PAYGo companies typically hold consumer debt on their own balance sheet and have an asset heavy working capital cycle</li> <li>– Because they are extending consumer credit without accepting deposits like a commercial bank, in the short term PAYGo companies require regular injections of working capital to cover their receivables for the tenors of the customers' loans, requiring regular raises from capital markets</li> <li>– We are seeing some interesting off-balance sheet fund raises in this regards</li> </ul>
<b>2. Under-penetration of formal financial services creates wider opportunity</b>	<ul style="list-style-type: none"> <li>– Clear overlap of consumers that live off-grid and do not have access to formal financial services</li> <li>– PAYGo SHS provides an opportunity to layer other financial services such as loans, health insurance to the most hard to reach customers</li> <li>– Much of the value chain provides strong synergies with other financial services e.g. distribution channels already in place</li> </ul>	<b>2. Payment collection and default rates</b>	<ul style="list-style-type: none"> <li>– Default rates are low to date, usually lower than 15%, because the solar kits are affordable and become first necessity products for customers</li> <li>– Some companies have seen higher defaults, possibly due to relaxed credit standards in the pursuit of growth</li> <li>– Handling of defaults can be labour intensive, particularly in rural areas</li> </ul>
<b>3. Enables assessment of credit risk &amp; build-up of credit history</b>	<ul style="list-style-type: none"> <li>– Consumers can create a formal credit history (providers collect repayment data and score customers)</li> <li>– Creates a positive virtuous circle; better pricing of risk, leads to greater credit extension and potential to up-sell</li> <li>– Ownership of data creates sticky, long-standing customer relationship</li> </ul>	<b>3. Reputational risk</b>	<ul style="list-style-type: none"> <li>– Ethics of charging high effective interest rates to typically low income segment could be seen negatively, requires careful management in order to be a responsible provider e.g. threat of being seen as a pay-day loan lender</li> <li>– Perception of high price of electricity to the customer relative to the central grid requires consideration, onus on provider to demonstrate prices are fair</li> </ul>
<b>4. Modern payments infrastructure</b>	<ul style="list-style-type: none"> <li>– Mobile money and airtime are excelling in these markets</li> <li>– Consumer is often incentivized to move to electronic rather than cash payments (there is opportunity within our Actis payments portfolio to help in this regard)</li> <li>– Where infrastructure is limited, cash collection is possible</li> </ul>	<b>4. Obsolescence</b>	<ul style="list-style-type: none"> <li>– Solar costs and technology are improving fast, new advances can make existing equipment obsolete, possibly creating a raft of low tech goods doomed for the dump over the long run</li> <li>– As consumers increase their income, there is some uncertainty as to whether they will still use their off-grid supply</li> </ul>
<b>5. Regulation</b>	<ul style="list-style-type: none"> <li>– Generally progress regulation in support of energy access and financial inclusion (provision of basic need)</li> <li>– e.g. Ethiopia waived duties for off-grid lighting products meeting quality assurance standards, Uganda has a 45% subsidy on solar equipment, Kenya has implemented various tax exemptions for imported solar equipment</li> </ul>	<b>5. Regulation</b>	<ul style="list-style-type: none"> <li>– Off-grid is being encouraged generally by policy makers, but risk of negative regulations exists as the sector grows and potentially threatens the incumbent utility, and other conflicted parties</li> <li>– These risks include possible change of tax regime, application of interest rate caps and introduction of energy license requirements</li> <li>– For example, the East African Community re-interpreted the tax rules on solar lights in August 2016 which led to an overnight introduction of a 24% tax on the import of solar lights</li> </ul>

credit controls, over indebtedness, and the insolvency of the high-profile East-African focused Mobisol in 2019. Mobisol closed on a significant investment in 2016 from leading international development and commercial investors and provided electricity to more than 500,000 customers. Whilst some are retreating and rationalizing, others march on with their expansion plans at all costs. There is not a clear “right path” today.

On the previous page we outline the current pros and cons that we see in the sector through a Financial Services (“FS”) lens.

### Concluding remarks

Off-grid solar demonstrates that installing a solar system in a home, an apparently small intervention, can enable out-sized gains in welfare, productivity, and income generation. In growth markets, the sector could lift millions of households out of energy poverty and provide them a route to financial inclusion, opening up new economic opportunities for the next generation.

In many ways the business models being deployed in this space are on the cutting edge of emerging trends shaping electricity and financial service markets in developed economies; decentralized technologies, complex data analysis, the Internet of Things, mobile banking, and so on.

We could see a double leapfrog; over traditional electricity-grids and traditional financial services, straight to distributed generation and mobile banking. With US\$26bn expected to be invested in the SHS sector by 2030, the private sector has a vital role to play in scaling the off-grid industry.

**As off-grid SHS providers look to enter the next phase of growth, the business models being deployed will continue their refinement. There will likely be an increasing focus towards strategic M&A in order to scale and deepen customer worth through value-stacking of adjacent services on top of basic electricity connections.**

**When our pre-conditions for growth, scale and success are met, Actis is uniquely positioned to participate in this exciting sector given our knowledge and experience of Energy, Financial Services and the growth markets.**









# Saving the future

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**Currency volatility remains the bane of investing in Emerging Markets. The UN reports in its 2019 *Financing for Sustainable Development* Report that 'Financiers responding to an FSB consultation cited currency risks as the most relevant factor constraining availability of infrastructure finance in developing economies.'**

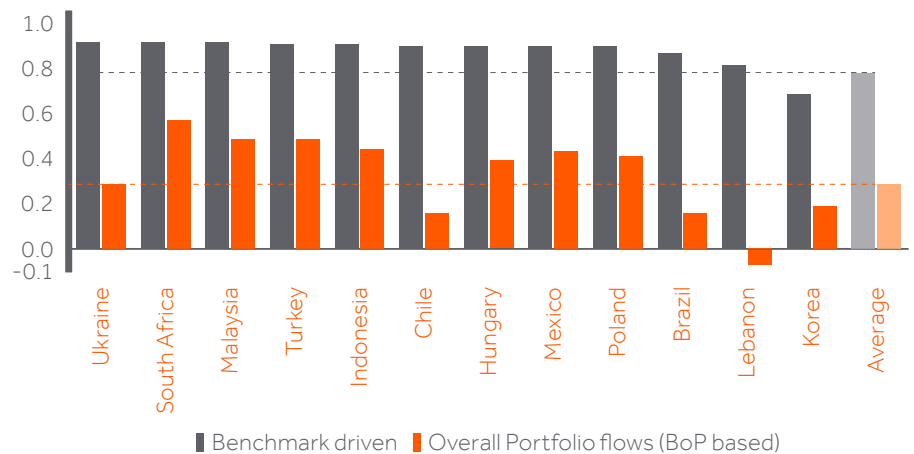
**Currency and commodity prices respond at the margin to the laws of supply and demand. That's particularly true in those EM countries where local currency is seen as a source of consumption rather than wealth. In such jurisdictions—usually but not always low-income economies demand for currency is frequently impacted by terms of trade shocks often driven by commodity price change.**

Somewhat ironically much of the ensuing macro volatility is tied to liberalisation policies prescribed by the IMF and others in stabilisation programs. The very cure—opening to foreign portfolio flows and banking presence—becomes a killer when flows hit a sudden stop. Long in the tooth EM investors hardly need reminding of how such reversals led to the various 1990's crises.

Portfolio flows have risen nearly fivefold in the last 4 years exceeding \$250 billion in 2018. The IMF estimates that a material proportion of these flows are through index-based instruments such as ETF's. This can be seen in the chart showing correlations between single country and overall EM equity inflows. Exhibit 1 suggests that foreign investor flows are dominated by passive investors. Such investors are more inclined to asset class views - 'China trade wars mean we sell EM' than country specifics. A terrible beauty is born.

Happily, offsets exist. We wrote last year (March 2018, *Bringing it home: Opportunities and trends in migrant remittances*) about the growing importance of remittances sent home to poorer countries. Such flows provide a stable source of demand for local currency being spent by families back home on basic consumption, healthcare and education. From Nepal to Nigeria or the Philippines to Panama these

Exhibit 1: Correlations between flows to a particular emerging market country and overall emerging market flows



Source: International Monetary Fund. *Global Financial Stability Report*, April 2019

remittances - way more stable than FDI or portfolio flows—play a role in stabilising currency markets. Such flows rose by 8% to over \$520bn in 2018 and are forecast to rise further over the next few years aided in part by fin tech bringing down transaction costs.

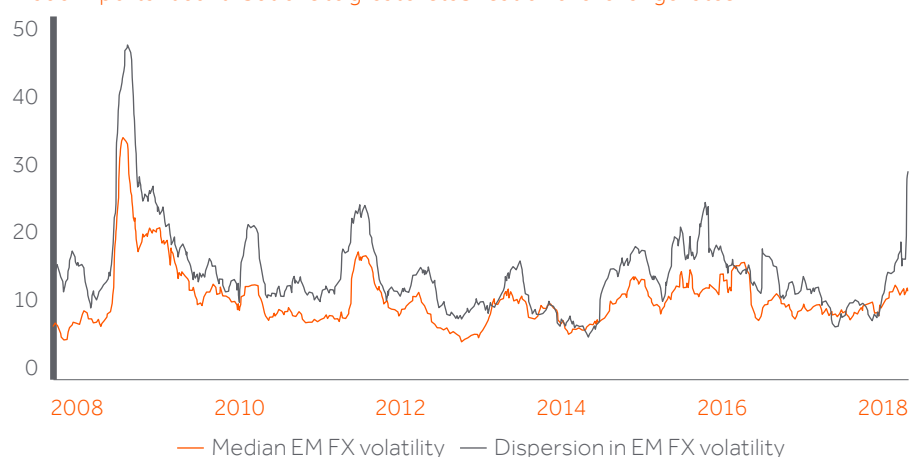
Wealthier countries have other sources of demand for domestic assets cast off by foreigners. Mandatory savings linked to retirement or insurance needs create demand for domestic assets to hedge liabilities. In developed markets pension savings, more than doubled their share of GDP in the period 1980-2010. Starting from a lower base the same is true in many low to middle income countries.

Many of the mandatory savings schemes were born of crisis. The poster child, Chile, introduced mandatory funded worker schemes in the aftermath of

the 1980's Latin American debt crisis. Mexico revamped her system in 1997 as a response to the near ruin of her financial system created by the 1994 Peso devaluation. Malaysia's MPF and other cousins owe much of their growth to legislation introduced in the wake of the Asian crisis. In all 3 cases the crises themselves owed something to a sudden stop in short term banking flows. Today as foreigners sell, onshore savers buy the assets and help smooth currency, financial and macroeconomic volatility. For sure the South African Rand has seen its share of volatility, but this would have been far worse without onshore insurance and banking led demand for long duration assets.

Financial inclusion also plays a role. This is the extension of financial services to an ever-wider audience. Worldwide some 1.2

Exhibit 2: The dual medicine of remittances and mobilisation of domestic savings have made important contributions to greater stabilisation of exchange rates



Source: IMF, *Financial Stability Report*, October 2018

billion new bank accounts have been opened since 2011 but more than 1.7 bn adults are outside the financial system altogether. Governments are struggling to address this problem which is largely income related. Failure has enormous risks: -by 2050 over 1.3 bn elderly will live in developing economies of whom two thirds would lack any formal retirement income World Bank estimates. Programs in India such as Jan Dhan Yojana for banking and Atal Pension Yojana in pensions are designed to deepen financial inclusion.

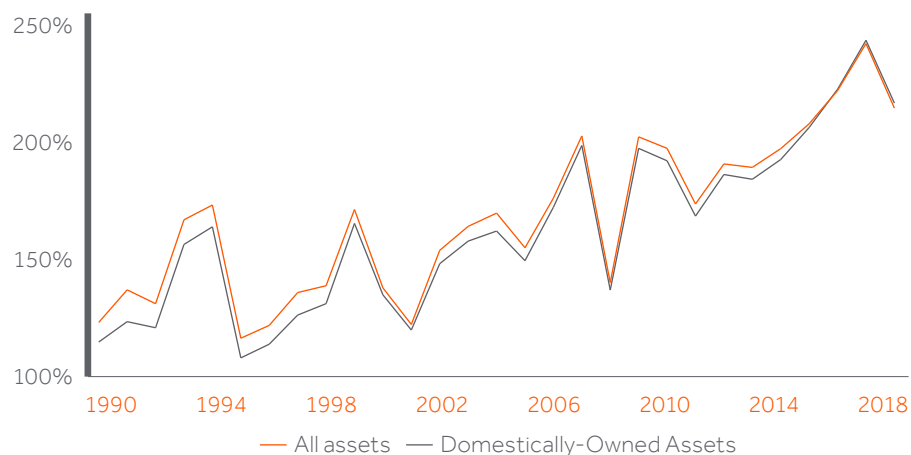
Clearly many emerging economies have come a long way from the 1990's. The rise in domestic savings and the associated reduction in currency volatility has encouraged citizens to hold assets in their own base currency. Analysis from Cross Border Capital, a London based specialist in analysis of financial flows shows a picture of growing financialisation. Whilst citizens in Turkey and Argentina have preferred to hold foreign currency in general the clear trend is an increase in domestically held assets even after allowance for growing foreign interest in owning local currency debt.

A considerable share of this growth is China which now represents over 28% of global credit. Even so in most countries we see a similar trend line.

Currency volatility does remain a threat. The IMF analysis suggests that whilst the occurrence of core currency fluctuation is declining single country risk is increasing- the dispersion line. Our suspicion is that this reflects deteriorating fiscal dynamics and debt service risks. The Bank of Canada tracks these countries in a database found at <https://www.bankofcanada.ca/2018/07/staff-working-paper-2018-30/>. Most of the casualties are smaller economies whose economies are neither large enough nor sufficiently diversified to have material stabilisers.

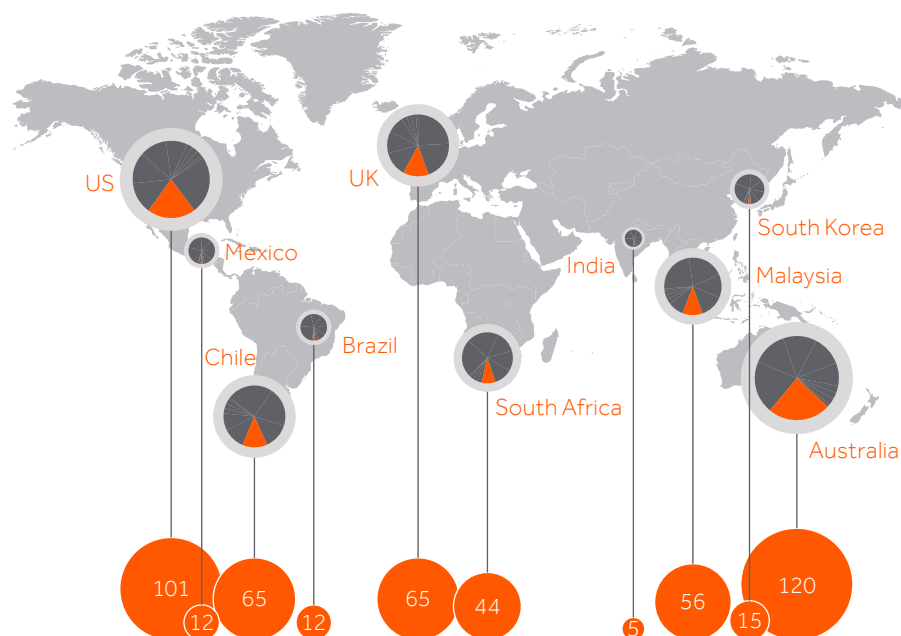
Terms of trade shock also remain a material source of currency volatility. Under diversified economies are particularly vulnerable to commodity price led shock. Onshore savings can go some way towards stabilisation, but the chicken and egg conundrum of low income and undiversified economies still exists. Such risks are a part of the risk premiums investors demand.

Exhibit 3: Financial assets to GDP



Source: Cross Border Capital

Exhibit 4: Pension Assets:GDP



Source: OECD, 2017

Debtor Category	2010	2011	2012	2013	2014	2015	2016	2017
Advanced Economies	0	0	312	356	0	3	26	53
EM/Frontier Markets	80	61	61	69	99	111	96	72
HIPC Countries	32	15	18	9	9	10	10	11
Other Developing Countries	92	97	109	92	119	86	87	80
Total	205	173	501	526	227	210	219	217

Source: Bank of Canada

**Will portfolio flows continue to be a two- edged sword for Emerging Economies? For sure but the growth of financial inclusion and domestic savings channels plays a growing and important stabilising role. For poorer countries migrant remittances are stabilisers for the better off mandatory savings play that role. Both groups benefit from deepening financial systems and the enabling mechanisms provided by fin tech.**



# Street view: Nigeria's pension pot



Please watch this podcast at [www.act.is](http://www.act.is)

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**15 years on from inception, Nigeria's compulsory defined contributions pension scheme modeled after the Chilean scheme has grown to \$24bln, a substantial pool of long-term savings at 6.2% of GDP. It's a major shift from a predominance of unfunded defined benefit schemes that existed pre-2004, mainly for public sector workers, which do not provide inflation protection or an income safety net due to significant back pensions. The 8.5m contributors now covered is laudable at 60% of the 14m employees in the formal sector. Compliance is boosted with incentives: access to certain government contracts/licenses requires full compliance and non-compliant state governments can't access pension funds for bonds issuance.**

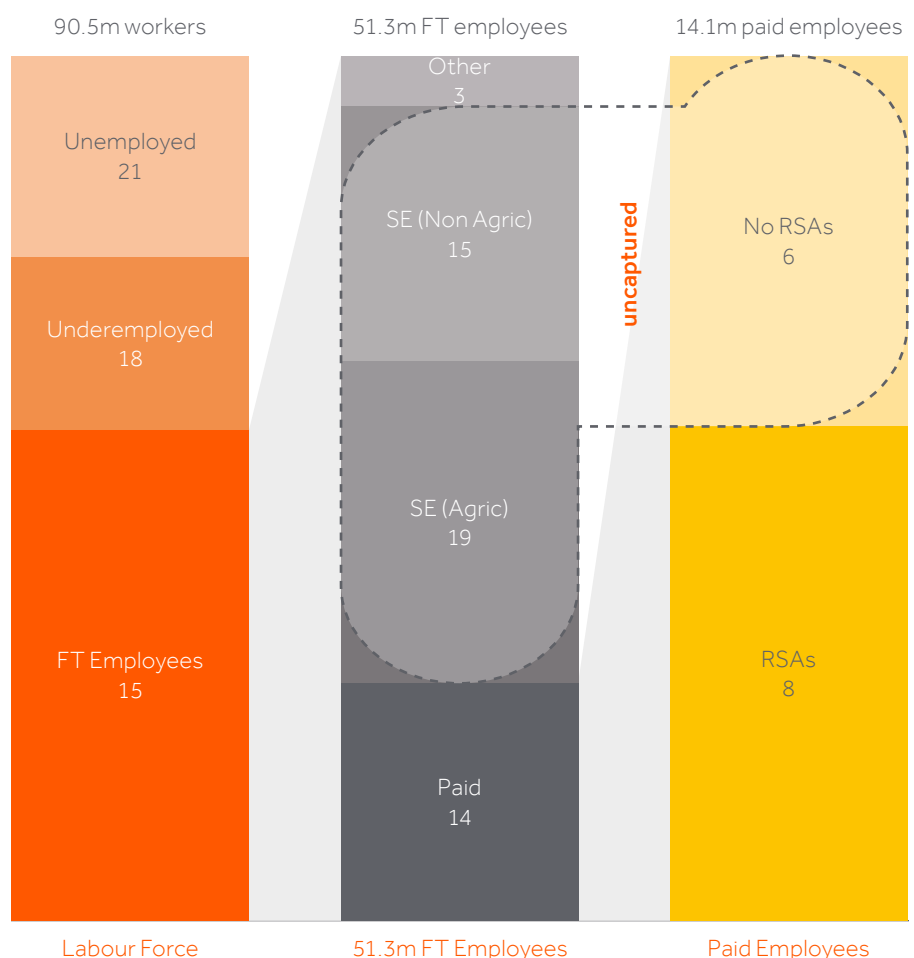
### Informal sector under penetrated

The scheme is still a far cry from its potential, given the 51.3m fully engaged work force and 90.5 million total work force! This is as the scheme is focused only on the formal sector, excluding self-employed and SMEs that account for 85% of the work force. Two new initiatives are set to boost growth. First is the micro-pension scheme targeted at

increasing coverage to 30% of the workforce by 2024. This will leverage on mobile technology platforms to address the peculiarities of low-income earners often without regular wages and adopt incentives as the scheme will not be mandatory; ideas include options to use savings as collateral for mortgages and other financial products. Secondly, all contributors will be allowed to switch pension providers. Competition engendered will put pressure on providers to differentiate services, lower costs and boost performance with marketing directed at the wider populace, rather than on employers, that will generate demand for pension services from the unpenetrated market.

### The Nigerian Labour Force

- The Nigerian labour force is made up of 90.5 million workers
- 51.3 million of these workers work full time (>40 hours)
- Majority of full time workers are self-employed, working in Agriculture
- 14.1 million FT workers are in paid employment (pensionable)
- 8.5 out of 14.1 million of these workers have Retirement Savings Accounts (RSAs)
- There is an uncaptured pensionable market of around 40 millions workers
- Of the uncaptured market, only about 6 million are in paid employment, the others are either self-employed (SE) or work without contracts.



Source: Nigeria Bureau of Statistics and National Pension Commission

RSA – Retirement Savings Accounts; SE – Self Employed; FT- Full

# Street view:

## Mexico: AFOREs to be reckoned with



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**Like many of the Latin American power sector reforms of the 1990s, accelerated by crumbling infrastructure and countrywide blackouts, pension reforms in the region were also born from crisis. Mexico is the most obvious example. After the inflationary 1980s, the fiscal cost of the legacy pay-as-you-go system became clearly unsustainable. But it wasn't until after the 1994 Tequila crisis that policymakers sprang to action. In 1997, Mexico began a structural transition towards defined-contribution schemes, with a private administration of funds, the Afores. This was marketed to Mexican savers as an opportunity to take control and ownership of their financial future, a feeling sought out by many after a decade of market volatility and inflation.**

In its 20+ years of existence, the Mexican pension system has amassed over \$180 billion of assets (15+% of GDP) from the savings of over 50 million Mexicans. This has deepened the local capital markets and fostered the emergence of a local institutional investor class. While at inception this funding was targeted mainly towards sovereign fixed income, AFOREs have increasingly expanded their portfolios, allocating to and helping foster the capital markets for Mexican equities, REITS, alternatives, and corporate debt. This growing pool of capital (c. 7.5% CAGR expected over next decade) has become a steady source of demand for Mexican paper and a stabiliser of portfolio flows at a macro level.

However, as in many markets, the pension reform process is ever-evolving. Pension coverage levels are far from ideal, and most of the labour force is without any old-age protection. The high level of informality in the Mexican economy, as well as limited financial literacy and retirement planning, are the main culprits. Increasing life expectancy, lower birth rates, and unfunded commitments also remain key issues. Not surprisingly, ongoing pension reform is high on the agenda in Mexican politics for 2019.







Santiago Metro

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