

Building For The Digital Age

The Street View

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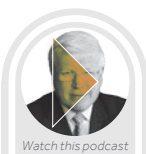
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Building for the digital age

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Welcome to the latest edition of The Street View - where Actis pools knowledge and investment perspectives from our worldwide network of colleagues, investee companies and external experts. In this edition, we focus on how technology is driving and transforming the opportunity across our hard assets franchise.

In this edition, we focus on how technology is driving and transforming the opportunity across our hard assets franchise. In the digital infrastructure space, continuing demand for 'techno logistics' - data storage, management and associated services and logistics all need reliable power supply and specialised facilities. In the power space, Actis plays a role at all stages of this value chain as an infrastructure investor and systems user. The existing ecosystem is ripe for technology transformation: the integration of clean energy into power systems requires frequent and reliable data and state-of-the-art grid management. That is before we even contemplate the role of battery storage in these power ecosystems!

Digging a bit deeper, we continue on the theme of digital transformation in Energy/Power with an article from Claire Curry of BloombergNEF on how Emerging Market countries are digitising the power sector. The development of clean energy generally requires smaller plants, decentralised distribution, and improved systems management, reducing operating challenges and supporting national sovereignty and security. Claire points out that the most basic impact of localising supply is the need to bolster local human capital development. Fascinating stuff!

These 'winds-of-change' (no renewable pun intended!) are not just in the Power sector either. 'Digitising' real estate with state-of-the-art Artificial Intelligence (AI) is an increasingly crucial tool for real estate developers to manage cost and to monitor and manage environmental impacts.

Rodger Du and Hugo Lee from our Real Estate teams in Shanghai and Hong Kong develop this story further through an Asian lens. They point to the growth in data centre demand at regional and country

level in a region which will overtake North America as the largest global data market within 5 years. Data Centres (DCs) need to be nearer their consumers-to reduce latency and meet increasing levels of national regulation across Asia. Read this article closely - the 'so what' at the end is well worth the read.

Back-to-basics with a piece on 'What is different about data centres?', this time from one of our Energy colleagues. Alberto Estefan from our Energy Infrastructure team in Mexico City explains: 'These are physical facilities offering space to host infrastructure that houses critical applications and data'. Alberto reflects on the need for network and storage infrastructure plus reliable power supply to make data centres work. For Actis, this is a true nexus as we blend our real estate DC expertise with our knowledge of power as essential infrastructure. Coming from our Energy practice area, Alberto reflects on the growing role of data management in global electricity demand - currently 1% and forecast to double that share by 2030. Alberto also highlights how efficiency is helping to make DCs less 'power hungry', with constant improvements in PUE. Do read his article to discover why this is such a crucial acronym in the world of data centres.

Africa is often characterised as a laggard in any global trend. On the surface, this may be so in the world of data centres, but such underdevelopment is providing huge opportunity for first movers in Africa. Kabir Chal and Funke Okubadejo from our Africa Real Estate team focus on this in their review of the small but rapidly growing market in Sub Saharan Africa. Here as elsewhere, growing smart phone penetration and mobile technology enables rapid growth, highlighting the importance of size, operating efficiency, and localisation.

Don't just take Actis' word for this. Read the contribution from Ayotunde Coker, Managing Director of Rack Centre, the leading data centre operator in Nigeria. Rack Centre is a new and exciting Actis investment. Ayotunde has seen his business nearly quadruple productive capacity since Rack Centre began in 2013. One key perspective is the advantage of being carrier neutral - offering services to a range of carriers rather than operating as a closed-carrier system, allowing

considerable economies of scale. We are particularly grateful to Ayotunde for giving us the 'Operator' perspective.

Finally yet importantly, William Lu from our Asia Real Estate team looks at how the market for Grade A logistics assets (including data centres) is developing in China. William points out that it is not easy obtaining development sites for these investments, which typically have lower tax and employment yields and higher physical traffic needs than conventional industrial property. The neat solution - which we have prosecuted at Actis - is to move away from Tier 1 cities to Tier 1 satellite cities and selectively into Tier 2+ cities. China's improving transport facilities, burgeoning e commerce markets and short development timelines make this an attractive strategy for yield focussed investors.

And COVID-19? Our colleagues conclude that whilst the onset of the pandemic delayed capital expenditure, the growth in data demand driven by new societal norms has overtaken this pause. Building for the future needs data and power plus operating expertise to link these inputs. We expect much more to come in this exciting space.



Guest view: Digitalisation and Emerging Markets

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John Thompson speaks to Claire Curry Head of Digital Industry at BloombergNEF

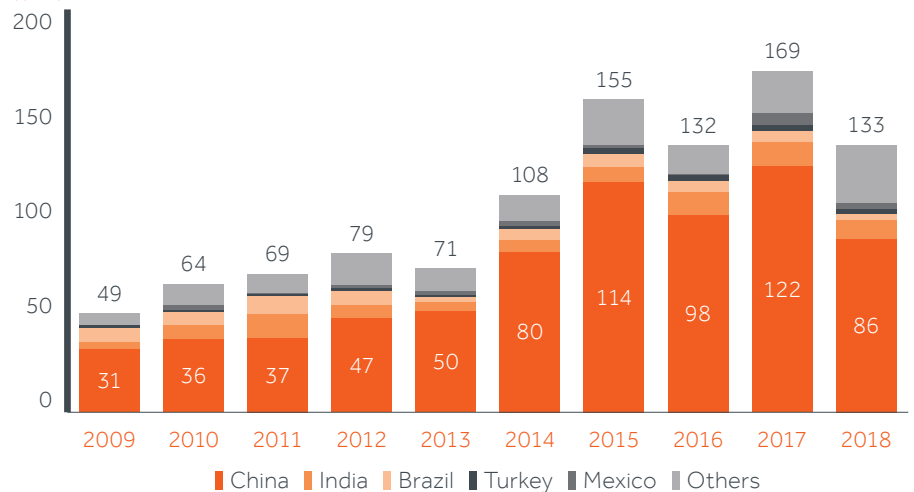
The impact of digital technologies is being felt by all of us. Whether it's the Internet of Things connecting our systems and devices to an extent never known before, the emergence of new technologies in automation, robotics and Artificial Intelligence (AI), 5G, or the way drones are transforming how we view and interact with the world, digitalisation is already embedded in our day-to-day living.

So what does this mean for Emerging Markets?

Much of the focus of the debate around just what that impact is – and how far it can go – has centred on developed markets. But while it is true that much of the progress in the area has been made in these parts of the world, there are notable changes occurring in many Emerging Markets as well. Which of these countries digitalise fastest and how successful it will be depends on a few factors.

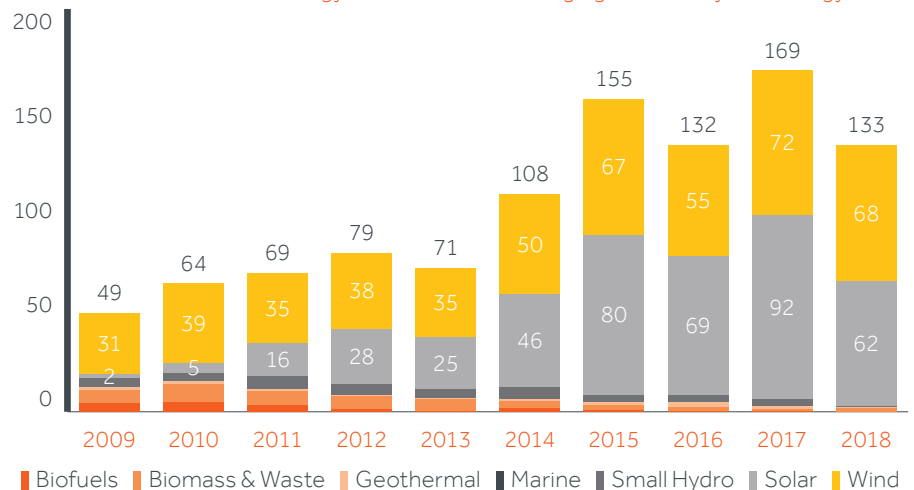
Emerging Markets have lagged in their adoption of digital technologies for a few reasons. Many don't have a large domestic technology sector, so if they want to invest in the area, they have to invite in expensive help from overseas. And as well as a lack of a technology base, skills and education levels often aren't as high in Emerging Markets as elsewhere, which means it is harder to find enough computer scientists and engineers. That in turn means having to import staff from overseas, which again is expensive, and not sustainable in the long run. The focus of many emerging nation digital policies, therefore, is on cultivating domestic digital skills through training, often leveraging private company partnerships – Brazil & Nokia, Malaysia & Coursera, India and IBM.

Exhibit 1: New-build clean energy asset finance in Emerging Markets, by major country (\$bn)



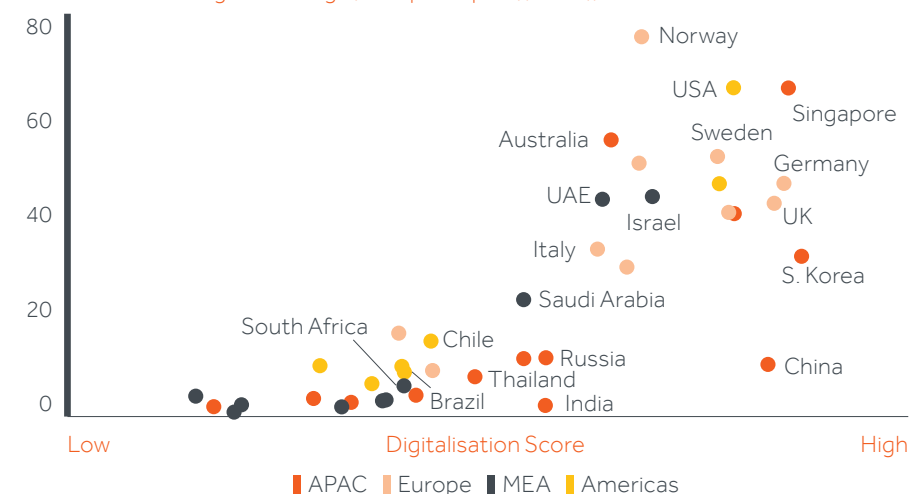
Source: BloombergNEF, Climatescope 2019

Exhibit 2: New-build clean energy asset finance in Emerging Markets, by technology



Source: BloombergNEF, Climatescope 2019

Exhibit 3: National digital rankings (GDP per capita (\$1000))



Source: World Bank, BloombergNEF

The benefits of digitalisation are as relevant to the Emerging Markets as anywhere else. Digitalisation allows for substantial savings in terms of construction, operation or decommissioning costs across the whole value chain because of greater data visibility and control. It can also help overcome labour shortages and lack of sufficient, qualified, local employees: for example drones can monitor a remote solar farm and, if there are problems, an engineer can use augmented reality technology – potentially from thousands of miles away – to diagnose the issue. All that helps brings opex and capex down, critical if businesses are to compete effectively.

In addition to reducing costs and helping overcoming skill shortages, there are other ways in which Emerging Markets can benefit from digitalisation – notably construction, manufacturing and renewable energy.

Digitalisation and Real Estate

Many Emerging Markets have very active real-estate construction sectors, and the potential gains from digitalisation are significant. Tools such as IoT, computer vision, drones and digital twins can generate digital models of the site, overlaying real-time data to track construction progress more accurately. As well as giving instantaneous updates about the progress of construction, this helps with safety and security. These technologies are being adopted by some large developers in the U.S. and Europe but have not yet taken off in Emerging Markets, meaning it is likely to be a really interesting prospect in the years ahead. This is particularly true in Asia where governments such as China have a strong focus on 'smart cities', leveraging digitalisation to build greenfield cities with 5G connectivity and automated buildings.

The power of digitalisation to help reduce the carbon footprint in Emerging Markets – as well as the other benefits it will bring – implies continued substantial investment activity in the years ahead.

Powering the future

When it comes to the energy sector, renewable power plants can particularly benefit from digitalisation. The switch towards a lower carbon system will mean solar and wind plans will become a significant part of a country's power generation – whether in developed or Emerging Markets. This will lead to the shrinking of the average size of power plants and decentralisation of power generation, for example to rooftop-solar panels on people's homes. This decentralisation, and intermittent generation, makes the system more complicated, creating problems which digitalisation can solve. For example being able to automatically balance supply and demand in the grid so power which is generated only when the sun is shining can be available 24 hours a day. The good news for many Emerging Markets is that they have huge solar and wind resources and are already using digital technologies to remotely operate and maintain their renewable power plants. BloombergNEF estimates the software market for solar and wind assets will be worth \$1.2 billion in 2025, Emerging Markets comprising up to one-third of this. Many Emerging Markets already have significant levels of power decentralisation, having not built large transmission grids. This means they are well placed to invest in digitalisation to increase the resiliency and operational efficiency of their power systems, while avoiding the costs of retrofitting ageing grid infrastructure that developed markets are dealing with. However, capital in the area is often lacking, meaning that the full benefits aren't being seen.

If those are some of the opportunities, what is the digitalisation progress of different Emerging Markets?

In many ways Latin America and parts of Asia are leading the way. Leading countries in these regions have state-owned oil companies and power businesses, which the governments are mandating they modernise: digitalisation is an important part of this. In addition, countries in South America have large mining and agriculture sectors vital to the countries' economies, so the governments are pushing them to digitalise in those areas too. Meanwhile in the Asia Pacific Region, the huge chemical, oil and solar energy sectors will digitalise

fast. What's common to all the Emerging Markets is that where there are key industries that support the economy, the push to digitalisation will be stronger.

BloombergNEF estimates the software market for solar and wind assets will be worth \$1.2 billion in 2025

Other important developments are taking place in the Emerging Markets.

A number of them have set – or are planning to set – AI and data protection rules, which are vital to create a level playing field for digitalisation to flourish. Kenya has formed an AI taskforce, Egypt has launched an AI strategy and passed data protection legislation, while Brazil, Argentina, Chile and Colombia all planned AI strategies for this year – until they were derailed by COVID-19.

In general, the impact of COVID-19 on the emergence of digitalisation has been mixed. On the one hand, social distancing rules have meant that remote monitoring and operations have become essential for some critical industries. Much of the power grid is being remotely operated for the first time. On the other hand, the virus saw a significant drop off in investment in its early stages. Projects were delayed, and some of the legislation which would have been important for digitalisation to thrive has been put on hold.

Yet, while start-up funding for digitalisation projects plummeted in April, there were huge increases in June and July, reflecting the reality that investors realise these technologies are vital for the future. That trend will only intensify. Developing countries' power sector CO2 emissions are rising rapidly thanks to their growing economies. Reducing these carbon emissions will be crucial in meeting the world's climate goals.

The power of digitalisation to help reduce the carbon footprint in Emerging Markets – as well as the other benefits it will bring – implies continued substantial investment activity in the years ahead.

Data Centres & AI, China: HAL 9000: "Good Morning, Dave"

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First appearing in the 1968 film – "2001: A Space Odyssey", HAL 9000 is a fictional artificial intelligence character and the main antagonist in Arthur C. Clarke's Space Odyssey series. "Good Morning, Dave", which is an instantly recognisable greeting from HAL 9000, is still one of the most famous quotes in science fiction history. Having said that, since 1968 when the epic film was made, AI has been through cycles of hype and bust. As at 2020, AI is everywhere, no longer just a character in science fiction.

The proliferation of AI-based applications will be one of the growth drivers for data centres, the physical assets that house the "brain" of AI. For this piece we will focus on the data centre market in the Asia-Pacific region where our team is based.

Spoiler alert:
you are advised to read to the end!

APAC IDC market - a tale of two segments

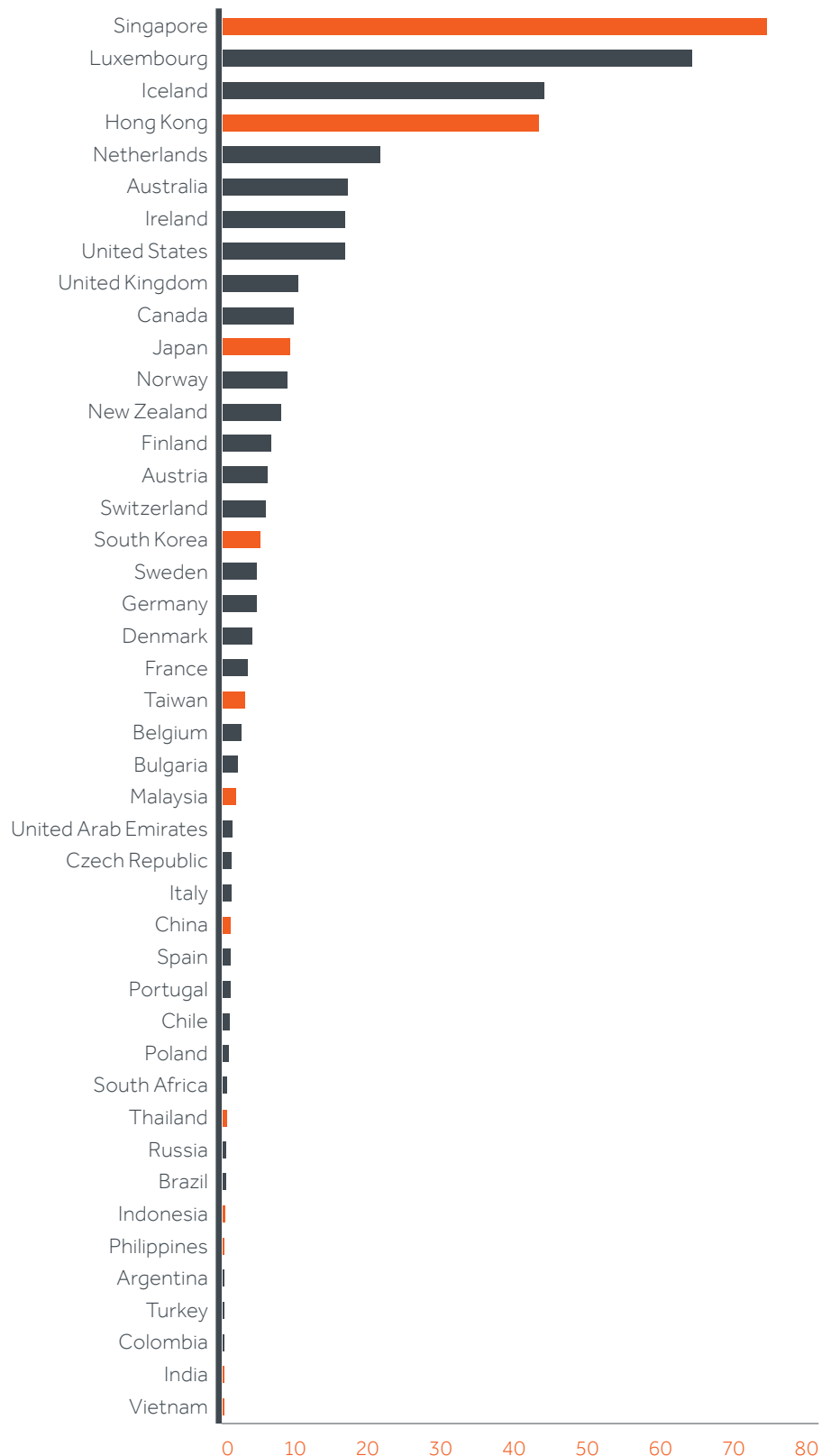
APAC is one of the fastest developing and largest data centre regions in the world. According to Structure Research, the co-location market for Asia Pacific will grow at an expected compound annual growth rate of 12.2% from 2018-2024. (Whilst this pre COVID-19 forecast may be revised down we still expect healthy growth).

The Asia Pacific region has two distinct segments of data centre markets – those which serve regional demand, such as Hong Kong and Singapore, and those which serve mainly domestic markets, such as Tokyo, Seoul, China Mainland and Australia. There are also several interesting Tier II markets, such as India, Vietnam and Indonesia, which have high population growth, but very low data centre capacity at the moment. The whole of India now has only 1.5 megawatts of electricity capacity per million population, but it is clear that this figure will soar in the near future.

Exhibit 1: Megawatt per million population of data centres globally 2019

Ranking by megawatt per capita of data centres globally

MW per capita



Source: Cushman & Wakefield

Growth drivers of Asia-Pacific data centres

Business Migration to Cloud - Countries such as India, China, South Korea and Japan are among the demand-driven markets in the Asia-Pacific region. At the same time, the region is home to countries like Indonesia and Vietnam that are just beginning to scratch the surface of the data centre market. Driven by the flexibility in capacity, lower upfront cost and increasing assurance in security, enterprises have firstly chosen to move to co-location facilities and more recently to a mixture of co-location plus public/private cloud.

The increasing adoption of cloud services is driving the growth of data centres in the Asia-Pacific countries, leading to the birth of more hyper-scale plants and prompting big corporates such as Google, Alibaba Group and Amazon Web Services (AWS) to expand their cloud infrastructure footprint to facilitate the expansion. China, Singapore, South Korea, Indonesia and Malaysia will be the fastest growing region for wholesale co-location data centres over the next five years, with its market size expanding by a compounded annual growth rate (CAGR) of 13% between 2019 and 2024.

Currently North America is the largest co-location data centre market by size, at US\$17.2 billion but the Asia Pacific region is expected to take over the top position by as early as 2021. The total market size for Asia Pacific co-location data centres is forecast to be around US\$28 billion by 2024, 20% higher than the US\$23.4 billion market size projected for North America.

Tech- Savvy young population - In APAC, increasingly tech-savvy demographics boosts mobile phone penetration. The United States and the United Kingdom have rates of above 90%, so mobile usage in APAC with an average rate of 67% in 2019 has huge potential for expansion. For example, India has the second largest population in the world – and it's also one of the youngest. They are facing a huge data boom. Many people have multiple mobile phones. Today the whole of India has only 252MW of data centre power which translates into 0.2MW per million population. In comparison, the United States is close to 20MW per million

population. It's obvious that number for India will skyrocket. There is a lot of big data centre development going on in India, especially in Mumbai.

Asia-based social media and messaging platforms and mobile payments are on the rise and have become one of the biggest battle zones in technology. Asian apps are increasingly helping to transform economies around the world. Messaging apps tailored to Asia are also gaining in importance and staying ahead of the competition by constantly introducing innovative ways to engage users.

In 2019, an average Asian user spent two hours and eight minutes a day on social media channels, the most important of which are YouTube, Facebook, WhatsApp and Instagram. According to Bain & Co., by 2022, 50 million new consumers will be elevated to middleclass status in Indonesia, Malaysia, Philippines, Thailand and Vietnam, driven by rising income. As a result annual disposable income within the region will increase by US\$300 billion from today, contributed by 350 million people. The expected increased IT and large domestic consumption, explosive growth in e-commerce and digital banking and demand for data storage across Asia is appealing to data centre players.

Data localisation - Data centre service providers are attracted to the idea that they will be bringing data and cloud storage closer to the consumers, who access voluminous data daily to watch movies, upload photos and videos, play games and make cashless payments. These trends have caught the attention of Alibaba and Tencent, major players in fin-tech and cashless payment systems, who are now sharpening their focus on locating data centres in second-tier cities.

The growth of original content in Southeast Asia could be a way for global content providers such as Netflix to attract new subscribers in the region. Netflix has already begun producing localised content for South Korea and debuted in Japan, the company has announced plans to launch in China, South Korea, Hong Kong, Taiwan, Singapore, Malaysia, and Vietnam. Global content providers are increasingly opting for a decentralised content hosting strategy to stream data locally and reduce latency issues.

Furthermore, driven by a combination of regulations around cybercrime, the e-commerce boom and proliferating ride-hailing industries, data localisation requirements are evolving rapidly and are being enforced in many countries, including China, India, Indonesia, Malaysia, Vietnam, Thailand and the Philippines.

5G roll out - The progressive roll out of 5G networks across the world is expected to fuel demand for data centres. A 5G network could be up to 20 times faster than the current 4G networks and would spur massive consumption of data and unlock new capabilities such as self-driving cars, cloud gaming and a thriving ecosystem of smart appliances that require a constant connection. In Asia Pacific, Singapore is one of the early adopters of 5G and is on track to roll out 5G mobile networks by 2020.

Take a bow, HAL 9000

And finally, we must come clean that 60-70% of this article was written by an AI engine, which is accommodated in data centres. We simply told the AI writer how we'd like the piece to begin and end, picked the data graph, specified what we needed in each section, separated the sensical from the nonsensical in the output, and inserted connectives between paragraphs.

Thanks to data centres, which bring us AI, Facebook, Amazon, Taobao, WhatsApp, The Game of Thrones, Uber, Zoom and future creative powerhouses unimaginable today!



Power to the data centre!

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The Digital Revolution is characterised by the manipulation of data. At the heart of this massive and accelerating exchange of data is the data centre, the “brain” of the internet, where data is captured, computed, and stored. Electricity is central to this process such that data centre capacity is expressed in MWs.

The explosion in data centre traffic has attracted attention to the question of its impact on energy demand. In this piece, we seek to shed light on 1) how important is power supply to data centres, 2) the importance of data centres to global power demand, and 3) whether data centres hinder or enable the energy transition.

Importance of power supply to data centres

A data centre is a physical facility that offers space to host the infrastructure (building, servers, backup power supply, cooling, bandwidth, security, etc.) that houses critical applications and data. The core components are network infrastructure, storage infrastructure and computing resources – all of which are powered by electricity. In addition, these processes generate heat, which needs to be removed by cooling equipment that is also powered by electricity (the extent to which power is used to cool the data centre largely determines Power Usage Efficiency (PUE) metric – more on that below).

From a capex perspective, electricity equipment represents up to 50% of hard costs and 30% of total development cost. This power equipment includes generators, Uninterruptable Power Supply (UPS) systems and rechargeable batteries that are used to maximise reliability. Arguably more relevant, though, up to 65% of the cash operating expenses of running a data centre are electricity and power equipment related. Actis has recently announced the construction of a 21MW IT load data centre in South Korea in which it will invest nearly \$100m in power equipment and expects to pay over \$30m per annum in power and power equipment related costs during its operations phase.

This is a real example of two core Actis capabilities – in power and real estate combining knowledge.

No surprise then that from a data centre development perspective, the procurement of stable and redundant power supplies is a key success factor (alongside the right physical location and enabling the right ecosystem within the facility). From a value proposition and returns perspective, power procurement cost competitiveness is crucial.

Importance of data centres to global power demand

The relation cuts both ways: data centres are an increasingly significant source of demand for energy in the global context. Today, an industry that really only took off in the early 2000s, consumes around 200 TWh per annum, equivalent to 3% of all electricity used in households globally and around 1% of total electricity consumption. Google estimates that any given search on its popular search engine requires 0.0003kWh of energy, enough to light a 60W bulb for 17 seconds – these searches do add up (over 1.2 trillion in 2019 and rising by over 6 billion a day in 2020).

Data centre IP traffic is expected to grow exponentially during the next phase of the Digital Revolution: in the immediate term cloud computing, characterised by computing processes and data storage migrated to the cloud as opposed to devices (which requires a lot of data flowing around) and, in the near future, artificial intelligence, internet of things, virtual reality, autonomous vehicles and blockchain, all of which require massive amount of data creation, processing and storage. From 2010 to 2018 data centre IP traffic increased 6-fold. HSBC estimates that between 2017 and 2030 it will increase another 19-fold.

If data centres use a lot of power and their use has grown exponentially, so has power demand by this sector... right? Interestingly, this has not been the case in the last decade, when the 6-fold increase in data centre IP traffic between 2010 and 2018 has corresponded with a 6% total increase of power demand by this sector over that period. Efficiency improvements in core IT components and the shift away from small, inefficient facilities towards large cloud and hyperscale data centres are to blame.

PUE – the ratio of total power use by IT equipment – in large data facilities has dropped from 2.5 in 2007 to an industry average of around 1.6, with the very best hyperscale data can have PUE values of around 1.1 (meaning 0.1 kWh used for cooling/power provision for every 1 kWh used for IT equipment). Actis has a data centre under construction in China in which different design measures were adopted to target a 1.19 PUE.

The key question is whether this technology evolution will be sufficient to keep up with data centre growth. The IEA projects that while data centre demand will increase by 60% through 2022, if the trajectory of efficiency gains in IT components and data centre infrastructure continues, data centre power consumption can remain constant through that period. Some caution that longer term power demand will inevitably increase on the argument that Moore's law – the doubling of processing capacity and 50% reduction in its cost every 1.5 years – will tend to break eventually. Also, after all, the PUE can never be below 1. HSBC estimates that by 2030 total power demand by data centres will increase 9x, and cautions about consequential strains on global energy systems. A 2018 article in Nature estimates that the sectors power demand could increase by “only” 5x or less, to 1,100TWh or around 2.5% of global electricity consumption. This is a matter of debate, as others argue that these projections fail to consider continued efficiency gains.

Data centres: an enabler of the energy transition?

A first element to contextualise this question is that while data centres are facilities with high concentration of power consumption, they serve as outsourcing replacement for IT processing needs that would have otherwise been done internally by corporations. Also, cloud computing saves the overall energy to be utilised by IT equipment, drives more efficient use of computer resources, saves office spaces and as more human activities goes online, there is an overall more efficient use of resources, including energy, compared to offline activities.

In terms of power demand by the data centre industry, while the rate of growth is uncertain, it is clear it is already a large carbon emitter. However, the journey that

data centres have gone through lays out important lessons for other industries, namely: scale, energy efficiency and, importantly, adoption of renewable energy.

Actis has witnessed first-hand the muscle of efficiency derived from scale via our activities in the power sector. Our first wind farm in Latin America (also the region's first utility scale wind farm), PESRL in Costa Rica, used 410kW turbines in a facility with a total capacity of 24MW. Our latest wind farm in Brazil utilises 4.2MW turbines – 10x the capacity per turbine vs. PESRL's. In Mexico, we built what is today the largest operational windfarm in Latin America at 424MW. This facility sells power at a 50% discount to that first investment in Costa Rica. On the data centre side, AWS estimates that hyperscale data centres require only 16% of the power as compared to on-premises infrastructure, which reduces carbon footprint by 88%. Sometimes bigger is better.

We also know that the cleanest (and cheapest!) kW is that which is not wasted – energy efficiency. In our power distribution businesses, loss reduction is a key element of our value creation toolkit. In Umeme, a power distribution business in Uganda, annual network losses decreased from 34.7% in 2009 to 19.5% in 2015. The data centre industry has also focused on energy efficiency, by applying new technologies. Google developed an artificial intelligence algorithm that monitors data generated by sensors within a data centre to optimise the cooling configurations, reducing power usage by 15%.

Ultimately, though, the data centre industry will continue to require massive amounts of power: an equivalent of more than 300GW of new plants by 2030. The good news is that information and communications technology (ICT) companies have become major players in anchoring new renewable capacity. The declining cost of renewable energy supports a robust economic argument, while it allows the offtaker to hedge its power cost from price volatility via long term, fixed price PPAs – something that fossil fuel generation cannot provide.

Across the globe, adoption of renewables by data centre operations has gone mainstream. According to the IEA, ICT companies accounted for about

half of global corporate renewables procurement in the past five years. This charge has been led precisely by data centre operators. In 2018, Google procured 10TWh of renewable power to match 100% of their data centre energy consumption: this is equivalent to the total electricity consumption of Guatemala, with a population of 17 million. AWS has committed to procure 100% of their power needs from renewables by 2025. For renewables developers, these offtakers, with their huge demand requirements, corporate commitment to renewables and credit profile, represent an ideal commercialisation path to anchor new projects. After all, Microsoft, which sourced half of its electricity from renewables in 2018, is one of only two corporations in the US to boast a AAA credit rating – higher than the US government itself!

Conclusion

The world's appetite for data has increased exponentially over the past decade and is expected to accelerate further with the advent of new technologies – artificial intelligence, virtual reality, autonomous vehicles, and the internet of things. Data centres are a key component of this digital ecosystem that is powered by electricity. Electricity is most important component of a data centre cost structure and is a key development success factor. Operators that excel at power procurement will have an edge as will Real Estate developers with in-house expertise in this area such as Actis.

From a macro perspective, data centres account for 1% of global consumption. While efficiency gains in operations have mitigated any increase in total power demand in the past decade, it is projected that the share of global power consumption could increase towards 2.5% plus by 2030.

While this increase could pose challenges and strains to the global energy system, the industry has relevant lessons for others on the energy transition journey: scale, energy efficiency and the adoption of renewable energy have come together to power the data centre in a smart, sustainable way. Stakeholders should take note to keep and build on this promising path.



Africa's digital revolution needs data centres

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Have you ever wondered what happens every minute on the internet?

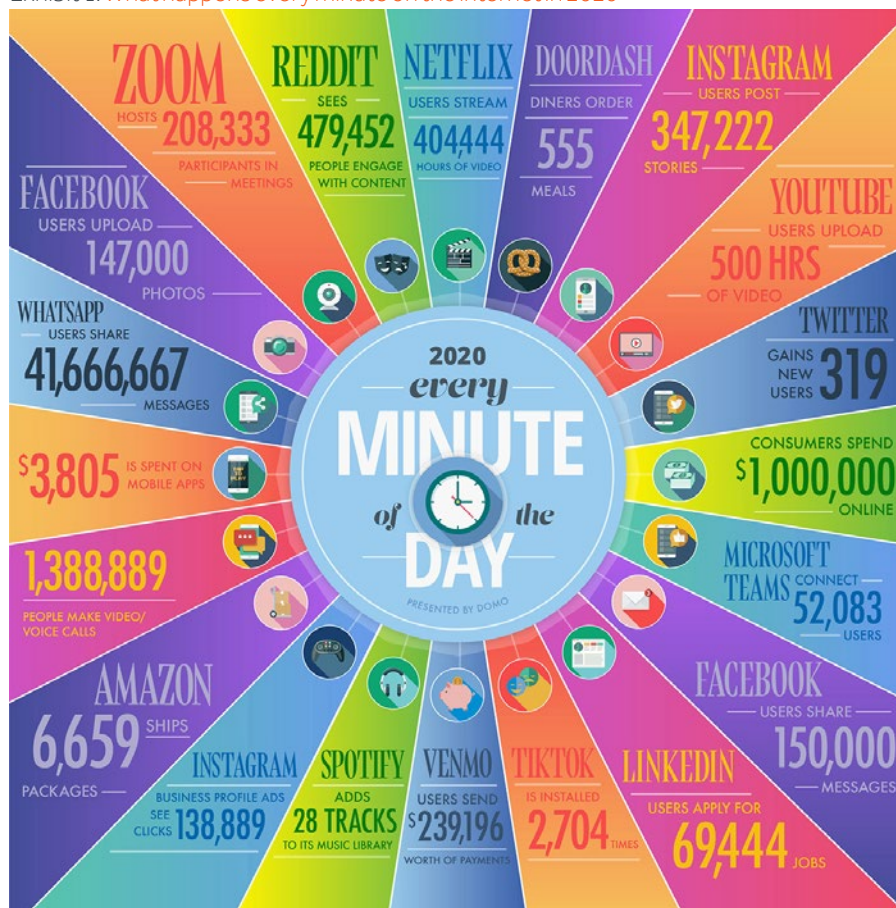
The answer is a lot! The world's most popular apps and websites have seen significant growth over the last four years and will continue to grow rapidly as more people access the internet and the cost of access falls. Internet users grew from 3.4bn to 4.6bn from 2016 to 2020 but the main story is rising use per capita. We live in a world where huge amounts of data are being produced and consumed. All of it needs a home and that home is the data centre.

The global data boom is not only being driven by consumer usage. Automation and machine learning are significant players in this story giving birth to what is widely known as the Internet of Things ('IoT'). IoT refers to the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data. The lead role however is cast to the Cloud—the ethereal space out there where people store their memories, where companies host their applications and increasingly computing is taking place. To many of its end users the Cloud is a virtual concept, out of sight out of mind. The reality is that Cloud needs somewhere to live, somewhere that maintains the ambient conditions to allow it to operate at peak performance. That somewhere is the data centre. Cloud is responsible for the recent explosion in data centre growth globally.

72%

Mobile data subscriptions are set to account for 72% of all subscriptions in SSA by 2025.

Exhibit 1: What happens every minute on the internet in 2020



Source: Visual Capitalist

Sub-Saharan Africa: High growth in data consumption, off a low base

Africa is one of the fastest growing data usage regions in the world – albeit from a low base. In addition to the active mobile network operators, this has caught the attention of several global majors including Google, Facebook and Amazon all of whom are making substantial investments to help boost Africa's network infrastructure to cater for this demand. One of the key areas needing investment is the data centre sector which sits at the heart of the digital revolution.

According to the Ericsson Mobility Report, in 2019, 54% of SSA's mobile subscriptions were data users of which 11% were on 4G networks. By 2025, 72% of SSA's mobile subscriptions are expected to be data users with those on 4G networks growing to 29%. From 2019 to 2025, SSA is forecast to be the world's fastest growing region in terms of new mobile subscriptions – 4% per annum (compared to 1% in Latin America and China), with

absolute subscription numbers second only to Asia. Over the same period, smartphone subscriptions are forecast to grow at 9% per annum, second only to MENA. SSA is by far the fastest growing region globally in terms of monthly mobile data consumed (per smartphone)– 52% per annum. Whatever scepticism there is to be had around affordability of, and access to, data in Africa, the reality is that data usage is growing at tremendous rates and infrastructure investment has not kept up.

Latency and regulation point towards hosting data locally in Africa

To date, a large amount of content is being stored in offshore data centres (mainly Europe and the US) servicing African markets through sub-sea cable linkages. This was fine at a time when usage levels were lower but started to prove problematic as an increase in users began to challenge bandwidth and the broader network investment, thereby introducing

greater latency. This has caused several international cloud and content providers to explore hosting their content locally in data centres and, in the last three years, heralding the entries of: Facebook, Google, Amazon, Apple, Netflix etc. to South Africa, Kenya and Nigeria.

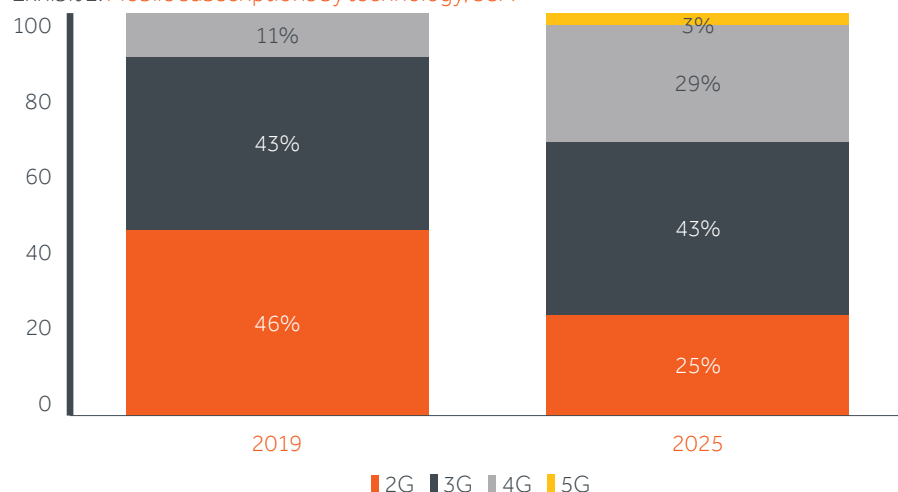
The renewed global focus on data sovereignty has prompted several African countries to revisit their own regulations which has brought further impetus to data centre development across the continent. For instance, in Nigeria, the Government requires data to be hosted locally for key sectors – oil & gas, financial services and public sector.

Latency and data sovereignty regulation are two major drivers for hosting data locally. Cloud made its first major appearance in Africa last year with Azure establishing a presence in two South African data centres and AWS building three of its own facilities in Cape Town. Reading across from trends in other markets, one would expect Google to follow suit very soon. These majors are also actively looking at East and West Africa and the expectation is that they will have an initial preference to host their cloud platforms in third-party data centres.

Lowering costs for local hosting requires investment in network infrastructure

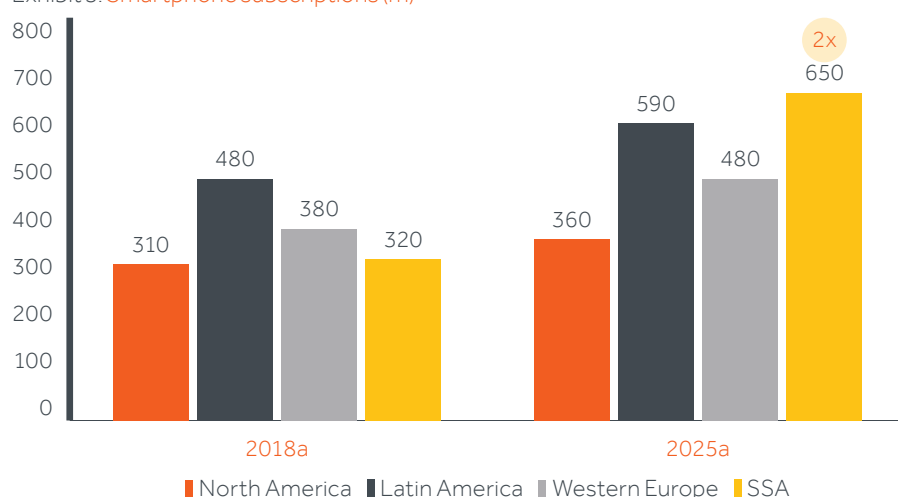
It is easy to understand why Google and Facebook may be well placed to have good insights into Africa's data consumption and indeed the trajectory of its growth – as the adage goes, actions speak louder than words. In 2019, Google announced the Equiano cable that will connect the West Coast of Africa with Europe – the project being only the third privately funded cable project by Google. In 2020, Facebook announced that it was joining to lead Project Mercury, an ambitious subsea cable project. The 2Africa cable will connect Africa's circumference starting and ending in Europe. Both cables will add a huge amount of internet capacity to Africa and help to substantially reduce broadband costs. Localising the hosting of content and increasing the peering, the exchange of data directly between internet service providers ('ISP'), rather than via the internet) carries substantial benefits to the end user: cost and latency being the most obvious. In 2010, the Internet Society set an ambitious goal to see 80%

Exhibit 2: Mobile subscriptions by technology, SSA



Source: Ericsson Mobility Report, June 2020

Exhibit 3: Smartphone subscriptions (m)



Source: Ericsson Mobility Report, June 2020

Exhibit 4: IXP growth and impact on ecosystem

Kenya	2012	2020
IXP Traffic	1Gbps	19Gbps
Mobile internet users (% of population)	0.42%	41.92%
500MB of data prepaid	US\$5.92	US\$2.42 (2017)

Nigeria	2012	2020
IXP Traffic	0.3Gbps	125Gbps
Internet users (% of population)	16.1%	42%
500MB of data prepaid	US\$12.75	US\$3.27

Source: Internet Society - Anchoring the African Internet Ecosystem: Lessons from Kenya and Nigeria's Internet Exchange Point Growth, Michael Kende, June 2020 (www.internetsociety.org/issues/ixps/ixpreport2020/)

of African internet traffic hosted locally by 2020. In order to achieve this, pieces of the ecosystem needed to come together: Africa needed more subsea cable capacity, fibre networks needed to be expanded, more data centres needed to be built and internet exchange points ('IXPs'), where ISPs and content delivery networks (like Facebook) exchange internet traffic, to be established. A case study done in 2020 on Kenya and Nigeria has shown tremendous progress. In 2012, approximately 30% of each country's traffic was localised; today that figure has grown to around 70%. Growth in peering volumes through IXPs in both markets was exponential as were cost savings from exchanging traffic locally (in doing so avoiding expensive international transit).

The IXPs in Kenya and Nigeria have seen their respective peering traffic volumes grow 19-fold and 400-fold respectively with significant cost savings estimated at US\$6m pa and US\$40m pa respectively. In addition to lower data bundle prices for consumers, both countries have seen significant increases in the number of mobile internet users - 100-fold for Kenya and 4-fold for Nigeria to 42% of the population.

IXPs are hosted in data centres and it will be no surprise to note that over the same period data centre capacity in Nigeria has grown 3-fold, whilst Kenya's has almost doubled. That said, Xalam Analytics contextualise in their latest publication, Africa Data Centre Gold Rush, that the entire installed data centre capacity in SSA is less than half than that of London's and is broadly on par with Paris.

COVID-19 and its restrictions have accelerated the digital revolution

COVID-19 and the lockdown restrictions that followed had a huge impact on data consumption globally. Data traffic increased by between 20 - 100%, on a like-for-like basis, across the world's largest markets. The pandemic ushered in a closer relationship with the internet where people now rely on it more for work, education, communication, entertainment etc. It is unlikely that this will materially abate once the pandemic eases, putting further urgency on the build-out of network infrastructure, like data centres, to cope with the increase in traffic and dependency. Across major developed market economies, Ericsson reported a 10-20% increase in mobile data traffic in Q1 2020. Over the same period, MTN Nigeria recorded a 60% growth in data revenues, supported in part by the addition of 1.7m active data users to its network. Both the IXPs in Kenya and Nigeria recorded record daily spikes in peering volumes during COVID-19's lockdown restrictions.

An early mover opportunity exists to establish a network of Pan-African data centres

Notwithstanding the strong sector fundamentals and secular growth trends supporting the data centre sector in Africa, it remains relatively underinvested in SSA (excl. SA). There are a number of reasons for this, including: it is a capital-intensive sector; there is little local expertise in developing and operating data centres; most markets present challenges when dealing with power, real estate and fibre connectivity.

The impression of a challenging operating environment in Africa may deter international strategic players from entering SSA (excl. SA) on a greenfield basis, providing an opportunity for investors who have experience of investing in the development of power, infrastructure and real estate assets across Africa.

Actis in action

Actis, through its Africa Real Estate Fund, established a US\$250m Pan-African data centre platform. The platform is focussed on establishing a network of data centres in Africa's largest markets following a buy-and-build strategy. Actis has partnered with an experienced ICT private equity firm, Convergence Partners as well two industry experts Tim Parsonson and Frank Hassett. The platform completed its first acquisition of a majority stake in Nigeria's leading data centre, Rack Centre, and has swiftly embarked on an investment programme that will see capacity increase by up to 15-fold depending on demand. In parallel to being on track to double capacity to 1.5MW by Q1 2021 and the development of a 13MW facility is already on track for completion by Q4 2021. The platform is now being built out and in parallel evaluating a number of acquisition opportunities across key markets



Corporate view: Rack Centre - growing West Africa's digital infrastructure

Ayotunde Coker

Managing Director,
Rack Centre



Rack Centre is a carrier neutral data centre in Nigeria offering colocation, content distribution, interconnect and cloud services. The company commenced operations in August 2013 with 375kW of IT power capacity and 300 square metres of space. Following growth in capacity utilisation, the facility was doubled with an additional 375kW of IT power capacity which went live in April 2016. The project has now commenced to double capacity to 1.5MW of IT power due ready for service in Q1 2021.

Rack Centre is a highly connected facility providing access to over 40 of the major carriers and Internet Service Providers (ISPs) in Nigeria, Tier 1 networks, pan Africa international carriers, and direct connection to all 5 undersea cables serving the Atlantic Coast of Africa.

Rack Centre offers a locally hosted comprehensive cloud and content distribution marketplace, bringing the hosting of world-class cloud services to

Nigeria. In doing so, it reduces the cost to access high quality cloud services in West Africa.

What does the term carrier neutral mean and why is it important? Carriers compete with each other. As such they struggle to attract competitor carriers and ISPs to locate at their data centres to offer services. Having all carriers and ISPs at a carrier neutral data centre gives powerful competitive advantage, as large customers and hyperscale cloud providers require easy access to a range of networks with low latency at the same location.

Rack Centre was the first data centre company in Africa to achieve Tier III Design Certification by the Uptime Institute, the global authority for data centre quality certification, and then went on to achieve the Tier III for Constructed Facility by the Uptime Institute in April 2017. It has received a wide range of prestigious global accolades including the Excellence in Regional Data Centre Award, Middle East and Africa" at the prestigious 2019 Datacloud Global Awards in Monaco.

Key growth opportunities for Rack Centre

Data Centre markets across the world evolve and addressable markets unlock at different speeds. Since inception, Rack Centre's management has been focussed on creating awareness around data centre hosting seeking to unlock the addressable market. In Africa, South Africa has set the pace for growth and currently has about half the total available capacity in Africa. Total available capacity in Africa with a population of 1.3 billion is only half that of Amsterdam, and a quarter of London. In addition to South Africa, the key African growth markets are Kenya, Nigeria and Egypt, with Nigeria showing the most compelling drivers for growth and scale.

There are a range of factors and catalysts for data centre growth potential for Nigeria. Availability of undersea cable capacity and broadband penetration for the last mile underpin growth of data consumption and therefore data centre capacity. Broadband penetration in Nigeria has been growing rapidly. 40% penetration today is forecast to hit 70% by 2023. Internet connections grew to 136 million in Q1 2020, having been 129 million

Exhibit 1: Rack Centre hyperscale expansion now underway



Exhibit 2: Rack Centre phase 1 ground floor



Rack Centre: Actis value add

The Actis investment has been transformational for Rack Centre. Having built a strong brand, with global recognition, the acquisition of a controlling stake by Actis a highly reputable firm has significantly enhanced the credibility of the Rack Centre brand. This has had a positive impact on how Rack Centre is perceived by the local and international prospective customers. In addition, Actis has brought with it expertise in the form of Tim Parsonson, a founder of Teraco, Africa's largest data centre, as Chairperson and Frank Hassett, ex-Vice President of Equinix, as technical adviser.

Given Rack Centre's ambitious expansion, Actis' knowledge and expertise in the real estate and power sectors coupled with their legal and commercial frameworks has been valuable in helping accelerate the company's growth plans.

Exhibit 3: Rack Centre phase 1 with top floor expansion



at end 2019, higher than any country in Europe and the highest in Africa. The very latest information from the Nigeria Communications Commission indicates a figure of 146 million for July 2020. This figure, which represents a significant growth trajectory, is over twice the number of any other African country and ranking sixth largest in the world. It is likely that Nigeria will surpass Brazil to be the fifth ranked in the world in the next year.

The 45 million MSMEs, regardless of total population are economically active entities ready to demand consumption of cloud services.

Nigeria has been consistently improving its ease of doing business performance over the past few years. Coupled with an excellent geophysical location that halves the latency of data transmission to Europe and US compared to South Africa, it is well placed to be the next location for hyperscale cloud and content providers not only to meet the Nigerian market demand, but the regional requirements. Rack Centre is well placed to take on this growth, having created an impressive ecosystem as outlined earlier. Google's Equiano cable and Facebook's 2Africa consortium of undersea cables serving Africa are expected to further drive content and data centre growth.

China's new logistics

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Demand from manufacturers seeking space to store their products and components was the earliest driver of China's logistics property market. Over the past decade, this market saw significant leasing demand from the E-commerce sector, now the most critical sales channel for the world's largest consumer market. As a result, Grade A logistic plants in China are hot properties for investors looking for both development and stabilised warehouse projects that cater to e-commerce firms, 3PLs, retailers and other firms serving the consumer sector.

China's growing consumer class, particularly the middle-income sector, has supported the rising consumption trends. The number of middle class households is expected to increase from 89 million in 2007 to 361 million in 2027, based on Oxford Economics at a CAGR of 7.2%, while the CAGR in the US during the same time period is only at 0.2%. Whilst COVID-19 outbreak did impact consumption over the short term, demographics and policy support are much more resilient and longer-lasting positives. E-commerce retailers benefit from this situation as shoppers gravitate towards buying from the safety of their homes. We have seen increased warehousing demand for fresh food and medical supplies.

In the first 6 months of 2020, online sales penetration rate increased by 5.6%, far higher than average growth rate of 2.5% during 2015-2019.

China's evolution towards a consumption led economy will continue to boost its rapidly growing E-commerce Sector. Based on Cushman & Wakefield research, Gross merchandise value (GMV) of China's E-commerce industrial was only RMB 1.9 trillion in 2013, GMV is expected to increase to RMB 13.6 trillion in 2021, at a CAGR of 27.9%. Alongside with the domestic consumption growth story, the rise in E-commerce spending has been major tailwind for the logistics real estate market. With E-commerce expanding its offerings into fresh food and cross-border merchandises, warehousing requirements from cold storage and imported goods

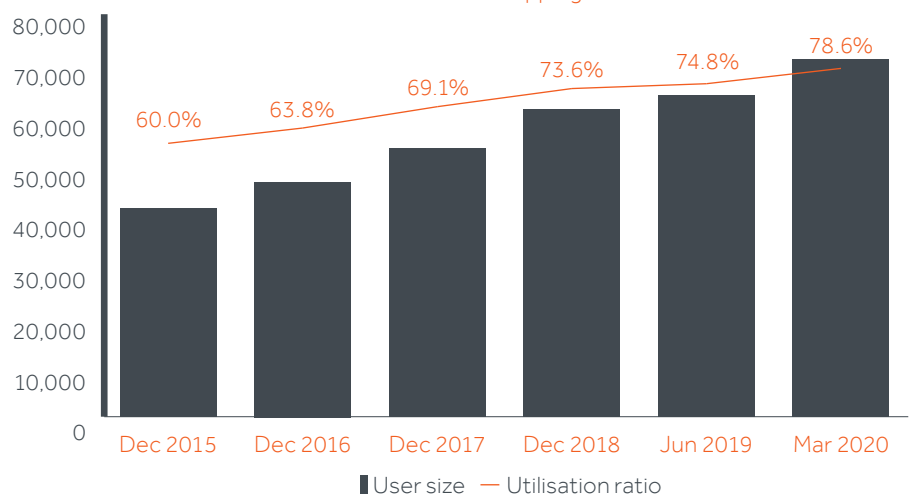
has already emerged as the new demand driver for modern logistics warehouses. It is estimated that China's e-commerce logistics revenue will increase by an annual growth rate of 18-25% from 2019 to 2023 according to iResearch Inc.

Grade A logistics property stock in China's major cities quadrupled between 2010 and 2019, but it merely accounts for 4.8% of the total logistics stock in China and was not sufficient to meet the booming logistics demand for high quality warehousing space. Tenants increasingly prefer to lease modern warehouses to maximum operational efficiency and to meet the compliance requirement. As one example, vast majority of old and poor quality stock simply doesn't meet the fire safety standard. Industrial land supply has contracted across China since 2012. Contraction in land supply for logistics warehouses will be more severe than industrial land in general. Logistics land generates less output, taxation and employment compared to other traditional industrial uses such as manufacturing, but a large number of new logistics facilities can impact local traffic and the environment in surrounding areas. Therefore, the supply of logistics land from local governments in industrial zones across China is usually relatively limited. Local government has increasingly stringent requirements on tax commitment, owner occupation and restriction on transfer. For example, in Beijing, the local Government issued Circular 39 on 12 January 2018, which reduced the maximum land tenure for

industrial developments (including logistics) from a standard 50 years to 20 years. With such a shorter land tenure, no pure logistics land has been granted since 2018 in Beijing. Such practice of having a shorter land tenure for new logistics land supply has since been adopted by a number of other cities in China including Shenzhen, Shanghai, Kunshan and Chengdu.

In general, Grade A logistics properties include specifications such as optimal space utilisation, high operating efficiency, storage safety, flexibility to customise, and high loading capabilities. In terms of the development and construction schedule, it normally takes around 12-24 months from land acquisition to stabilised occupancy/ completion, while development cycles for large-scale commercial real estate projects can take at least 36 months or more. Given an attractive yield spread upon stabilisation as well as a shorter development period, most institutional capital has traditionally been concentrated in develop-to-core logistics investment models targeting opportunistic returns, in which investors have formed partnerships with experienced developers with strong presence in China or those leading developers raising development funds from institutional capital directly.

Exhibit 1: User size and utilisation ratio of online shopping from Dec. 2015 to Mar. 2020



Source: China Internet Network Information Center (CNNIC), April 2020. The 45th Statistical Report on Internet Development in China

Most of this logistics development activity has been concentrated in three major regions with the greatest investment potential, the Great Bay Area (GBA in the south), the Yangtze River Delta (in the east) and Beijing Tianjin area (in the north). Wealth and spending levels in the first twenty years of China's reform period were also largely concentrated in these three regions, particularly so-called Tier 1 cities in each of these regions. The most centrally located cities in these three centres alone cover over 25 million consumers in a two-hour drive. And in the highly populated urban areas of YRD and GBA, there are mega cities (and logistics warehouse in them), which provide access to around 60 million people.

In recent years, a growing population base in tier 1.5, tier 2 and even tier 3-4 cities has witnessed a steady growth in wealth and consumption. At the same time, China's massive investments in road infrastructure has laid the groundwork for increasingly efficient distribution networks across the different regions. Chinese E-commerce players have started to enter smaller towns and expand the supply of products and services, enhancing network demand for a wider range of logistics facilities. Grade A logistics markets in satellite cities are becoming another strong warehouse location in China. Located in proximity to the country's largest tier 1 cities, these satellite markets are attractive for spillover demand for those who wish to serve consumer markets in the Tier 1 cities, but are unable to find warehouse space there due to supply constraints. Rents are relatively low and there are typically more space options for tenants in satellite markets. In recent years, satellite markets that sit between multiple large cities have emerged as ideal locations for regional distribution.

With a great number of Grade A logistics projects generating consistent rental income through mature tenant bases and higher weighted average lease expiry (WALE), stabilised quality logistics assets are becoming more attractive to yield-focused investors targeting core return. For example, in Q2 2020, GLP reached a final close for a core China logistics fund with RMB15 billion fund size. CBREI and Logos also jointly launched a RMB core fund with a fund size of RMB5.5 billion in Q12020 with domestic insurance companies as key investors. We expect to

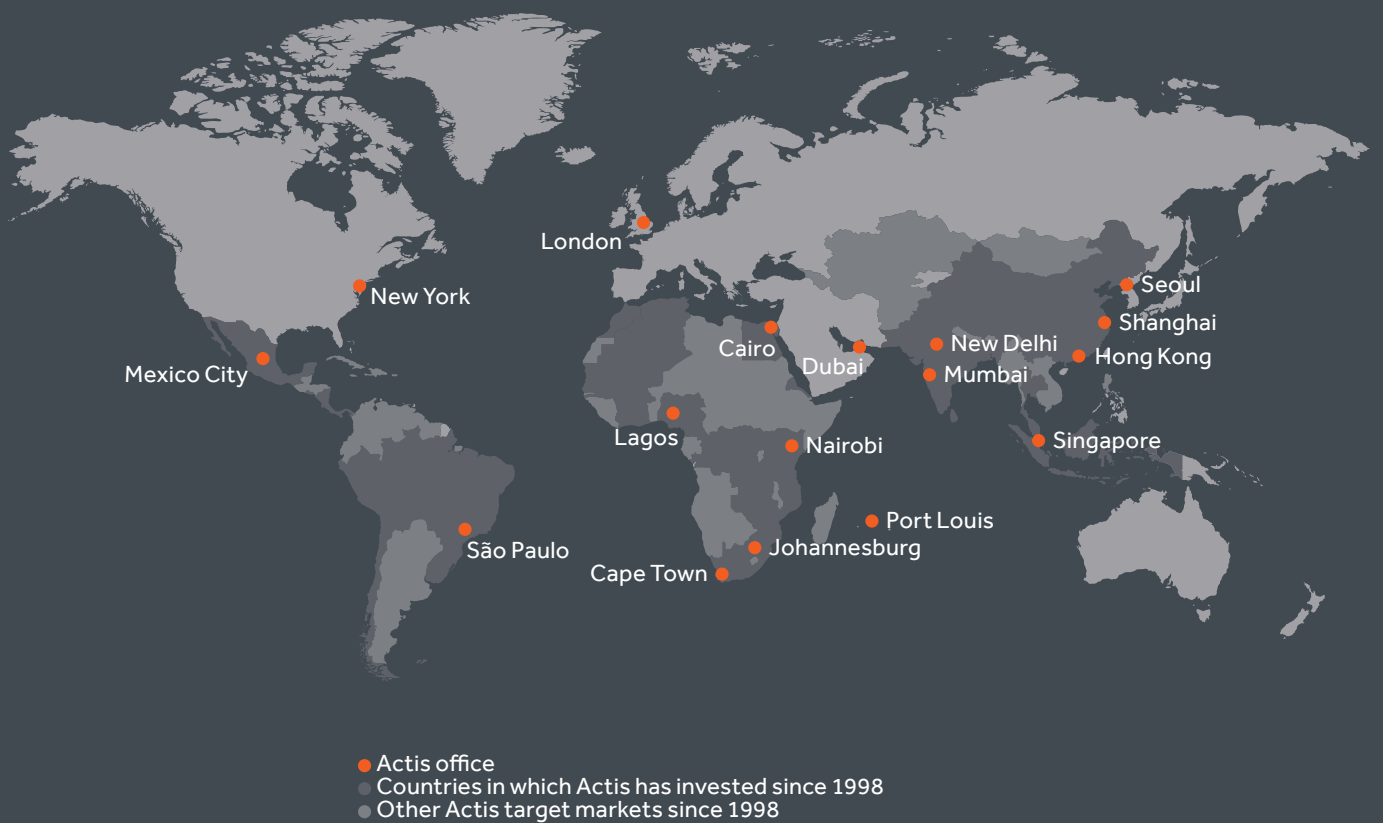
see even more capital inflows to large core logistics fund vehicles with institutional quality portfolios. The opening of domestic listed markets for real estate through the development of REITs will further accommodate core vehicles, by introducing liquidity and direct capital. There was a positive step in this direction on April 30 2020, with the announcement by the National Development and Reform Commission (NDRC) and China Securities Regulatory Commission (CSRC) of a pilot program for mutual funds to issue publicly traded REITs with a focus on infrastructure, including warehouses as the only property sector.

Over the longer term, we believe investors interest in China's logistics sector will remain strong as the sector benefits from strong economic and demographic fundamentals that extend across short market cycles. In addition, the upcoming domestic REITs will provide a new channel of liquidity for prime logistics assets, which is set for a period of accelerated and sustained growth.

Actis Asia Real Estate has one of the most experienced teams on the ground with deep understanding of the local China property and strong local network. Based on that, Actis has worked with one leading logistics developer to jointly invest in and develop Grade A logistics facilities in Tier 1 and key Tier 2 gateway cities in China. We aim to gradually expand our exposure in the China logistics development sector.







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