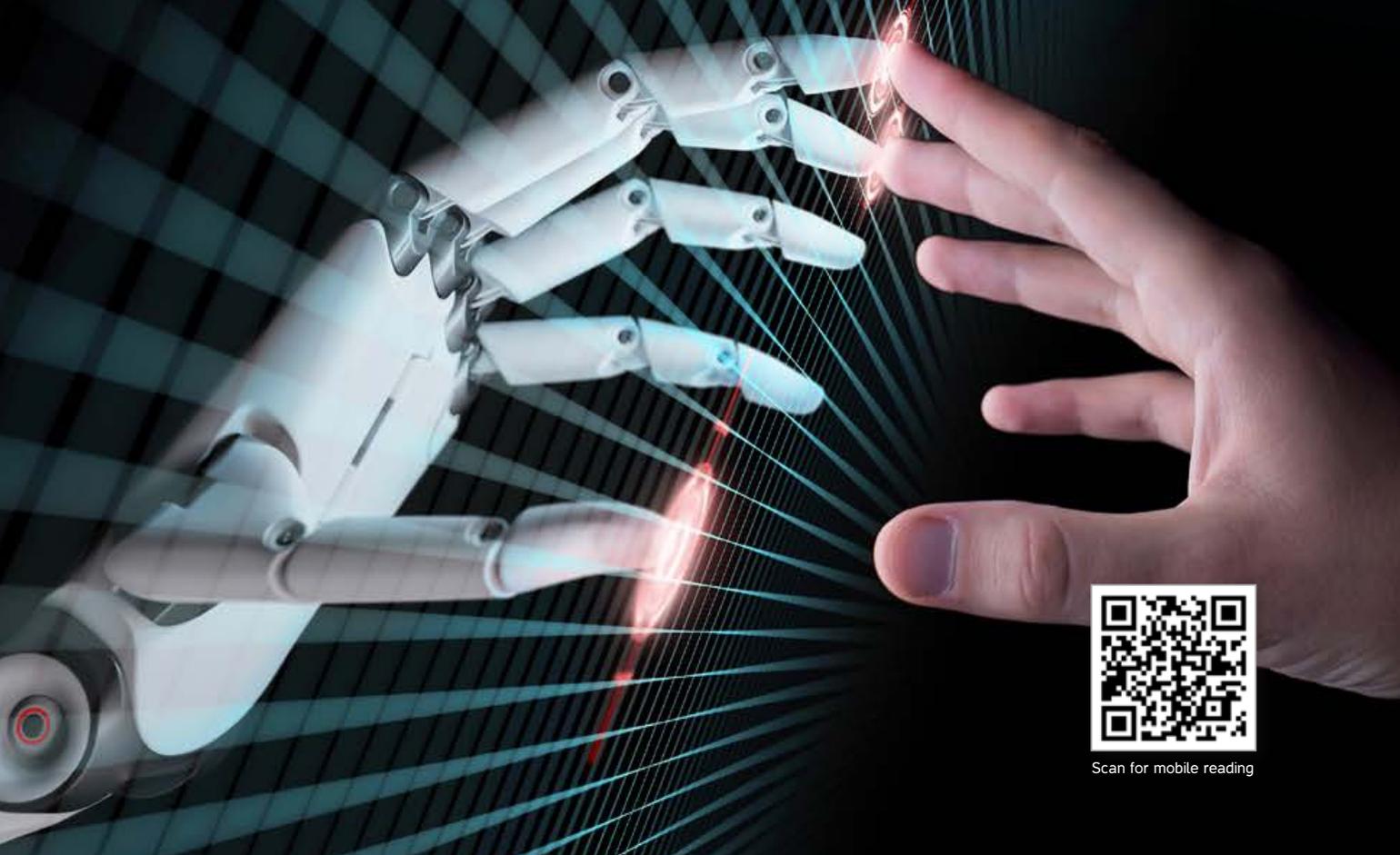


Special Edition | 10.2017

WinWin

+INTELLIGENCE

A New Era For Industry Verticals



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Proving scientific predictions can take centuries of trial and error

Exploration
never stops at failure



+Intelligence: A new era is coming



To thrive in the global digital economy, enterprises in all industry verticals must plan and execute digital transformation strategies that go beyond smart and enter the +Intelligence era – an era of cloud backed by big data and AI.

Broadband connects the data center networks that provide cloud services like computing and storage and enable platform and sharing economy models such as XaaS and pay-per-use. IoT provides the huge volumes of data that feed in the cloud for ubiquitous AI analytics to provide actionable insights for enterprises.

By 2025, 100 billion devices will be connected on pervasive 5G networks, generating huge amounts of data. For business, this data will enable a true customer-first approach, enabling fully personalized products, solutions, and services.

Digital infrastructure and virtualization will forge mature vertical-spanning ecosystems that bring together disparate industry cogs to form coherent value chains and deliver unprecedented efficiency and precision. And enterprises need to get smart with digital transformation if they don't want to be left behind.

However, reaching this point isn't easy. Nor is choosing the right transformation path to follow and then seeing it through. Enterprises need partnerships. And they need the right solutions to move forward over the next decade.

Telcos – the drivers and enablers of digital transformation – face ten possible transformation journeys and five destinations, each requiring a specific strategy. Slow-to-change and diverse in nature, manufacturing must overhaul outdated legacy IT infrastructure to evolve into Industry 4.0 and the age of data-led productivity and mass customization.

By 2025, the Earth's population will have hit 8.1 billion, which will exert pressure on our food and energy resources. Both the agriculture and energy industries need the vision and digital solutions to create a cleaner, greener world that can be fed. Equally, connected transportation and driverless tech can be a force for change, a disruption that gets people and society where they need to be – quickly, efficiently, and cleanly.

Digital transformation will revolutionize financial services over the next decade, as Fintech startups disrupt the industry and force banks to cooperate and compete, while consumers will be more in control of their money than ever. Digital transformation will allow a much more tailored approach to health and education, and place both into the hands of underserved, remote, and developing regions, heralding a great leap in equality.

This Better Connected World brings together people, businesses, and things, forming a world of +Intelligence where data is the new oil and cloud the refinery.

A handwritten signature in black ink that reads "Sally". The signature is fluid and cursive, with a long, sweeping tail on the letter 'y'.

Sally Gao, Editor-in-Chief



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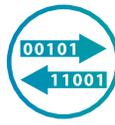
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Digital Transformation

**Better connected enterprises:
Your transformation journey starts here**

By 2017, 34 percent of all technology will be allocated to digital transformation projects.

Do you know how to start your journey?



Telcos + Intelligence

**Telco digital transformation: The conditions,
journeys, and destinations**

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**When mobile networks meet AI: Redefining
network limits**



Manufacturing + Intelligence

Smart manufacturing: More than just robots

The new reality for manufacturing is Industry 4.0: Full automation and cyber-physical. But manufacturers are slow to change. Why? And what's the way forward?

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Energy + Intelligence

Energy 2025 is surprisingly different from energy in 2017



Transportation + Intelligence

Get up and go with connected transportation

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In safe hands: Connected cars will quickly, quietly, and carefully change your life

To drive us safely into the future, driverless cars require faster and more robust networks to realize true vehicle-to-everything connectivity. How can we get there?

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Agriculture + Intelligence

Feeding the world with connected farming



Finance + Intelligence

Better financial services through a Better Connected World

Fintechs have arrived on the banking scene and digital transformation is necessary for banks to survive. And the way involves both competition and cooperation.

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HSBC puts partnership and data at the heart of digitalization

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Government + Intelligence

eGovernment: Smarter, safer, and better connected

To make smart cities a reality and to power industry transformation, eGovernment's first stop is public safety.

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Healthcare + Intelligence

On a health kick with connected healthcare

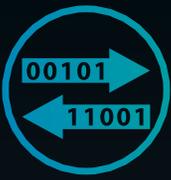
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Education + Intelligence

Learning for the future with Digital Leadership

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Digital
Transformation

Better Connected Enterprises

YOUR DIGITAL TRANSFORMATION STARTS HERE



By Jarrett Potts
VP of Enterprise
Marketing, Huawei

Enterprises need digital transformation to survive. Find out the best approach to starting this journey.

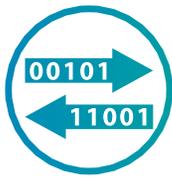
According to IDC, by 2019 enterprises across the globe will have spent over US\$2.1 billion on tech-based services to implement and manage digital transformation initiatives. By 2020, over two-thirds of enterprise IT spend will go on cloud-based offerings. But let's back up and start at the beginning.

What is digital transformation?

Digital transformation is defined as the “profound and accelerating transformation of business activities, processes, competencies and models to fully leverage the changes and opportunities of digital technologies and their impact.” What

does this mean to your business and to technology in general? Is your infrastructure ready for this transformation and how are you planning to handle this dynamic environment in the future? We look at some of the trends that are coming, how to plan for them, and some of the high level items you should consider before digital transformation becomes a disruptive force in your business.





Did you know that in 2017, 34 percent of all technology will be on digital transformation projects? IDC states that this is mainly because IT with the help of digital transformation is becoming more of a cost center than ever before and is now, on average, responsible for 6.5 percent of revenue growth. That means IT infrastructure is no longer just an expense but a money maker. Not only that, but organizations with digital-ready networks are seeing double or triple the revenue growth compared to those without. IDC goes on to show that companies that have linked their distributed enterprises have increased profits by between 30 and 50 percent.

The reasons to move towards digital transformation are simple. With a more distributed and dynamic infrastructure, building a flexible and scalable IT environment is a money maker – rather than an expense – that's not only needed, but mandatory. Making your IT serve as your best sales person or your hardest working employee may be a foreign concept, but think of the alternative. If your IT department and environment is not performing up to expectations, every part of your business suffers.

A well-thought-out strategy and execution plan for digital transformation can actually deliver a competitive advantage. If your systems are faster, more flexible,

and more affordable than those of your competitors, you'll increase your market share and drive more business. A great example of this is online advertising, where ads are served to hundreds of millions of people a day. These ads are a very large income driver for online marketing companies, but competition is fierce. The most successful companies have completely digitalized so that the process to bid, approve, and serve an ad to an end user takes less than a second. The kicker is that if it takes longer than that in today's online market, the user will dismiss the ad and the company responsible for serving it loses an opportunity.

How to get there: Cloud

Now the question is how do you get ready for digital transformation? How do you set a plan in motion to get where you are today to where you want to be? Well, it begins with cloud technology and a cloud infrastructure. Cloud computing is a type of online-based computing that provides shared IT resources and data to computers and other devices on demand.

First, let's assume that your IT stack is a traditional setup with multiple vendors' servers, storage, and networking solutions. In this infrastructure, an application like

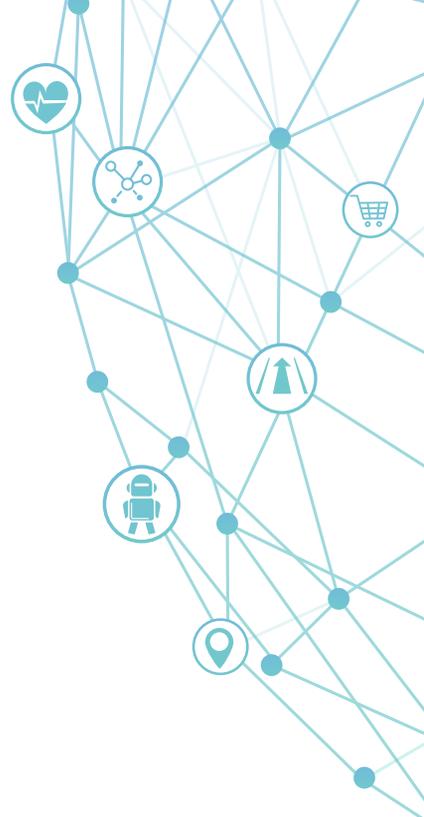
SAP/Oracle would have its own dedicated resources. The database and applications would all sit on a physical server with dedicated physical storage and, usually, semi-dedicated (zoned) networking. The database administrator would be limited to those resources. Adding resources would involve scheduled downtime. The standard setup also creates operation silos and bottlenecks in administration and information flow.

The first step is virtualization. You must virtualize the foundations of your environment before you can start providing services. There are three basic building blocks of any given infrastructure: servers, storage, and networking.

Storage and servers

Take storage as an example. If you're an average business, you have at least three storage vendors and, usually, a combination of two different technologies such as SAN and NAS. This provides you with very little flexibility. But, virtualizing storage is a key feature for monitoring, managing, and distributing storage according to its properties rather than vendor or type.

Let's say you need a very fast disk for a new production database. In legacy infrastructures, that disk would exist inside a single vendor's disk array. However, if virtualized, the disk



could exist across multiple vendors' storage – even in different cities.

Products like VMware and ZEN are now used to virtualize servers. This blurs the lines between physical resources and the actual places where applications live, unfortunately creating a point at which more complexity could choke an organization. This physical versus virtual relationship must be proactively managed to avoid further complicating the IT infrastructure.

You'll need a policy-driven control layer to control and coordinate all virtualization in the IT environment. This layer is also known as software-defined and is the basis of a hyper-converged infrastructure. It makes the server, network, and storage virtualization from different vendors speak the same language and work together as one large, well-oiled machine.

But, how does this work together and lay a better foundation on which to build your digital transformation project? Good question. Let's look at an example of how the layers of virtualization make your IT work for you instead of you working for your IT.

If the SAP/Oracle Instance that your development and operations group needs to start testing its new application, the software control

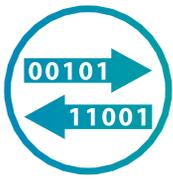
plane would use its policies to create a workflow that would find and allocate storage that matches the agreed service level agreement (SLA), regardless of vendor. It would then use the best practices of the database and storage vendors to allocate the correct number of disks, file systems, and servers. Next, it would find and allocate proper networking with the correct level of backup, recovery, and – if needed – active/active failover. After that it would automatically create virtual machines and install all the appropriate software using the vendor's best practices. Finally, it would apply the policy for monitoring, business continuity and disaster recovery, and grant users access to the new environment.

In the past, this would have taken weeks of planning and meetings. Change requests and testing had to be done every step of the way. However, with the software control plane and the ability to create pre-tested workflows, that is no longer necessary.

3rd Platform

Once your foundation is built on solid virtualization principles and a robust policy control plane, you're ready to start digital transformation. IDC calls this the 3rd Platform and it's where the cloud combines with a mobile platform and a social platform that interfaces into your cloud environment.

A well-thought-out strategy and execution plan for digital transformation can deliver a competitive advantage. If your systems are faster, more flexible, and more affordable than those of your competitors, you'll increase your market share and drive more business.



Intelligent Industry Solutions



3rd Platform



Mobile



Social



Big Data



Cloud

Big data functionality must stretch across all aspects of your environment, even those parts you may not own.

Industry transformation

There are many industries whose futures depend on digital transformation and its many benefits, including the promise to turn traditional IT infrastructure into a cost center that allows a company to make money easier and faster. Telcos and banks now depend on mobile technology and the dynamic applications that allow business to be done anywhere at any time. Financial Technology (Fintech) is talked about in every trade publication around the world, and all the newest technology claims to have a huge impact on Fintech and other industries.

Agriculture is another great example of how digital transformation will revolutionize the way farming and food supply will change over the next 10 to 15 years. The UN states that the world's population is expected to exceed 8.5 billion people by 2030, the scale of activity required to provide food for everyone is driving the environment to breaking point. Using precision farming, smart irrigation and an overall smart farm management system will enable tech solutions deployed on robust digital infrastructure to streamline processes, minimize waste, maximize output, and let us once again walk the path to sustainability.

The energy industry requires smart grids and smart power distribution to prepare for upcoming demands. Smart government depends on digital

technology to bring government closer to the people, and the health and education industries require digital solutions to reach more population – more efficiently and at cheaper cost.

Any industry that wants to do more than just survive will need digital transformation. To thrive, the underlying technology that industries utilize must morph into an environment that promotes the rapid deployment of new services and the ability to serve customers cost effectively.

However, according to Forrester, only 27 percent of today's businesses have a coherent digital strategy that sets out how the firm will create customer value as a digital business. Conversely, Gartner says that 125,000 large organizations are launching digital business initiatives now and that CEOs expect their digital revenue to increase by more than 80 percent by 2020. IDC expects that the percentage of enterprises creating advanced digital transformation initiatives will more than double by 2020, from today's 22 percent to almost 50 percent.

IDC predicts the emergence of the "digital transformation economy," Gartner talks about the rise of the "algorithmic business" and "programmable economy," and Forrester charts a roadmap for



companies responding to digitally savvy customers and consumers. Based on their predictions, digital transformation will become the key strategic thrust for most CEOs.

Big data and IoT

Big data analytics will serve as the foundation of digital transformation because, with all the increased business and traffic to your online applications, collating and predicting your customers' needs becomes mandatory as they can buy or get services from hundreds of online providers. Big data directly affects the customer experience, and the better the experience the more likely a customer will become a repeat customer.

IoT will also catalyze the expansion of digital transformation to all corners of the economy. Gartner states that, by 2018, there will be 22 billion IoT devices installed, driving the development of over 200,000 new IoT apps and services. Also in 2018, 6 billion connected things will be requesting support and responding to service requests from things, creating new service businesses. By 2022, 1 million new devices will come online every hour. IoT devices and solutions have the potential to redefine competitive

125,000

large organizations are launching digital initiatives now

By 2020 their digital revenues will increase by more than

80%



22 BILLION

IoT devices will be connected by 2018

100%

of enterprises will be connected by cloud by

2020

advantages in every type of economic activity, and fundamentally alter how consumers interact with enterprises and how enterprises interact with their supply chain and distribution partners.

Huawei and industry experts predict that, by 2020, 85 percent of enterprise applications will be cloud-based and that going to cloud is inevitable for enterprises that want to thrive with their digital transformation.

Every enterprise wants to deploy applications more efficiently and at lower cost. Every enterprise requires powerful and convenient platform services, smarter resource sharing, and the benefits of the “pay as you go” cloud model. In fact, Huawei and industry experts predict that by 2020, 100 percent of enterprises will be connected to the cloud in some manner, which then begs the question: Is your digital transformation plan vetted and viable?

If so, this is where your digital transformation begins. You have built a foundation that is solid and robust, which is able to scale and ready to take on the role of business catalyst. Your digital transformation starts with cloud and big data, but must be ready to tackle the coming tsunami of IoT. Your digital transformation starts now. **UUM**



By Martin Creaner, Author of
Delivering the Digital Economy



Telco digital transformation

THE CONDITIONS, JOURNEYS, AND DESTINATIONS

Three things telcos must do

Digital transformation must provide a range of benefits to telcos that help address the key challenges facing the industry today.

First, transformation must significantly improve the B2B and B2C customer experience if telcos wish to compete with OTT players. Second, transformation needs to meaningfully boost a telco's efficiency and agility. And third, it must enable them to maximize revenue from both traditional and new digital services. If telcos can achieve all three, research from Huawei, the World Economic Forum, and other sources

estimate that digital transformation could generate US\$15 trillion in profits over the next ten years.

Transforming everything

The biggest hurdle to overcome with digital transformation is to understand that it isn't just a simple technology challenge – it covers every part of the telco business.

In the "Scope of Transformation" diagram, the vertical axis recognizes the range of transformation, from core technologies to how telcos do business. The horizontal axis shows that transformation needs both an inward focus that changes how the telco operates and an outward focus covering

how it engages with the market.

This results in what I consider to be the ten major journeys that a telco can travel on the path to true transformation.

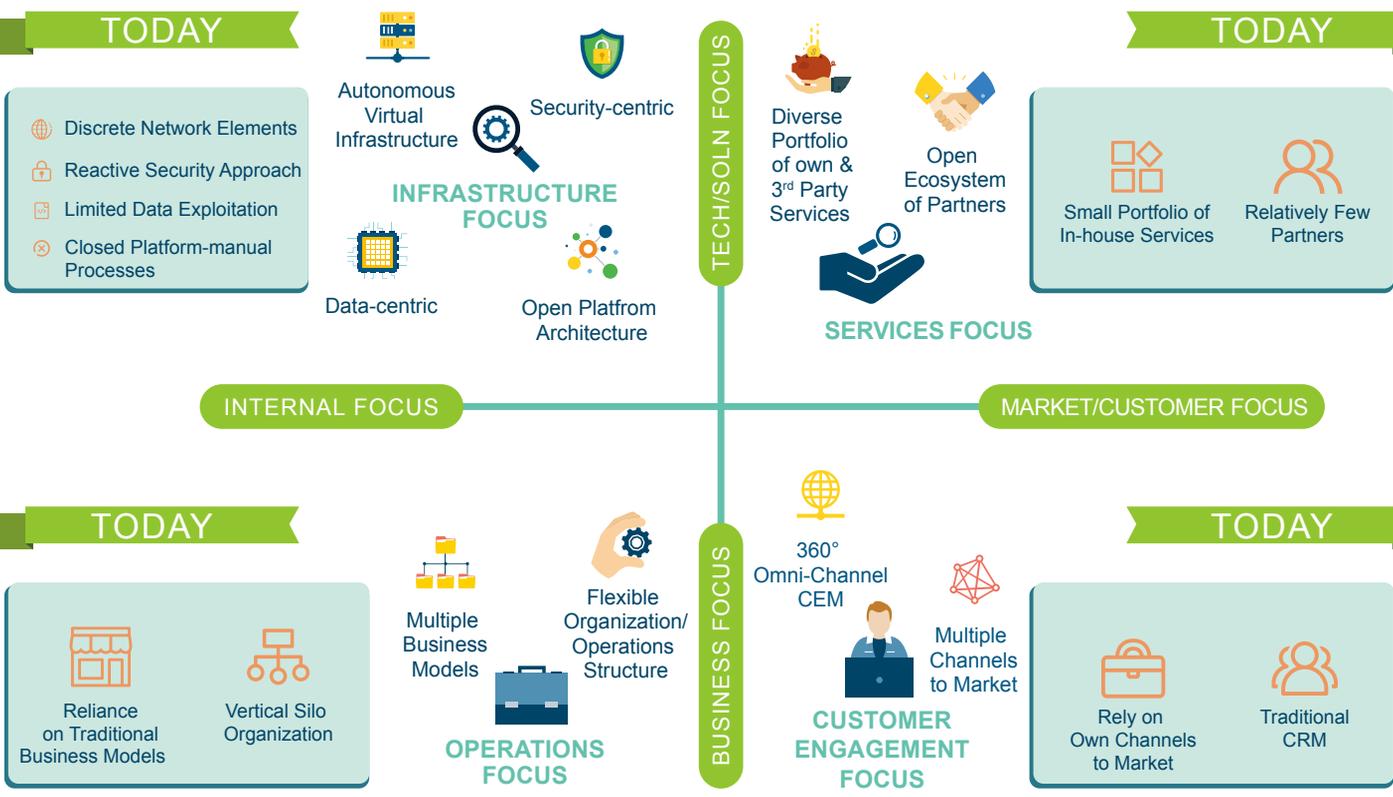
Ten journeys to the top

Journey 1: From discrete network elements to an autonomous virtualized communications and cloud infrastructure. The telco's infrastructure will evolve from discrete network elements to a highly autonomous set of communications and cloud infrastructure, which can be managed at extremely low cost. NFV/SDN next-gen networks are making this first journey a reality for many telcos, but the cost,



Back in the 90s, MIT's Nicholas Negroponte said, "Anything that can be digital will be digital." That's finally coming true. Digital services are extending way beyond movies and books to embrace every possible service in every major global vertical industry. But for telcos to take advantage of the opportunities offered by the digital economy, digital transformation is a must.

Scope of Transformation



Source: Huawei SPO Lab



complexity, and disruption are huge.

Journey 2: From reactive product-specific security to uniformly orchestrated security. Third parties will be increasingly involved in the delivery of digital services across channels provided by telcos.

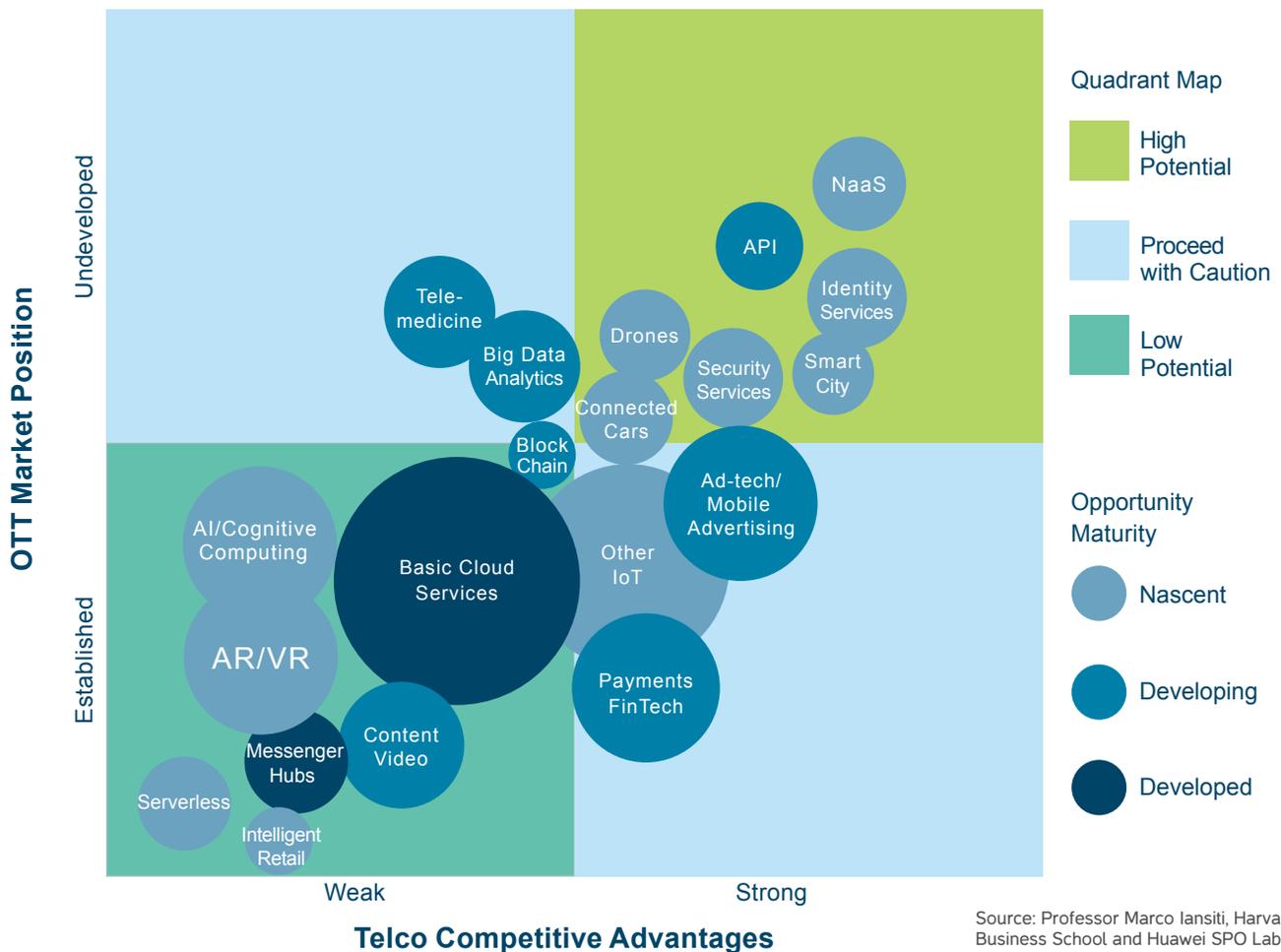
Frequently, these services have higher security requirements that necessitate complete, business-wide security transformation covering the full technology stack, service creation process, partners, physical environment, and all stakeholders that deliver and use a given service.

Journey 3: From limited data exploitation to a uniformly orchestrated data-centric enterprise.

Telcos must develop a single coordinated approach for the collection, analysis, distribution, security, and monetization of big data derived from infrastructure,

Opportunities for telcos based on competition from OTT/internet players and telcos' competitive advantages at their current levels of maturity

Opportunity Prioritization Map



Source: Professor Marco Iansiti, Harvard Business School and Huawei SPO Lab



services, social channels, business, and third-party sources. The success of all entities in the digital economy will largely depend on how well they use data, both for internal business optimization and external monetization.

Journey 4: From a closed management infrastructure to a platform for open services. Platform business models are driving the global digital economy, but the role of telcos isn't yet clear. However, it is clear that telcos must evolve their closed environments, which focus on designing and delivering their own services, to open platforms for developing both their own and third-party services under a wide ecosystem.

Journey 5: From a limited portfolio of own services to managing a diverse portfolio of own and third-party services. As the digital economy expands, digital telcos must expand their service portfolios far beyond their current scope. They must also learn which service niches best suit their competencies and define how to manage these diverse service portfolios. They can do so by identifying their competitive advantages and the relative market strengths of competing OTT players.

The Opportunity Prioritization Chart on page 9 shows where telcos' competitive strengths may lie and where they correspond to the currently under-developed OTT market position and investment.

Journey 6: From a limited set of supplier relationships to an open ecosystem of partnership relationships. A digital telco will only be able to expand its service portfolio by changing its approach to the wider ecosystem, engaging with more players, and developing ecosystem management processes that move at Internet speed rather than traditional telco speed.

Journey 7: From a limited set of telco business models to multiple value creation and capture approaches. A larger service portfolio will need to embrace a much wider range of value creation and capture models. Telcos need to transform in a way that lets them seamlessly pivot to a business model that enables a specific service to be successful, which may in turn require fundamental changes to financial processes, business case processes, and enterprise cost base.

Journey 8: From a vertical silo to flexible organization, culture and operations. A wide digital service

As the digital economy expands, digital telcos must expand their service portfolios far beyond their current scope. They must also learn which service niches best suit their competencies and define how to manage these diverse service portfolios.



While most believe that successful digital transformation involves evolution into a sophisticated digital service provider, by 2025 most telcos will look like something resembling the dumb pipe – closer on the transformation scale to infrastructure-centric than service-centric.

portfolio that’s monetized via multiple channels and business models – and that’s delivered across an extensive partner ecosystem – requires a commensurate organization and cultural change, which is perhaps the most difficult transformation journey to map and the most painful to travel. But a new culture, set of skills, and operating style that adapts to different parts of the business are essential prerequisites for a digital telco.

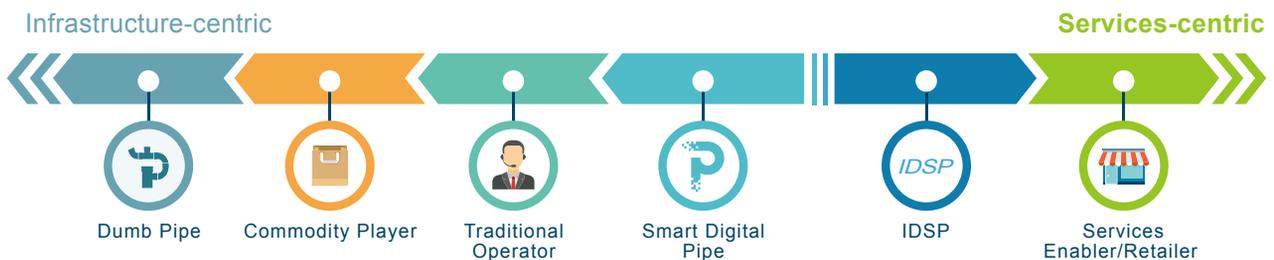
Journey 9: From focusing on own channels to market to adopting multiple channels for different vertical markets. With a service portfolio that expands across multiple vertical markets, a digital telco will need to open up new channels to market to maximize revenue. These channels may be based on a specific vertical, location, or retail scenario and lack a service development capability. They may require new

operating processes, new ways of incentivizing employees, and new paths for aligning business criteria to vertical market expectations, rather than sticking to telco norms.

Journey 10: From one dimensional management of customer relationships to 360-degree omni-channel management of the whole customer experience. Many telcos are embarking on this transformation process, which requires changes to systems, processes, and culture. These changes can empower all key stakeholders to make smart decisions on-the-go based on the right data. An omni-channel CEM environment will enable digital telcos to capture, store, process, and expose customer data in near real time from all channels.

Five digital destinations

Digital Transformation Scale



Source: Accenture Strategy & Huawei SPO Lab



Not all telcos will arrive at the same destination. While most believe that successful digital transformation involves evolution into a sophisticated digital service provider, by 2025 most telcos will look like something resembling the dumb pipe – closer on the transformation scale to infrastructure-centric than service-centric!

Dumb Pipe: This telco is pure infrastructure and no longer owns a B2C customer relationship. It provides highly efficient connectivity, selling under a wholesale B2B2C model.

Commodity Player: This telco focuses on core competencies like network, marketing, and sales. Some limited B2C customer

ownership allows it to be a B2B and B2C partner in a pseudo-protected market environment.

Smart Digital Pipe: This telco develops strong partnerships with web and OTT players, with a strong focus on B2B2C and infrastructure QoS boosted by regulatory protection on core business.

Requirements for Different Digital Transformation Journeys

						
		Dumb Pipe	Commodity Player	Smart Digital Pipe	IDSP	Services Enabler/Retailer
DIGITAL INFRASTRUCTURE	Autonomous Virtual Infrastructure	High	High	High	High	Low
	Security Centric	Med	Med	High	High	Med
	Data Centric	Low	Med	High	High	High
	Open Platform API Architecture	N/A	N/A	High	High	Med
DIGITAL OPERATIONS	Flexible Organization Operations Structure	Med	Med	Low	High	Med
	Multiple Business Models	Low	Low	Med	High	Med
DIGITAL CUSTOMER ENGAGEMENT	360° Omni Channel CEM	low	Med	High	High	Med
	Multiple Channels to Market	Low	Low	High	High	Med
DIGITAL SERVICES	Diverse Portfolio of own & 3rd Party Services	N/A	N/A	Med	High	Med
	Open Ecosystem of Partners	N/A	N/A	Med	High	Med

Source: Huawei SPO Lab



Recent analysis by the Huawei SPO lab indicates that less than 15 percent of the world's telcos have the right ingredients to become an IDSP, and instead should set their sights on becoming a finely tuned dumb pipe or smart pipe.

Integrated Digital Services Provider (IDSP): This telco offers access and connectivity, enablement to B2B2C partners, and a full-suite of digital products and services to end customers.

Services Enabler/Retailer: The ultimate destination where the telco no longer provides network infrastructure, instead serving as a VNO that retails services and enables other B2B2C parties to go to market.

The destination that a telco ultimately reaches depends on many factors, including regulatory environment, ambitions of investors and C-suite executives, and the skill profile of the organization. However, there's a growing consensus that only a very few will successfully transform into competitive IDSPs.

Recent analysis by the Huawei SPO lab indicates that less than 15 percent of the world's telcos have the right ingredients to become an IDSP, and instead should set their sights on becoming a finely tuned dumb or smart pipe, with perhaps additional, structurally separated services in the enabler or retailer business.

Becoming an IDSP will be extremely difficult and few telcos have the financial strength and executive

staying-power to make the journey. Becoming a smart pipe will be less complex, but will still require extensive investment in all ten journeys.

Developing a service enabler or retailer business also requires investment across most of the ten journeys, but is more achievable if the service business is created as a new stand-alone business rather than as an evolution of an existing one. A gradual evolution into a dumb pipe or commodity player is the path of least resistance for telcos, requiring the least change and least investment. It's therefore the most likely destination for many telco transformations.

A complex reality

We've suffered over recent years by looking at transformation as a monolithic transformation program, primarily technical in nature, with the goal of becoming a new-generation digital services provider. The reality is much more diverse and complex.

The digital transformation journeys that a telco must undertake will vary greatly depending on whether the telco expects to become a dumb pipe or an IDSP, but each journey needs to be planned separately and prioritized differently depending on the final destination target. [www](#)



By Dr. Peter Zhou
Chief Marketing Officer
Huawei Wireless Solutions

WHEN MOBILE NETWORKS MEET AI

Redefining network limits

As a field of research, artificial intelligence (AI) dates back to 1956, when a small group of just ten researchers held a low-key conference on the subject. At that time, nobody imagined that AI would someday conquer one field after another, from speech recognition (SI) and image recognition to the games of chess and go. In 2017, the new technological revolution led by AI is bringing us to the dawn of the fourth industrial revolution.

In 1973, the first mobile phone call was made on the streets of New York. Less than 50 years have since elapsed, and now a fully connected

world is rapidly taking shape. There are 8.2 billion radio connections around the globe today, which means that more than 5 billion people are interlinked via wireless networks. The curtain on 5G is about to rise and the world is eager to see how this new generation of mobile networks will enable Smart Everything.

AI and mobile networks have, are, and will continue to revolutionize the world. These two technologies are bound to intersect, interact, and converge with each other in this golden era.

In this new and exciting age, mobile networks will enable AI anywhere.

Data fuels the smart era

The development of AI hasn't been smooth sailing. The majority of the most extraordinary AI achievements have been generated over the past ten years, thanks to new algorithms, breakthroughs in chip technology, and the growth of today's mobile Internet. The new algorithms and new chips have laid a foundation for the advancement of AI, and mobile Internet has provided AI with massive amounts of data. Approximately 3,000 petabytes of data were generated online every day in 2016. Compare that to the sum of all



How can we aggregate this massive amount of data on the cloud and transform it into intelligence? The answer is ubiquitous connectivity.

printed materials throughout history – an estimated 200 petabytes. This order of magnitude increase in the volume of data can better power AI's progression than improved algorithms. Data is the fuel of the smart era.

Mobile network connections make everything smart

How can we aggregate this massive amount of data on the cloud and transform it into intelligence? The answer is connections. To make all things sense, all things connected,

and all things intelligent, ubiquitous connectivity is the key. Today's mobile networks boast unprecedented connectivity thanks to the continuous evolution of 4.5G and rapidly approaching 5G technology. Such high-performance networks will use AI everywhere, and on-demand smart-tech will become a basic expectation for every digital citizen out there.

More AI applications with enhanced mobile networks

The demands for smart connections depend on applications. Mobile networks must meet a whole range of new requirements before AI applications can become ubiquitous. Wireless X Labs, Huawei's mobile application lab for wireless networks, has carried out a range of studies and joint projects related to this subject. X Labs' "Service Robots AI Helmet" is an excellent example of how 5G networks make certain AI applications possible. The helmet connects in real time to a cloud server, and benefits from the ultra-wide bandwidth and ultra-low latency of 5G. The helmet has the potential to help the visually





impaired avoid obstacles and walk around as if they were sighted.

Beyond all boundaries, AI redefines network limits.

Just as mobile networks enable ubiquitous, on-demand AI to reshape people's work and the way they live their lives, AI is also gradually transforming mobile networks.

From maximizing site capacity to maximizing network capacity

We can't talk about the development of mobile networks without mentioning Claude Elwood Shannon and his paper *A Mathematical Theory of Communication*. This ground-breaking 1948 article is a founding work for modern information theory. Shannon's theorem, first proposed in that paper, has guided the development of mobile networks as long as they've been around. Half a century has passed and, thanks to the progression of wireless communication technologies, single-channel capacity is approaching the Shannon limit.

And today's networks are growing increasingly complicated, with more

diverse services, RATs, terminals, and site configurations. A number of factors that may impact network capacity are also on the rise. The combination of these factors is raising more issues that cannot be resolved with experts' experience and classic logical algorithms, making optimal dynamic network resource allocation around the globe hard to achieve.

Incorporating AI into mobile networks

There has got to be some way to expand network capacity beyond the limits defined by expert experience and traditional logical algorithms. That's where the value of AI lies. It's where the world will find a new limit in network capacity. The purpose of bringing AI into mobile networks doesn't stop there. From the day it was born, mobile network AI aimed to make breakthroughs in air interfaces, O&M efficiency, business possibilities, and many other fields.

The force awakens

In the Star Wars universe, "The Force" is described as a mysterious

metaphysical power that permeates the entire universe. Those who are strong with the Force can see the future. To a certain extent, AI will become the Force of mobile networks. As the Force awakens, mobile networks will become more intelligent, more flexible, and capable of sensing and interacting with their environment.

Reshaping the world

Let's take another look at the 1956 Dartmouth AI research project. One of the four proposers was Claude Elwood Shannon, the founder of Shannon's theorem and father of information theory. Perhaps that was an early indication of the marriage between mobile networks and AI.

The convergence of mobile networks and AI will power the development of a smart society. In Huawei's vision of the future, a fully coordinated cloud-pipe-device architecture will form an intelligent infrastructure for this smart society. As devices ensure all things can sense, networks will allow all things to be connected, and the cloud will support all things intelligent. As the wave of AI rises, the mobile industry is going to reshape the world, just as the mobile Internet once did. [www](#)



Smart manufacturing **MORE THAN JUST ROBOTS**

Automation in factories isn't new. Today, though, the disruptive force of digital transformation is taking manufacturing far beyond automation. Industry 4.0, mass customization, and advances in tech like 3D printing and nanomaterials have placed humanity at the cusp of several game changers when it comes to this US\$11.6-trillion industry.

By Gary Maidment, Huawei





Many companies aren't all that clear on how and where to deploy analytics solutions or how to use the huge volumes of data generated by sensors.

robots. Fortunately, that's what the latest wireless network solutions deliver: high-bandwidth, low-latency, and reliable connections that can cut costs by up to 50 percent and energy consumption by 10 percent.

Equally significant, though, is the skills gap that exists in data analytics, a central facet of manufacturing and the source of insight into processes, faults, consumer habits, and much more. Many companies aren't all that clear on how and where to deploy analytics solutions or how to use the huge volumes of data generated by sensors. And McKinsey estimates that there will soon be a shortage of around 1.5 million analytics experts in the US alone. While Forbes writer Meta S. Brown questions the McKinsey stats and analysis, she also identifies the human factor as an issue, "Managers who have trouble finding analytics talent have usually not given enough thought to their business goals."

Moreover, in a survey by Tata Consulting about big data analytics in manufacturing, the top problem identified by enterprises was building trust between data scientists and functional managers, which in turn creates a gap between data insights and how and which business strategies are executed. Of the 17 categories

surveyed, the second biggest problem was determining what data to use for which business decisions, and the third was the inability to handle the volume and velocity of data generated by sensors. Simply put, manufacturers can't and aren't making the most out of the data they have access to.

The complexity of the manufacturing industry means that no coherent industry-wide digital transformation strategy exists, with individual enterprises digitalizing at different rates and in different directions. Moreover, many companies lack the agility to quickly shift from traditional goals like lean manufacturing. Indeed, the Tata Consulting survey found that the top three benefits of data analytics for manufacturers are still in line with the old-school aim of optimizing processes: tracking product defects and quality, supply planning, and identifying manufacturing process defects.

Reflecting the industry's commitment to lean processes, manufacturers have been relatively fast movers in analytics, smart sensors, and Industrial IoT (IIoT). That's all well and good, but the productivity gains from 6 Sigma and lean manufacturing have petered out over the last five or so years, because processes have



become as optimized as they can be.

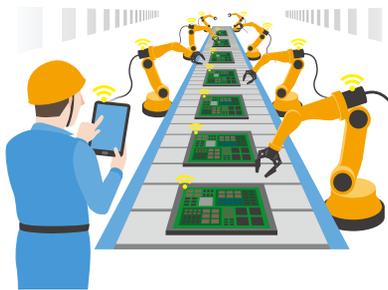
A change in mindset

Not all enterprises are benefiting from the new service-oriented business models that can arise from abundant sensors and data insights. In contrast, Denzil Samuels, Global Head of Channels & Alliances for GE Digital, gives an example of how his company benefits airline customers with the data, IoT, and service mix, “We can give the airline digital information in real time. That can help them with flight operations like scheduling crew and handling cargo. We can also provide data in a whole bunch of other areas by just selling them a jet engine.” Thus, GE is acting as a manufacturer and also as a service provider based on hardware embedded with smart sensors.

New business models are not just prompted by technology. Consumer expectations are leaning towards personalization and faster delivery, both of which require a shift towards mass customization, strong digital infrastructure and, more recently, drone delivery. However, many traditional manufacturers are slow to embrace the mindset of markets of one.

The manufacturing industry is worth

US\$11.6 TRILLION



Modern manufacturing requirements demand

< 1 MS LATENCY

and data rates of

10 GBPS

Cyber security breaches cost manufacturing

US\$400 BILLION

per year

Mass customization in action: unmade.com

Fashion startup Unmade enables customers to customize garments before they’re made, so customized designs can be produced at the same unit cost as mass-produced goods. Designed to avoid over-production and waste, the three elements of Unmade’s business model are personalization, ecommerce, and on-demand manufacturing. An online personalization editor allows customers to change colors, patterns, and logos on garments; the ecommerce model lets existing stock and customized pieces to be sold together; and on-demand manufacturing sends orders to partnering knitwear factories to be made. A press evaluation describes this model as, “Making the tools of factory production available at the click of a mouse, with no penalty for short productions runs.”

Smart robotics and machine learning will help achieve advances in mass customization. ABB, a leader in digital tech and robotics, is working with Huawei to combine wireless tech, smart sensors, and smart components to solve manufacturing challenges. According to Joni Rautavuori, president



of ABB Robotics and Applications, “The development that is happening on smart components and sensors makes it possible to use machine learning to develop new ways of programming robots.” This increases the potential for adaptive programming, which in turn helps enable mass customization.

Despite the flexibility and agility of companies like Unmade, mass customization isn't high on most manufacturers' agendas. In fact, it comes in last in the Tata Consulting survey. However, given shifting consumer expectations, it's quite probable that this will change for many products.

The security issue

In March 2017, the tech mag Manufacturing Business Technology reported that manufacturing is the

second most hacked industry after healthcare, in large part because of inadequate investment in security. Although cyber attacks cost businesses US\$400 billion every year, cyber security – like data analytics – lacks experts. Forbes cites the non-profit information security advocacy group, ISACA, which “predicts there will be a global shortage of two million cyber security professionals by 2019.”

The transition to Industry 4.0 is creating larger attack surfaces due to more complex networks, a vast number of connected IIoT devices, and big data processed in the cloud. Many companies lack a robust E2E Information Security Solution that protects against attacks from a hacker's armory, including server, client, web, software, and DDoS. Equally, on the R&D link of the chain,

IPR and sensitive data requires a network solution that separates the R&D intranet from the office extranet, provides secure connections, and encourages collaboration.

Transitioning into the future

Germany's Industry 4.0 might still draw a blank-face response from some business leaders, but it represents the next phase in manufacturing in Europe. Equivalents are the Industrial Internet in the US and Made in China 2025. All involve the convergence of a range of technological enablers and accelerators, the result of which will be connected, smart factories and smart manufacturing.

Smart manufacturing goes beyond computing and automation. It creates a cyber-physical system, or digital twin, as a virtual model of a process, product, or service. Underpinned by ubiquitous, low-latency connectivity in the shape of 5G, smart sensors transmit data to the cloud where it's processed and analyzed to give contextual and predictive data.

Pairing a physical and virtual world has several advantages. GE Digital's Denzil Samuel's explains one advantage using the example of a



jet engine on which smart sensors constantly transmit enough data to build a cyber copy, “The engine that’s now being simulated can take over the pain of major aircraft engine maintenance by replacing a single blade that’s worn as soon as we know about it. Or better still, predicting when it’ll get worn to the point when it needs replacing, so we can minimize the amount of time that the engine is actually out of commission.”

Moreover, the connectivity afforded by smart manufacturing links all processes from R&D, sourcing materials, and production to QA, sales, distribution, and logistics.

Manufacturing 2025

Over the next decade, smart manufacturing will extend past individual factories to connect groups of factories and the manufacturing industry with other verticals.

The convergence of manufacturing and services will continue with the XaaS model based on IoT and data insights. Thus, the services that manufacturers will require and deliver as a result of the products they make will increase, many of which will be driven by data insights and consumer demand.

In the B2C space, consumers in emerging economies will become a dominant market presence, while demand in developed countries will fragment. However, customization – both in products and after-sales services – is likely to increase.

3D printing will evolve from prototyping to a viable means of mass production in the 2020s. Advances in raw materials will enhance parts design, manufacturing processes, and printing technology. At the same time, the use of nanomaterials, which we’re seeing today in products like clothing, sports goods, and electronics, will expand into an industry worth US\$170 billion a year. Coupled with improvements in robotics and AI, new areas of demand will emerge.

Back to 2017, and C-suite executives need to consider how maturing technologies like AI, virtualization, and 3D printing will shape the future alongside the connected manufacturing ecosystem of Industry 4.0 plus changing market dynamics.

Despite advances in technology, we live in uncertain times. Strategic investment in digital infrastructure, skilled staff, and partnerships are the tools to make things happen in the next decade of smart disruption. 

Over the next decade, smart manufacturing will extend past individual factories to connect groups of factories and the manufacturing industry with other verticals.



By Glen Hiemstra
Founder & CEO, futurist.com



ENERGY 2025 IS surprisingly different FROM ENERGY 2017

Three main forces

The energy business will experience a great deal of change between now and 2025, some of which will be truly disruptive to older ways of doing business. Three primary disruptive forces will reinforce each other and lead to a surprisingly different global energy picture over the next decade. These three forces are systems intelligence, environmental and economic imperatives, and sunshine-based electrification. As they play out, energy consumers will have more choice, energy producers will require greater efficiency to survive, and the IT companies that make

energy-related products on the producer and consumer sides will have more opportunity than ever.

Sunshine-based electrification, which includes both solar and wind energy, is a dominant and accelerating trend. Solar energy generation hit 1 percent of all global electricity generation in 2015, after several years of record development and investment, especially in Europe, the United States, Japan, and China. For example, China is currently the fastest growing market, installing 10.6 GW in 2014, followed by Japan with 9.7 GW and the US with just over 6.5 GW. In 2014 in Europe, solar energy produced more electricity than nuclear energy for the first time, according to Solar Power



According to China News Agency, Qinghai in China ran for seven straight days completely on renewable energy generated from solar, wind, and hydro power from June 17 to 23, 2017. The 1.1 billion kilowatt hours generated by these sources was the equivalent of not using 535,000 tons of coal. Conversely, India and China produced more coal for power plants in the first months of 2017, reversing a steep trend of declining production. On a global scale, then, are we leaning towards renewable energy sources or traditional fossil fuel sources?

Europe in its Global Market Outlook 2015-2019. The same thing happened in the US in the first quarter of 2017.

Investment in solar and other clean energy lagged in 2016, falling 18 percent to US\$287.5 billion from 2015's record high. This was driven by a decline in demand in China and Japan. However, despite the lower dollar amount of investment, solar technology is becoming cheaper. Thus, the amount of solar and wind energy attached to the global electricity grid grew by another 19 percent in 2016. It's this latter growth rate that's key.

An average growth rate of 20 percent suggests a doubling time of just 3.5 years. This means that solar will be a

rapidly growing force in global energy by 2025. While a small percentage of the total energy picture, it's the one with the brightest long-term outlook. To better understand why, try doing this: If the sun is shining where you are, step outside for a moment, look up and soak in the sun as you count to 10. In those 10 seconds you've just witnessed enough energy hitting the Earth to power the whole world for a day – all of our industry, all of our homes, all of our transportation. Watch the sun for an hour, and you've witnessed more than enough energy to power the world for a year. Each hour, 430 quintillion – that's 430 with 18 zeros – Joules of energy reach the Earth from the sun. In context, humanity uses about

410 quintillion Joules in one year.

Cheaper and cleaner

If sunshine-based electrification is the dominant global energy trend, it's enabled and reinforced by the second dual force: environmental and economic imperatives. The first imperative, though still debated in a few countries, is the physical dynamics of global warming due largely to carbon and other emissions. The real question is whether we can deliver the incredible amount of energy needed for growing the world in a sustainable way. And it's here that economics comes into play.

In the past few years, providing



more energy via clean technology has become not just desirable for the environment, but also economically smart. Clean energy is becoming cheaper than traditional fossil fuel energy.

This isn't to say that the traditional oil and gas industry will vanish in the near future, as both will be used for many vital energy and chemical processing needs for many, many

decades to come. Both also require advanced networking technologies, like Huawei's Intelligent Oilfield and Intelligent Pipeline solutions.

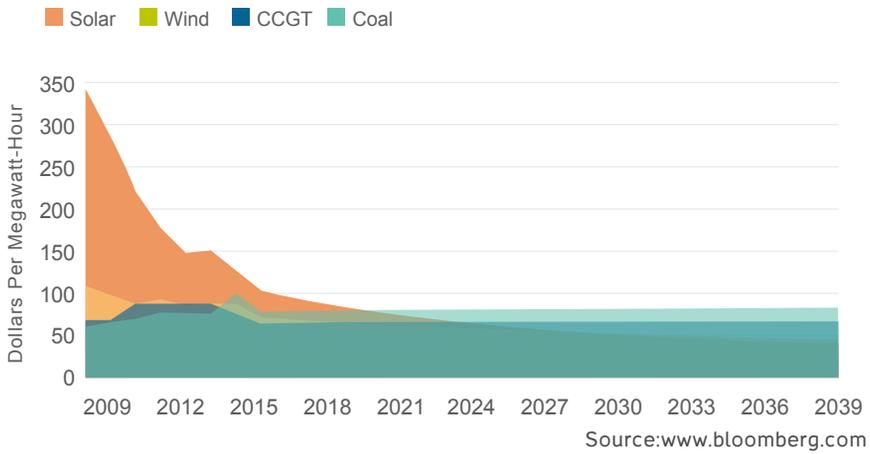
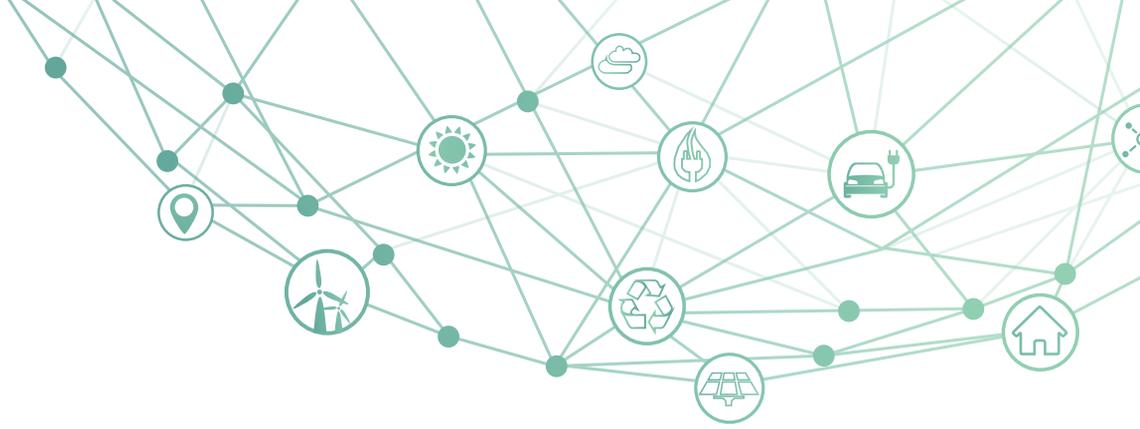
But, speak to anyone in that industry and you learn how much their world has been rocked in the past two years by supply gluts, dramatic price drops, and future uncertainty. These pressures on one of the world's largest industrial

enterprises are only going to increase as we move toward 2025.

In January of 2017, Bloomberg New Energy Finance first reported that solar energy would soon be cheaper than coal at producing electricity, something many had assumed would never happen.

Cheaper solar energy





The economics of solar energy are so good that it's now generally more expensive to build natural gas-powered electricity plants than to install new utility scale solar.

In fact, the price of solar energy has fallen so precipitously since 2010 that when the cost is placed on a chart comparing solar to other energy solutions, the falling price looks like something falling off a cliff, and the future trajectory seems clear.

Because of economies of scale from greater deployment and improving technology, unsubsidized solar photovoltaics can now compete with natural gas power plants and will soon compete with coal plants. The electricity industry is recognizing that solar is a better bet for the long term, and in recent weeks we've seen the announced cancelation of new coal power plants in the US, India, and China. The economics of solar

energy are so good that it's now generally more expensive to build natural gas-powered electricity plants than to install new utility scale solar.

As these economies of scale and advances in solar technology continue, they'll simply get cheaper and cheaper. This means that the remaining stumbling block to a major solar and wind revolution on the electric side will be the intermittency of these power sources – the sun doesn't always shine and the wind doesn't always blow.

However, these problems are being eliminated by improving technology and rapidly falling prices for utility scale batteries and electric vehicle



Sun-based electrification, the rapidly falling cost of renewable and solar energy combined, and the environmental imperative for cleaner energy are the first two dominant forces shaping the energy world in 2025.

batteries. The addition of large battery farms to solar fields has enabled both an island in Hawaii – and soon part of Australia – to become self-sufficient with solar arrays and batteries combined.

Innovation in action

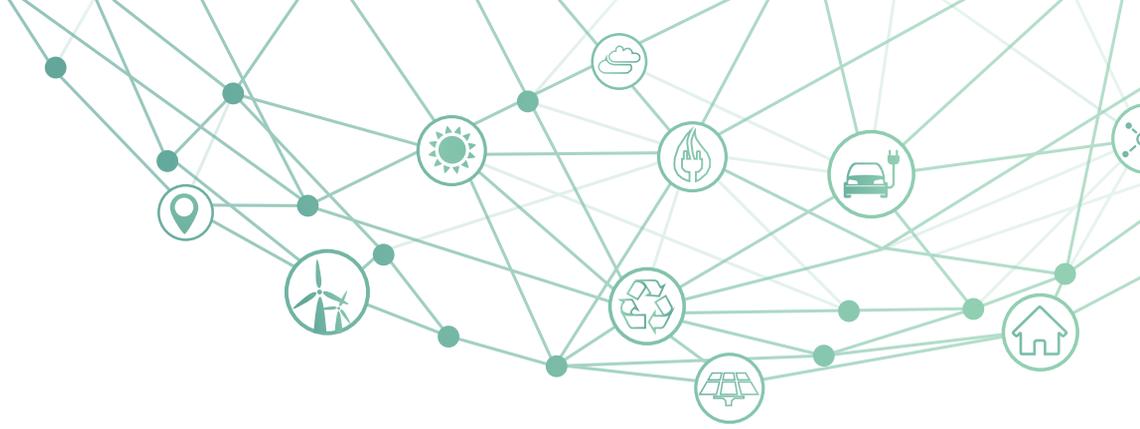
Whole new product ideas can grow in this new, volatile energy future. The German start-up Ubitricity noticed that as street lamps are converted to LED lights, the energy demand on the system of street lighting is much lower, but the power is still there in the light

poles. At the same time electric car drivers want regular charging stations, but don't have them. So the company invented a hardware and software solution that installs a plug into the light pole that connects to the electric cars of owners who subscribe. Software manages payments when the owner plugs into a retrofitted street lamp. The city and utility get paid, the car owner has many convenient places to plug in, and everyone wins.

Systems intelligence

Sun-based electrification, the rapidly falling cost of renewable and solar energy combined, and the environmental imperative for cleaner energy are the first two dominant





forces shaping the energy world in 2025. The third force, systems intelligence, will tie things together, lead to greater energy efficiency for both renewable and traditional energy providers, and, we predict, make the global energy picture quite robust, if volatile, in 2025.

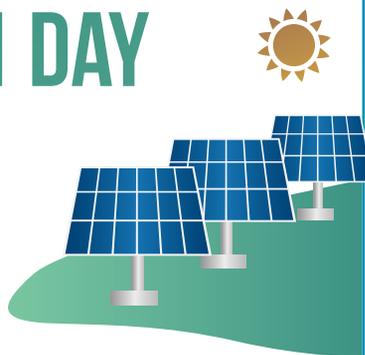
First, the dominant trend will be the electrification of energy. By this we mean that more transportation, including cars and trucks, will be electric. While we won't be there by 2025, a recent earth-shaking report by RethinkX suggests that by 2030, the transition to electric transportation will be dominant, which will drive oil prices down to US\$25 dollars per barrel. Electric vehicles will cost the same as conventional cars by 2018, and over time become much cheaper than gasoline or diesel vehicles due to their simplicity and lower O&M costs.

But running more electricity demands a much smarter grid and much more intelligent switching and communication systems than old energy systems. With solar and wind growing there's great demand for robust prediction tools

10 SECONDS

of sun provides enough energy to power the Earth for

1 DAY



Electric vehicles will cost the same as gas cars by

2018

US\$287 BILLION

was invested in clean energy in

2016

– a fall of

18%

from 2015

so that we know with precision where energy will be available or unavailable, along with the ability to move energy quickly.

This is true even in local and micro-grids. Residential-scale power generation, such as solar cells on the roof, will work best if all homes know how much energy all the other homes or buildings are producing and using. Homes can use systems intelligence to best share all the energy produced and supplement power from an instant-on, utility scale natural gas power plant in the region. This will require a great deal of network intelligence and IoT tech.

Traditional energy companies – oil and gas primarily – will need to optimize efficiency to survive a world of lowering demand, supply gluts, and the prospect of US\$25 oil. Exploration and drilling will need to be more efficient and intelligently planned. Refineries will need to improve their ability to quickly shift products.

Global energy in 2025 will look quite different from 2017. It will not be completely different, not yet, but the energy transition of the 21st century will be well underway. [www](#)



GET UP AND GO WITH BETTER CONNECTED TRANSPORTATION

If you can describe your default transportation experience as cheap, smooth, and on-time, you're luckier than most. Traffic jams, long commute times, and packed trains are a fact of city life for many. Jetting off on vacation is great, but getting to the airport, checking in, and security aren't much fun. Neither are delays. Infrastructure is ageing and efficiency is low, so travelers suffer and businesses lose reputation and money. Digital transformation is needed to disrupt the transportation vertical into something faster, cleaner, and altogether more pleasant.

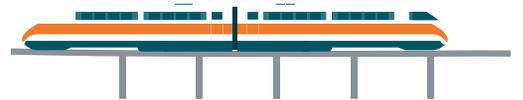
By Gary Maidment, Huawei



2.5 billion
Trips made on land during Chinese New Year, which includes:
356 million by rail
58 million by plane

77%

On-time trains in Germany in Jan 2016



40 minutes
The average global daily commute time. But, in Thailand, it is **2 hours**

Global gridlock

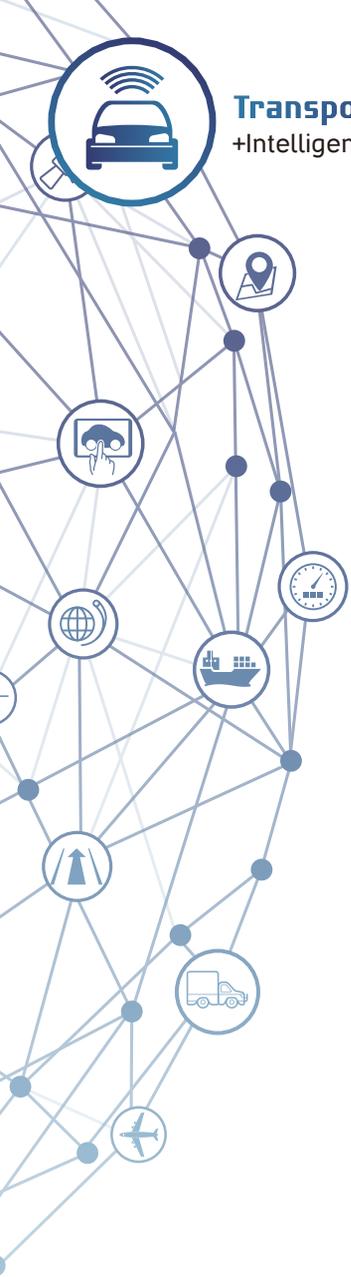
The Earth is a crowded place. And with humanity swelling its ranks by 1 billion in 12 years, it's



becoming more so. When reporting on New York's decaying subway in June 2017, the New York Times points out how this affects transportation: "The major cause of subway delays is a factor that basically did not

exist 15 years ago: overcrowding." More people also mean more pollution. In the UK, the health impact of NO₂ from diesel engines began making headlines in 2016, the year

the European Environmental Agency reported that NO₂ had caused 11,904 premature deaths in the island nation in 2013. Across the Atlantic, regulators announced plans earlier this year to combat the deadly smog



Transportation +Intelligence

that kills 1,300 people annually in Los Angeles, allocating a hefty US\$15 billion to a 15-year project. And China, where car ownership has more than tripled since 2007, is famous for the airmageddons that blanket many of its cities with smog.

It's not just overcrowding and pollution that impact quality of life. In its article "The Astonishing Human Potential Wasted on Commutes", the Washington Post reported last year that people spend a cumulative 5 to 31 unproductive days commuting each year, "People hate commuting more than just about any other activity in their lives," claims the writer, before explaining that it's

also killing us thanks to slow-burn health problems like obesity, cholesterol, and high blood pressure.

The seeds have been planted

Despite the commute that you hate and statistical doom and gloom, Bibop Gresta, founder of Hyperloop Transportation Technologies (HTT), is bullish about how transportation will improve over the next decade. His vision is a "seamless connected experience" that's woven into the fabric of urban infrastructure, a connected everything powered by ubiquitous broadband, big data, analytics, cloud, IoT, and AI. These



Pedal power

High-tech solutions are also being applied in green, low-tech scenarios. Connecting more than 6.5 million bicycles worldwide for more than 100 million subscribers, ofo is a burgeoning success in the *use it when you need it* sharing economy. With footprints in the US, Britain, Singapore, Kazakhstan and Thailand, the bike giant recently began applying Huawei's NB-IoT solution to its smart locks. Sensors ensure that ofo's bikes can be found at peak locations when commuter demand is highest. They also cut payments from 25 to 5 seconds and let users unlock a bike and ride off in less than a second.



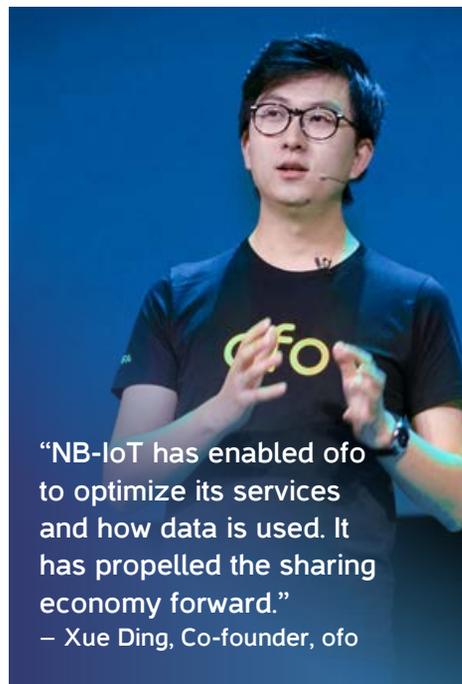
tech enablers, Gresta tells us, will “coordinate your wearables and devices, your car, the entrance to your building, your destination, and so on to deliver a complete experience.” And it’s starting to happen, even if many people don’t know about it, “Artificial intelligence is already permeating a lot of transportation systems,” he claims, “But, I think people and a lot of governments are completely underestimating the impact of that.”

However, smarter governments and businesses are already putting solutions in play that are creating and connecting the cleaner, greener, faster world of the future.

In July 2016, Huawei and cloud application developer Roiland teamed up on a next-gen solution for the Internet of Vehicles (IoV) that connects Roiland’s IoV cloud platform to Huawei Enterprise Cloud to achieve dual-active backup. According to Roiland CEO Tian Yunong, IoV is the most complex IoT scenario because it involves “interaction between people, vehicles, and sensors,” creating requirements that he describes as “extreme.” As traffic accidents are literally a matter of life and death, he’s not exaggerating. Physics holds that a collision takes place in 20 ms, so data collection and then transmission must happen in less than 20 ms to

avoid a crash in driverless scenarios. In a fully connected V2X (Vehicle-to-Everything) model, connectivity must be ubiquitous and constant.

The Roiland project will advance driverless tech and the smart vehicle ecosystem, and complement other smart transportation solutions that utilize agile networks such as eLTE and GSM-R alongside cloud, big data, sensors, AI, and 5G. Functions like traffic signal control, ePolice, traffic flow data, traffic detection systems, and unified traffic command achieve fast emergency response, video surveillance, and rerouting by improving traffic flow dynamics. For people, this makes for a quicker,



“NB-IoT has enabled ofo to optimize its services and how data is used. It has propelled the sharing economy forward.”

– Xue Ding, Co-founder, ofo



With future-proofed digital solutions starting to pervade road, rail, and air travel, the stage is starting to take shape for automated, seamless, and greener connected transportation.

cheaper, and safer travel experience.

Away from roads, IP-based solutions for urban rail are responding to a surge in bandwidth-hungry applications by boosting efficiency, management, comfort, and safety. Successful system integration cases in Malaysia and Singapore, for example, have resulted in significant switching, transmission, bandwidth, and control gains – the things that get people where they need to be on time.

Looking to the skies, Hong Kong International Airport deployed Huawei's green uninterrupted power supply solution, which saves 40,000 KWh of electricity a year and eliminates flight delays due to power outages like the one that took down Delta last year. In the US, flight delays cost stakeholders US\$62.55 per minute.

But, with future-proofed digital solutions starting to pervade road, rail, and air travel, the stage is starting to take shape for the automated, seamless, and greener connected transportation experience that Gresta envisages.

And it can't come too soon. Let's

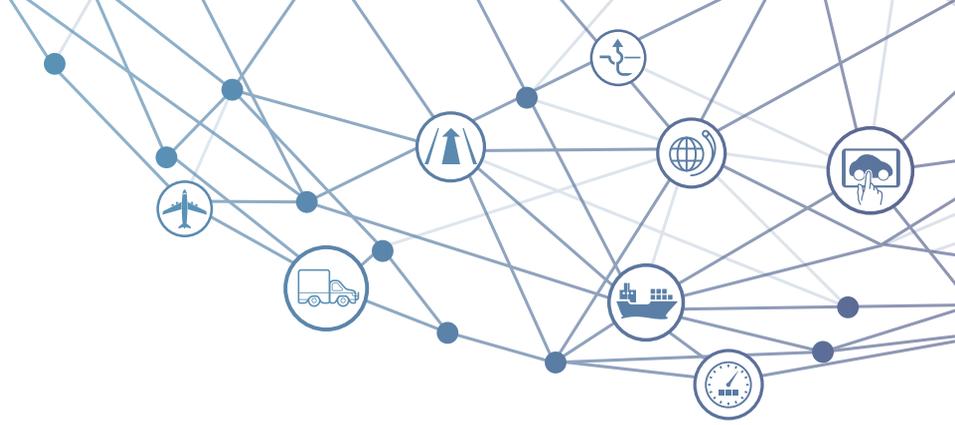
think back to the overcrowding problem: The world's population will hit 8.1 billion by 2025, which isn't great news for core infrastructure or the environment.

Smart mover

As we accelerate into the next decade, increased AI in all areas of transportation, coupled with a shift to solar and electric solutions, will accompany a likely global decrease in car ownership, as autonomous tech and the on-demand model for getting from A to B matures.

Although less embedded in the public consciousness than driverless vehicles, Gresta believes that by 2025, Hyperloop journeys will be commonplace.

First conceptualized by Elon Musk and set out in a white paper by Space X engineers, the idea behind Hyperloop arose in part because of Musk's disappointment that "the home of Silicon Valley and JPL... would build a bullet train that is both one of the most expensive per mile and one of the slowest in the world," in reference to the high-speed rail project in California.



Musk believes that future transport should be “safer, faster, lower cost, more convenient, immune to weather, sustainably self-powering, resistant to earthquakes, and not disruptive to those along the route.”

Hyperloop ticks these boxes. With a theoretical top speed of 760 kph, Hyperloop comprises a bi-directional steel tube 2.23 meters in diameter that connects two cities. The tube would run about 6 meters above ground on concrete pylons spaced 30 meters apart, but it would also work underground. Solar-powered and electrically propelled, 40 capsules holding 28 people

each would zip along the tube’s near-vacuum on a cushion of air.

In Musk’s example, the tubular system would get commuters from San Francisco to LA in just 35 minutes, compared with 12 hours by train. Departing every two minutes, a round trip would take just 80 minutes, including 5 minutes at each station. For entertainment and productivity, the windows would be interactive AR displays or super-res depictions of user-chosen scenery.

Crowdsourced from JumpStartFund, HTT is already progressing with Musk’s vision, with three projects

scheduled for completion by 2020.

So, will Hyperloop make subways and rail obsolete? Not so, says Gresta, “Hyperloop isn’t about speed, it’s about efficiency. The goal of Hyperloop is actually to bring back profitability to in-ground transportation.” He points out that while infrastructure like the London Underground could be upgraded to Hyperloop, “history shows us that we never fully replace one system with another.” What it will do, he says, “is force the rail industry to actually innovate.” Digital solutions are helping rail companies to do just that.





As we progress through the 2020s, passenger journeys will be evolving towards a seamless experience that transitions between different modes.

Hyperloop would also have a potentially huge impact on cities, as people would no longer need to live in the city they work in. Complemented by IoV and autonomous transport, its capacity will also help reduce the congestion threatened by overcrowding.

Enjoy the ride

As we progress through the 2020s, passenger journeys will evolve in efficiency to move towards a seamless experience that transitions between different modes.

Your personal and predictive AI assistant may, for example, summon an electric driverless car – or more likely a single-occupancy pod – without needing any input other than knowing your habits. And retailers may push discount vouchers your way based on the patterns of your routes and stop points – something that’s already happening now.

As well as automating, accelerating, and arranging un-fun tasks like bookings, payments, and security, your AI assistant will start connecting your journeys where needed – data will flow from myriad sensors into algorithms that will predict your behavior to best manage your travel experience.

The transitions between different modes of autonomous transport or stations will dovetail nicely, “Because,” states Gresta, “We will know exactly what the passenger wants even before he reaches the station.” Autonomous transport won’t be confined to the ground either – in June 2017, Airbus started trialing its Optionally Piloted Vehicle (OPV), aka pilotless chopper.

Gresta believes that the way we do things now will soon come to an end: “It’s stupid to design travel that’s based on first class, second class, it doesn’t make sense. A journey will be based on your particular reason for traveling – with your boss, for work, for leisure, and so on.”

The experience will be fully personalized, tailored both on your current destination and objectives, as well as on your historical preferences. In the foreseeable future, you can expect any future autonomous travel mode, be it in an individual or mass transit scenario, to greet you by name, know where you’re going, and even what TV shows you like.

By 2025, the world of better connected transportation will have started to take shape. Ubiquitously connected tech is the enabler, but the experience will be all about you. 



IN SAFE HANDS

Connected cars will quickly, quietly,
and carefully change your life

In 2025, you probably won't own a car. The chances you'll die in a road accident will also be much slimmer because there'll be far fewer incidents than today's annual global figure of 1.4 million. Instead, picture yourself watching your favorite TV show in the safe, virtual hands of an autonomous data center on wheels, zipping along in the smoothly flowing traffic of one the biggest tech disruptions in the first quarter of this century.

By Gary Maidment, Huawei





Experience comes in threes

By 2025, 20 million fully autonomous vehicles will make up around 1 percent of all vehicles on the world's roads, which is set to rise to four in ten in some cities by 2030.

Three experience stops will get us there. The first is today's 4G-based **telematics**, a mix of infotainment, e-calls, on-line navigation, and remote diagnostics. We're now transitioning into the second, which is **safety**: a time of 4.5G-enabled V2X (vehicle-to-everything) connectivity, partial automation, and greater environmental awareness. Rolled out in 2015, Tesla's ADAS (Advanced Driver Assistance System), which can self-drive 90 percent of the time, exemplifies this stage. Enhanced safety, says Tesla, is the "combination of various sensors... cameras with image recognition with radar and long-range ultrasonics." The third and final stop will be **comfort**.

Enabled by 5G, high or full-automation and enhanced V2X connectivity will start to mature around the mid-

2020s. Vehicles will be completely aware not just of other cars, but of cyclists, pedestrians, traffic lights, and other infrastructure.

The Society of Automotive Engineers defines six levels of autonomy, ranging from Level 0 with full driver control to Level 5, where the AI driver equals human capabilities.

Smile, you're on camera

Video will feature heavily in the connected car ecosystem in a triumvirate of functionality: entertainment, safety, and security. Volvo's Concept 26 reflects the belief that the 26 minutes you commute each day "could be spent doing something more meaningful," including watching videos. Chevrolet is working with Future Lab to create interactive VR displays on rear passenger windows, while Lockheed Martin pulled off something similar in 2016 on a school bus. In partnership with VR specialists Framestore and McCann, it displayed the surface of Mars on the bus windows, giving children the impression they were traveling across its surface. The tech included a virtual 3D map of the red planet, a laser surface

velocimeter, GPS, and custom screens.

Augmented reality will make a strong showing in both unconnected and connected scenarios for safety. In 2015, BMW demonstrated augmented vision at the Shanghai auto road show. Drivers could see through their vehicles by relaying exterior camera feeds to special glasses, which aimed to eliminate blind spots and increase all-round visibility. Fully driverless vehicles will benefit from detailed hazard mapping enabled by video to identify things like potholes.

Internal and external video and audio fields will provide strong protection against car theft and damage, with motion sensors, cloud storage, and real-time alerts sent to phones that render autonomous cars virtually unstealable. A clutch of big names are already making inroads with trials: Ford and Intel are working on a joint facial recognition project, while Volkswagen is researching infra-red scans to ID would-be drivers.

However, there's no guarantee that you'll be using this tech to protect your own car come 2025, because the attractiveness and affordability



of owning one is likely to drop fast. People tend to use their cars just 4 percent of the time, which works out at just 58 minutes per day. But, in the US for example, the average car costs nearly US\$25 per day to run – that’s US\$9,125 per year. Economically, car ownership will make little sense when being asset-lite makes you better off.

By 2025, it’s more likely that biometric tech will be verifying you for a driverless car you’ve called up on an app, with the ID process tailoring the in-car experience based on your usage history.

Painting the town green

The on-demand, driverless model will also be good for the planet. Many future autonomous cars will be electric as the cost of lithium-ion batteries continues to fall, cutting global fuel use by up to 75 percent by 2030. Big cities in emerging economies like Mumbai and Mexico City will see a clean and shared model relieve congestion, pollution, and transport costs. In affluent urban centers with high population densities like London and Singapore, electric vehicles could

account for 60 percent of all vehicles.

When full autonomy and electric vehicles become commonplace, traffic flow will be faster and smoother, with traffic jams and exhaust clouds having spluttered out of existence. According to the Environmental Protection Agency, motor vehicles produce roughly 50 percent of all pollutants like VOCs, nitrogen oxide, and particulate matter. Moreover, it’s predicted that one autonomous car will be able to replace about 30 manned cars under the on-demand model, drastically cutting the total number of cars on the road.

Most autonomous vehicles are likely to be smaller than today’s four or more seaters because they’ll be designed for single-occupancy journeys. Today, around 75 percent of car journeys are single-occupancy and this is unlikely to change. As a result, driverless “cars” may be more likely to resemble connectable driverless pods, rendering today’s form-factors obsolete before they get off – or rather on – the ground. Two Italian designers are looking at developing this new mode of transport for release in 2020, which would enable a series of pods which

Most autonomous vehicles are likely to be smaller than today's four seaters because they'll be designed for single-occupancy journeys. Today, around 75 percent of car journeys are single-occupancy and this is unlikely to change.



The switchover to autonomous driving won't happen overnight. Semi-autonomous tech like ADAS will ease consumers into the passenger seat with functions like lane changing, adaptive cruise control, and automated braking.

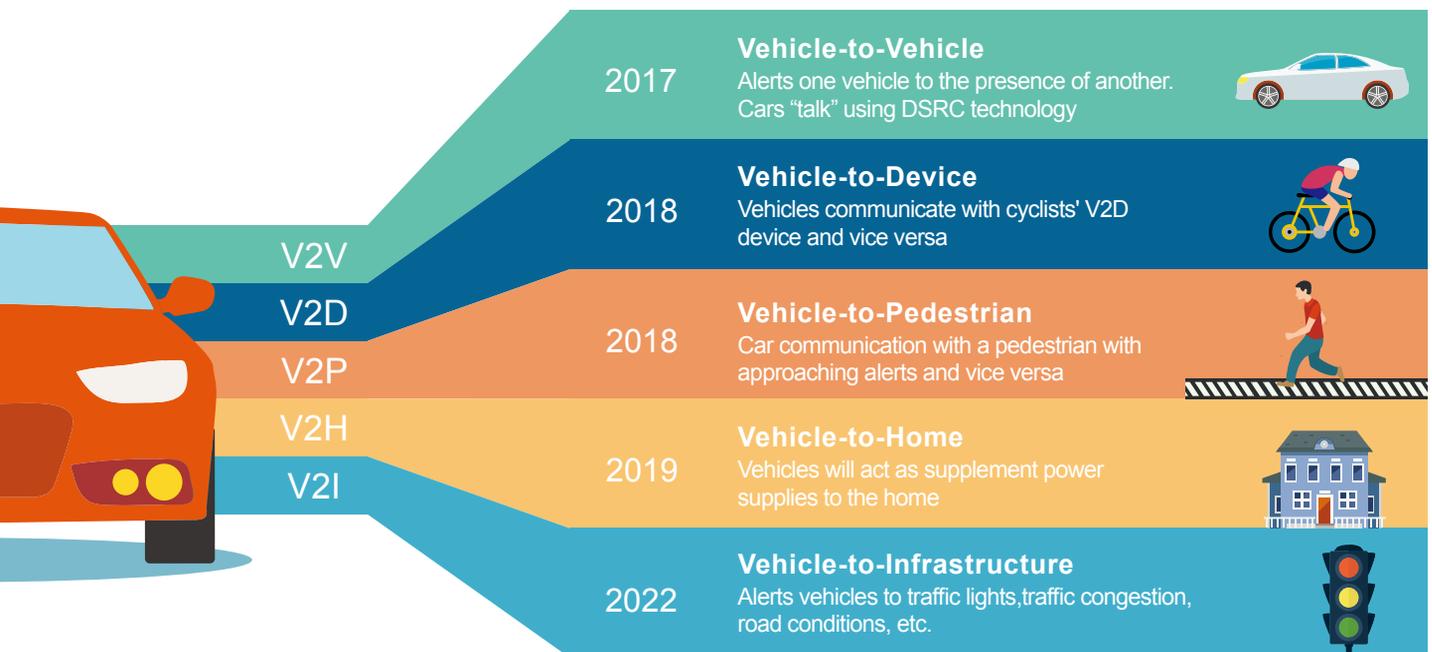
could connect into a mini-train.

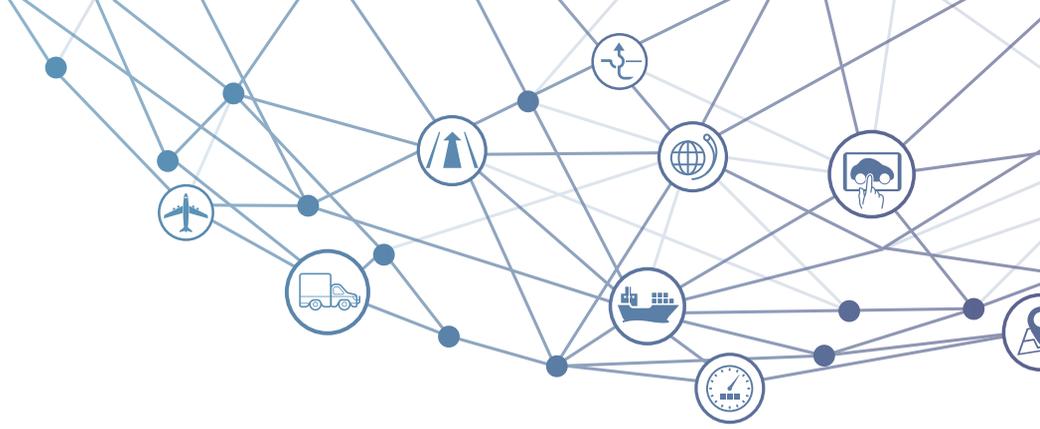
Because they'll be in constant use, the service life of autonomous vehicles will be relatively short compared with today's under-utilized cars.

The effect on the air we breathe and health will be huge. As well as environmental factors, quality of life will be improved in a less obvious way: the reality of overcrowding is often visibly, noisily, and time-suckingly manifested on the world's congested roads, eating into people's happiness. Solving

this issue will have a big impact on society's sense of well-being.

The switchover to autonomous driving won't happen overnight. Semi-autonomous tech like ADAS will ease consumers into the passenger seat with functions like lane changing, adaptive cruise control, and automated braking. It's predicted that people will start feeling comfortable taking the backseat by 2021, and that's when the market will shift up to high gear.





Choose life

With an estimated 94 percent of road accidents caused by human error, driverless tech's V2X advantages are complemented by an AI driver who doesn't booze, doze, or text its friends.

Popular oatmeal.com blogger Matthew Inman wrote about his experience encountering a pedestrian in a timid Google driverless car in 2016: "The car was waiting for a further visual cue from the pedestrian to either stop or go, and the pedestrian waiting for a cue from the car. When the pedestrian didn't move, the self-driving car gracefully took the lead, merged, and entered the roadway....Freaky." Perhaps future generations will look back in faint amazement that people willingly drove around in a ton and a half of gas-guzzling glass and metal, one poor maneuver away from leaving a trail of death and destruction.

Connected autonomy

What does this sort of safety mean on a networked scale? With every component in an intelligent car constantly generating data, a single vehicle could be producing up to 1 GB of data per second. Given this, a cloud

solution for the Internet of Vehicles (IoV) would need to receive that 1 GB in one second to fully understand the real-time status of a single cloud-controlled vehicle. If one car senses and then brakes to avoid a jaywalker, the ripple effect will cause the cars behind the first one to break, too. The network may then consider re-routing traffic to avoid a potential traffic jam. 4G isn't capable of the 1 ms latency required for this scenario, and IoV therefore requires the sub-1 ms latency afforded by 5G.

Prepare for disruption

Driverless technology and connected cars are destined to be one of the biggest disruptors that many people alive today will experience. An estimated one in four employment options will be consigned to history as a slew of economic sectors are impacted, including driving jobs, gas stations, dealerships, mechanics, and even motels on common long-distance truck routes. However, job losses will be offset by job creation as new businesses arise from the innovation and possibilities created by this amazing new vertical.

Cities will also be subject to massive change. One aspect that requires

some forethought by policy makers will be the potential 50-percent-plus drop in city revenues as speeding fines, gas tax, parking fees, and many other traffic-related fees begin to disappear. Some re-zoning is also highly likely in the future's cleaner, safer, and quieter cityscapes. Parking lots, for example, will be ripe locations for redevelopment in cities like Los Angeles, where 14 percent of the city is designated for parking.

Business locations won't be as important as journey times become quicker. People can work or be entertained en route and their perception of distance will change. Some of this disruption will require careful planning, but the overall picture is one of a considerably better quality of life.

In 2025, we will see a Better Connected World in almost every way we can think of. Connected cars will be a game-changer in how we experience life and in how it impacts our culture. As noted futurist Glen Hiemstra puts it, "Eventually, pleasure driving will go the way of horseback riding for pleasure – a niche activity and a public racing spectacle." And that future isn't all that far away. [www](#)



Feeding the world **WITH CONNECTED FARMING**

The world is struggling to feed itself. With the global population expected to exceed 8.5 billion people by 2030, the scale of activity required to provide food for everyone is driving the environment to breaking point. However, tech solutions deployed on robust digital infrastructure can streamline processes, minimize waste, maximize output, and let us once again walk the path to sustainability.

By Cipher Xi, Huawei





Fragmented and resource-intensive

Alongside pressures facing land and resource use, the agriculture industry consumes nearly 70 percent of the world's fresh water, yet 1.1 billion people lack access to water and water scarcity affects 2.7 billion people for at least one month per year. In parallel, climate change is an equal threat – at a time when agriculture needs to deliver more, increasingly erratic weather patterns can damage crops and, in some regions, slash crop production by more than 20

percent due to weather anomalies like floods and extreme heat.

Farmers, exposed to global competition and the need to supply food at prices consumers can afford, need to increase efficiency just to stay in business.

Innovation in the industry faces a number of historical hurdles. A major one is that global agriculture is fragmented, with the market mostly comprising micro farms run by families, especially in developing economies. Even developed markets are characterized by many more SMEs than large-scale farms.

This structure results in a couple of significant implications for adopting technology: Farmers typically lack the capital to invest heavily, especially when fast ROI can't be guaranteed. They also tend to lack the skills to initiate big projects and in many cases are unaware of how to improve their farms. Without external help, farmers lack sufficient scale to benefit from possible savings occurring throughout the value chain or to optimize ROI even if they do implement improvement projects.

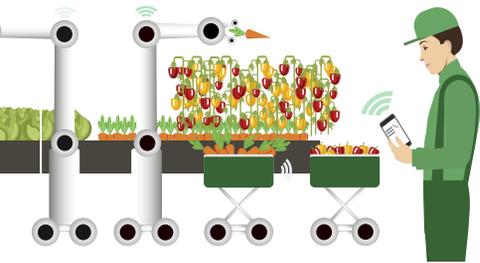
The lack of a joined-up approach means that solutions





8.5 BILLION
people will inhabit the Earth by
2025

Monitoring systems can boost productivity by **15%**



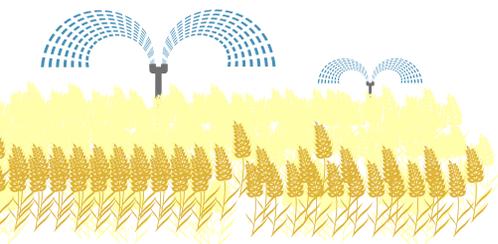
By 2020, the agriculture market will be worth

US\$ 26.8 BILLION

Telcos will generate nearly

US\$ 13 BILLION

through smart agriculture solutions and applications by 2020



only address limited aspects of farmers' operations.

Other restraints stopping farmers from moving their businesses forward are the general lack of targeted connectivity services and solutions coupled with a lack of standardization of how data should be collected, aggregated, and managed.

But things are changing. More farmers are using mobile devices and the Internet, both in emerging and developing markets. Doing so gives them the capability to improve trade and engage in industry initiatives. Moreover, advanced companies are adopting IoT in combination with low-cost cloud applications, low-power wide-area (LPWA) networks, sensor technologies, and data analytics platforms. These systems can impact everything from back-end processes such as purchasing or inventory control to field activities like planting, irrigation, fertilizing and harvesting.

Digital transformation is helping farmers evolve and transform. So, what will digital transformation look like in the agriculture industry when it's more mature?

Getting smart for 2025

By 2025 agriculture will be in the midst of a technological transformation, perhaps as important for global food supply as the invention of the tractor or combine harvester. Just as these machines enabled farmers to achieve much more at less cost and far more quickly, so smart agriculture will enable farmers to grow and manage crops without human intervention and use the continuous feed of intelligence and insight to drive up efficiency, resource utilization, and crop yields. Research by Huawei X Labs predicts that the total addressable market for smart agriculture is expected to grow from US\$13.7 billion in 2015 to US\$26.8 billion by 2020, a CAGR of 14.3 percent.

Key smart agriculture applications by 2025

- Precision farming will use data derived from images and sensors to track crops, soil, and the air in real time so farmers can observe and respond to changes at specific locations, also in real time.



- Variable rate input technologies will add accuracy to planting and fertilizer and pesticide use, so that farmers only use what's needed where it's needed, saving chemical costs and labour.
- Smart irrigation systems will minimize water waste and ensure delivery to the right places at the right times.
- Soil monitoring systems will track the overall quality and chemical composition of the land, so farmers can improve fertility for specific crops and deal with local issues like toxicity, salination, and acidification as they occur.
- Yield monitoring will provide real-time geo-referenced data about crops as they're harvested, including quantity, quality, and moisture content.
- Drones will monitor farms from the air, with data from cameras and sensors feeding into the other farming systems.
- Smart greenhouses will manage growing conditions, with automated climate control and irrigation systems optimizing

growing conditions and minimizing human intervention.

- Precision livestock farming will manage and improve livestock health.
- Farm management systems will combine all this field data with insights from wider sources like farm machinery telematics, weather observatories, and global trading markets. Data analysis, risk assessment, and financial analysis tools will help farmers minimize waste and maximize output on an E2E basis.
- Smart agriculture will slash OPEX by requiring fewer seeds and workers as well as less fertilizer, pesticide, and fuel and maintenance for machinery. Farmers will produce more food with the same resources through targeted sowing and an improved understanding of local environmental conditions. With better quality produce and a better knowledge of global trading markets, they'll also be able to command higher prices.
- Farmers will benefit by improving their operations. In turn, society will benefit because there'll

be more food to go round, agriculture will be easier on the environment and resources, and food is likely to be cheaper.

Telco stakeholders

Individual farms rarely have their own private networks as they're generally too small, lack skilled personnel, and have few established relationships with IT providers. But to benefit from IoT, they need communications coverage over very wide areas.

The value chain for smart agriculture is also complex. It includes device and farming equipment manufacturers; sensor makers; connectivity providers offering communications based on LPWA, satellite and mobile networks; IoT connectivity platform providers; application providers; vendors of data analytics solutions; and system integrators.

Telcos are ideally placed to help farmers deal with this complexity by providing the scale needed for the industry to exploit the available opportunities; the expertise for individual farmers to make most of that opportunity; and the market clout to create an ecosystem of partners delivering industry-standard, end-to-



Telcos are poised to generate nearly US\$13 billion in annual revenues by 2020 from the smart agriculture value chain.

end service packages and solutions that are easy for farmers to use.

Telcos are poised to generate nearly US\$13 billion in annual revenues by 2020 from the smart agriculture value chain. By delivering E2E smart agriculture solutions and applications on cloud through partners, telcos can generate revenues from increased numbers of wireless and fixed network connections, sensors, systems integration, and services.

The highest revenues will come from precision farming, precision livestock, and yield monitoring solutions, but all potential applications are set to deliver decent returns.

Tech and telcos in action

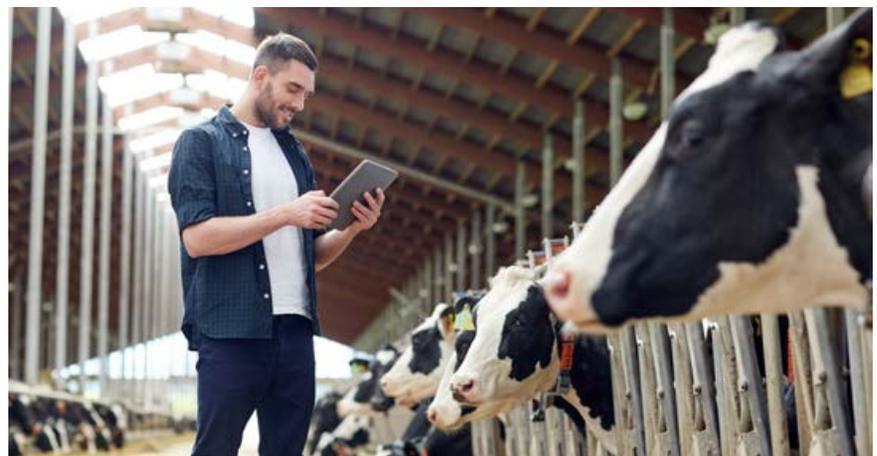
Monitoring banana production in Colombia: Colombia Telecom, Movistar, Claro and Tigo have all introduced monitoring systems for plantain crops to help farmers deal with flooding, soil oxygen exhaustion, humidity, and low temperatures, boosting productivity by 15 percent.

Monitoring fish in Vietnam: Viettel Mobile, MobiFone and VinaFone all offer livestock monitoring services. By deploying this type of solution, a major aquaculture has cut fish mortality by 40 to 50 percent and increased turnover by a similar percentage.

Automated irrigation in Spain: Telefonica and ABB have supplied a GPRS-connected automated irrigation system to a dozen farms in Spain, slashing water usage, reducing electricity bills by 30 percent, and increasing profits by 25 percent.

Connected cows: Low-power and high-capacity, NB-IoT modules from Huawei can be attached to cows, enabling farmers to understand cows' natural cycles and when they're most likely to get pregnant, and also predict sickness through monitoring temperature.

For telcos, opportunities abound in areas that require high levels of connectivity and mobility like monitoring livestock, drones for aerial



photography and remote sensing, logistics and distribution, and high-bandwidth applications such as machine surveillance. Applications requiring dense networks of connected sensors and associated control systems are also rich in potential such as variable rate input technologies. In each of these cases, connectivity that isn't based on 3GPP network standards won't meet downstream and upstream bandwidth or latency requirements.

Operators can also provide support services such as mobile payments and insurance, access to trading platforms, and farmer helplines, which is especially important in many emerging markets.

Enterprise stakeholders

The opportunity to serve farmers with smart agriculture solutions isn't limited to telcos, with various other supplier types set to benefit:

Device and equipment vendors that provide components like sensors and farm machinery with inbuilt sensor and connectivity capabilities have a great opportunity for upselling, providing differentiated products, and creating new service propositions. Every year, millions of new connected devices will be needed, from classic machines such as tractors, harvesters, balers and planters to new tech like drones.

By 2025, sensors for monitoring animals, crops and environmental factors will be shipping in the billions, representing a hugely lucrative market space.

Application providers will be involved in most aspects of the smart agriculture revolution. Their tools will enable farmers to use the data collected from devices and sensors to monitor and automate farm processes and interact with farm machinery. A variety of crop, process and equipment-specific applications will be delivered as cloud native software services. To open the channel to customers, application providers will use direct sales models and third parties such as equipment vendors, systems integrators, and telcos. They have the opportunity to target a market that has never before been software-intensive.

Data analytics companies will help farmers understand what's happening on a local level, predict outcomes, and suggest interventions. Partnerships and visibility into multiple farms will let them collate information from across the industry. Typically cloud-based, these companies can then position analytics about individual farmers' crops and decisions on improving efficiency and productivity into the context of the wider industry. This macro-level data will be invaluable for farm suppliers by, for example, identifying the need for more raw materials, finance, insurance, or new equipment.

Systems integrators and outsourcing providers will have a significant role to play in bringing together the various systems needed to develop smart farms, which will in particular benefit the largest farms, especially those run on an international scale. These companies will often be the primary contractor that stitches together disparate sets of smart farm applications to create fully interconnected smart agriculture ecosystems. Smaller value-added resellers will have a role to play too – providing a channel to market to smaller farming businesses.

Connecting the dots

Connected farming will disrupt the farming industry. The tech is here now, and can be deployed to instantly improve efficiency, environmental impact, yield and crop quality, and profitability. As sensors become smaller and cheaper and as farmers realize the benefits of wirelessly connected crop management systems, smart farming will very quickly become the norm.

Telcos and enterprises have significant roles to play connecting the network and technological dots, and making smart farming accessible and attractive to all farmers regardless of scale. Agriculture can then move into an age where threats like water scarcity start to diminish in tandem with the amount of hunger facing the world. 



By William Genovese, VP Strategy Planning – Banking, Financial Services and IT Solutions, Huawei

BETTER FINANCIAL SERVICES THROUGH a Better Connected World

The rise of Fintech

Digital platforms are fueling the on-demand economy by matching supply and demand in an accessible, low-cost way. Uber, Amazon, and Alibaba show the disruptive power of these “sharing” technology platforms, where buyer-seller interaction is high, a diverse range of goods are on offer, and the marginal cost of rolling out a new product or service is approaching zero. In essence, digital platforms seed trust.

Fintechs are disrupting the industry by both cooperating and competing with banks for customer attention and thus their wallets. Customers no longer have to engage with their bank or purchase goods or services separately. Shared marketplace platforms are injecting more

relevance for customers, letting them navigate the buying experience from end-to-end and make and pay for purchases on-demand.

Challenges in the digital age

As banks move into the third digital revolution and as the lines are blurred even further as we enter the fourth industrial revolution, customer experience is transforming. Banks are faced with the following challenges:

Growth and profits: This is the number one challenge – banks need to keep their customers and current profits, but also offer new products and services.

Customer experience: Digitally enabled, the customer experience has been transformed. Customers are now valued clients who engage with banks

on a level above transactions. Banks are an extension into other areas of their lives, and so the relationship needs to broaden and deepen.

Compliance: The rapid change and broad impact of the digital revolution means that banks, legislators, and regulators are being challenged to an unprecedented degree, and for the most part, can't cope.

Fraud and cyber security: No longer a “behind the data center firewall” issue, diligent focus is required to develop a cyber security ecosystem.

New technologies: Customers are quickly adopting new technologies, pressuring banks into deploying digital solutions in a customer-facing way. But, not all banks are agile enough to do so quickly. Some big multinational banks



The financial services industry is feeling the impact of the digital revolution. Maintaining growth and profitability is an enormous challenge for banks as they need to keep tinkering with the customer experience, not only to provide financial services for their customers, but also to stay more relevant in customer's lives and keep their attention.

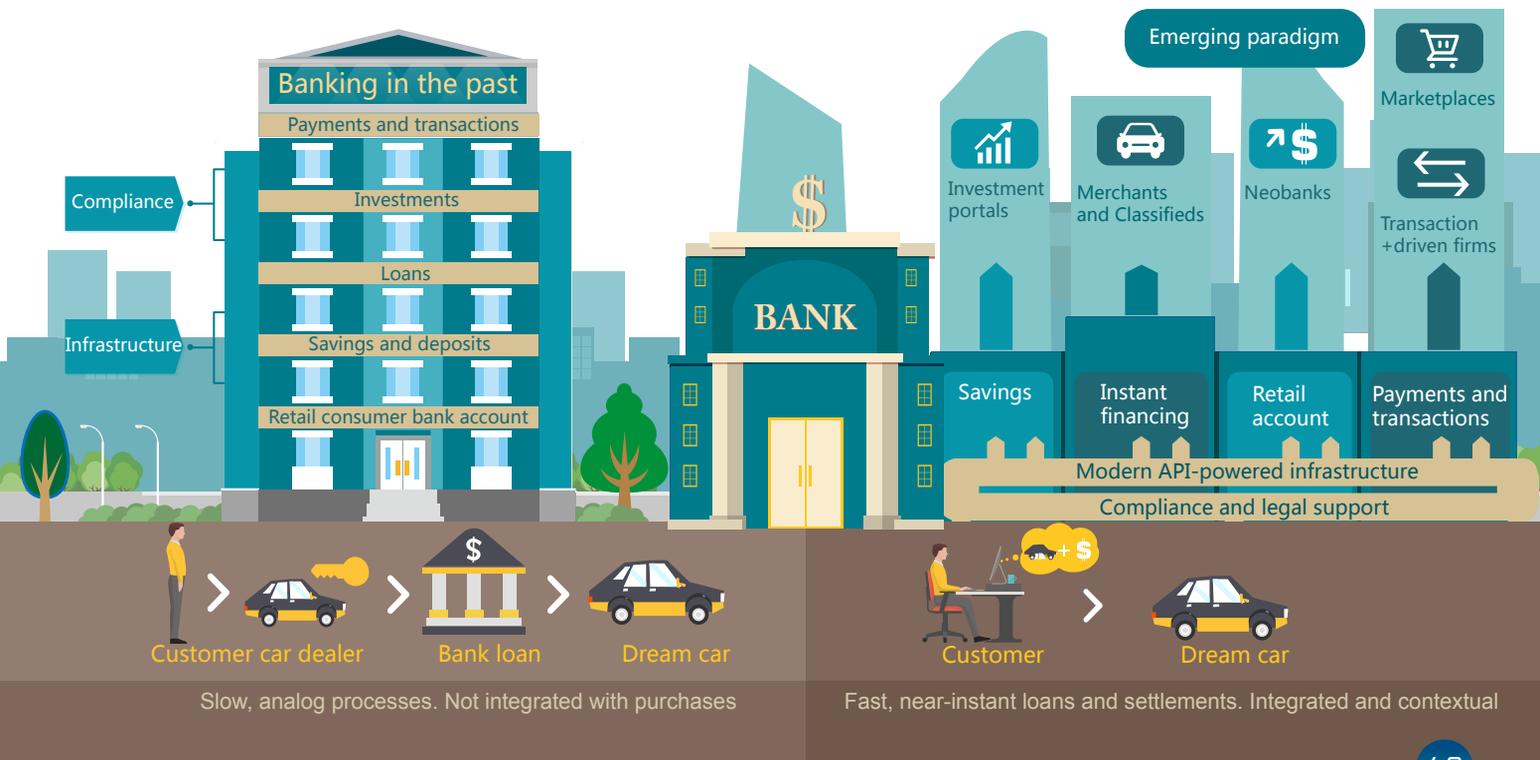
are partnering effectively with Fintech start-ups and providers, while smaller regional and community banks have different

challenges. They can move quickly and are partnering with Fintechs to solve resource, skills, and capability challenges.

A paradigm shift

To accommodate their customers' digital journeys, banks are undergoing

A Paradigm Shift in Banking to Accommodate Customers' Digital Journeys





Finance +Intelligence

their own paradigm shift.

In the past, a customer typically interacted with a bank within its walls or boundaries, either physically in a branch or virtually in a call center or by accessing certain online services. Characterized by slow analog manual processing, the old system saw products, admin, and infrastructure centralized and siloed. Today's customers expect everything, anywhere, anytime, with an experience that's seamless, integrated, and mobile. The bank's walls and boundaries are no more.

Near instant experiences are available for services like savings, instant financing, and purchases for non-traditional banking goods or services from an integrated marketplace retail account. Integrated payment and transaction processing augmented by artificial intelligence is providing recommendations and delivering highly contextual and relevant services for customers.

Banks' business strategies and service delivery models are changing. The interesting questions are how will the new monetary system be organized and structured, and how will it transition and change from what it is today?

One change is disintermediation. IT is

reducing search costs and enabling demand and supply to meet directly, regardless of distance, so online intermediation platforms are taking over from business models where an intermediary creates value.

In banking, disintermediation began in the late 1970s with the securitization of loans. In the 90s, banks established transaction platforms that were off-balance-sheet as legal entities, because they were much more flexible in terms of securitization. However, the financial crisis and its resulting increase in regulation ended the disintermediation trend.

Banks are now creating platforms and infrastructure that enable open banking based on hybrid APIs and web-based intermediation platforms. They can then integrate their legacy, centralized computing stacks with decentralized, shared platforms. As we enter the fourth industrial revolution, what technologies are banks turning to?

Five big accelerators

Game-changing technology convergence is happening. Big data, AI and advanced learning, and the digital and mobile experience we see today, will enable open API banking, blockchain, biometrics,

and adaptive security. These technologies, adopted in priority order, will shape the bank of the future and create a stable and secure customer experience.

The future of banking

As banks transform into a marketplace of services, the destination of the digital journey, so will the customer experience.

The typical customer will enjoy real-time, online, anytime services. Enhanced AI will advise customers in real time, for example, by providing instant alerts on higher-interest accounts or possible savings on goods or services based on previous spending patterns. Bank-provided apps will give way to the “push” of information to customers via connected and integrated partner services rather than customers having to “pull” information.

Innovation will extend past single enterprise borders into an ecosystem of services offered by banks' partners.

Priority Sequence of the Five Accelerators for Digital Maturity

Big data, AI and advanced learning **2**

- To use data from social structure
- Actionable insights from data
- Analytics and rules-based automated decision making, real-time marketing
- Artificial intelligence
- Machine learning and robotics
- Internet of Things

Open API banking **3**

- Open API and fintech partnership
- Regulatory impetus and better data protection
- Cloud: operational efficiency, shared resources

1 Digital and mobile experience

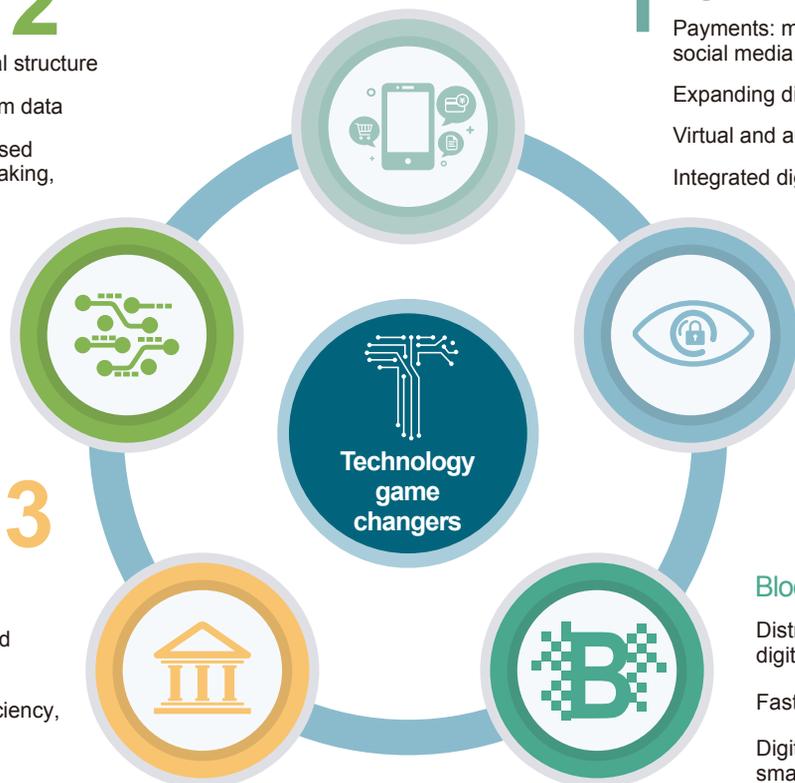
- Payments: mobile NFC, QR code, social media, cashless digital payments
- Expanding digital payments, digital sales
- Virtual and augmented reality
- Integrated digital experience

Biometrics and adaptive security **5**

- Biometrics: e.g., fingerprint, voice, face, and iris
- Cybersecurity and total cyber defence
- Adaptive security architecture

Blockchain **4**

- Distributed ledger technology, digital records
- Faster and efficient processing
- Digital currencies and smart contracts



Source: The Asian Banker



Where and how to begin the transformation journey are crucial questions. There's no standard or magic recipe in terms of sequencing to achieve digital maturity.

AI, predictive analytics, and data management will be commonplace and pushed content will be highly relevant and personal. Innovation will extend past single enterprise borders into an ecosystem of services offered by banks' partners.

Automation, RPA (Robotic Process Automation), machine learning, and smart contract engines with blockchain will amplify human potential, enriching and simplifying daily life.

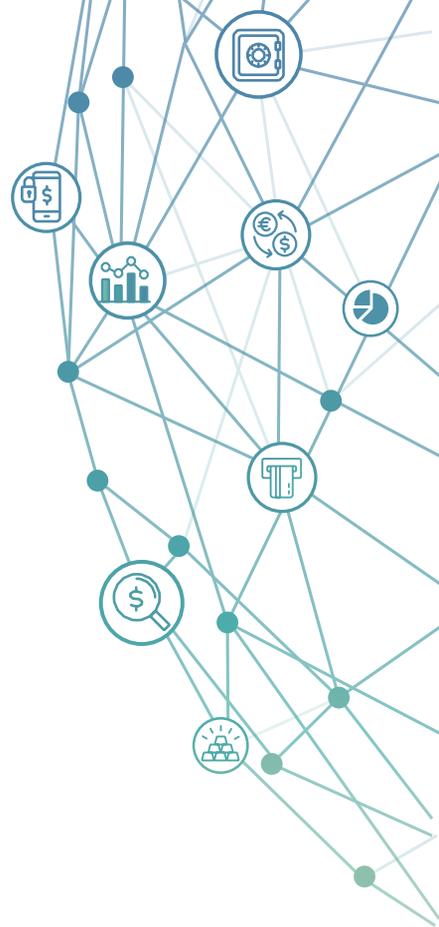
Starting the digitalization journey

Where and how to begin the transformation journey are crucial questions. There's no standard or magic recipe in terms of sequencing to achieve digital maturity. However, it's important to note that this journey is not just influenced by technology factors – organizational, geographical, cultural, and people factors all come into play.

Non-Technology Measures and KPIs for Digital Innovation Readiness

ANNUAL PROFITABILITY	Based on annual and quarterly reports
CUSTOMERS & BRANDING	Vendor size in the retail sector based on customer numbers (digital, mobile, and online). Vendor brand and marketing strength based on reviewing its website
ECOSYSTEM ENABLEMENT	Vendor success at integrating with other stakeholders, regulatory compliance, and innovation in business models and tech platforms/solutions.
DIGITAL ENABLEMENT & OFFERINGS	Breadth of retail banking offerings based on platform, tech, and channels. Includes success to date measured by mobile and next-gen device offerings.
DIGITAL INVESTMENT	Investment in tech (e.g., next-gen analytics, machine learning, automation) and in enabling customers and employees.
INNOVATION & PERSONALIZATION	Vendor success based on scale of innovation with digital tech, platforms (back-end and front-end), and customer solutions (for a seamless user experience).

Source: Juniper Research



Different organizations are at different points in their journey to digital maturity, but all must focus on stability and security. Huawei has helped banks accelerate towards digital maturity by focusing on the generation, transmission, processing, and storage of information through optimization of the pipe, device, and cloud.

Transformation in action

Gemini securities trading platform: Following the approval of the Shanghai-Hong Kong Stock Connect, a scheme to allow trading between the Chinese mainland and Hong Kong, Huawei and Infocast jointly launched Gemini in late 2014. The solution's application layer ensures trading speed and efficiency, enabling huge numbers of concurrent transactions in real-time with zero faults. At the facilities level, Huawei's FusionCube applied ultra-low latency flash-memory technology and dual-layer architecture to improve the processing capability of the HKEx Business Support System (BSS) for single customers to 1,000 orders per second, double the next highest level in the industry. Gemini can connect to more than 10 BSSs concurrently to process up to 10,000 orders per second, and has slashed the processing latency of each trade by 90 percent.

Huawei has helped many enterprises

in the financial industry accelerate their business and improve scalability through smart and intelligent network optimization, improving user experience at the device level and boosting retrieval, processing, and transmission via the Huawei Cloud and underlying Huawei servers and storage solutions.

The rules of the game are changing as financial services extend past the brick and mortar walls of banks and integrate more deeply with e-commerce. The industry will have to continue to accelerate digital readiness and the transformation journey, through innovative people, processes, culture, and technology to increase relevance and personal context. This can lead to a better life for individuals, better business for enterprises and ecosystems, and a better society where divisions are bridged and everyone benefits.

If banks avoid digital transformation, the customer experience will continue to erode, which will cripple growth and hand profits over to non-traditional financial service entrants to the market who can and will disrupt the traditional market.

One thing is clear: Financial services companies that invest in the digital ecosystem of partnerships can accelerate digital transformation. **WINWIN**



HSBC PUTS partnership and data at the HEART OF DIGITALIZATION

Coopetition with Fintech

Beginning perhaps with the founding of PayPal in 1998, the rise of Fintech companies and services was fairly gradual until a few years ago. Then it skyrocketed. Now, Apple Pay, Android Pay, Tencent, Alipay, and Ant Pay, are disrupting how consumers and small businesses interact with their finances.

These disruptions, from simple P2P e-money transfers to infrastructure projects that integrate payment platforms on company websites, come at a time when mortgages are out of reach for many and personal loans are risky.

Lending Club, the world's largest

online credit marketplace, issued US\$8.4 billion in loans to consumers and small businesses last year. In the P2P asset management space, Betterment was recently valued at US\$700 million – nearly doubling in value from US\$450 million just a year before.

Banks are taking notice. Many major players in the finance world are calling for increased regulation of the Fintech world. The question is then, what exactly is the relationship between banks and Fintech companies?

According to Knott, “We welcome competition from Fintechs. But we’d rather see them as potential partners than competitors.” In March, for example, HSBC announced its partnership with the Fintech startup Tradeshift, the world’s largest commercial business platform. Knott

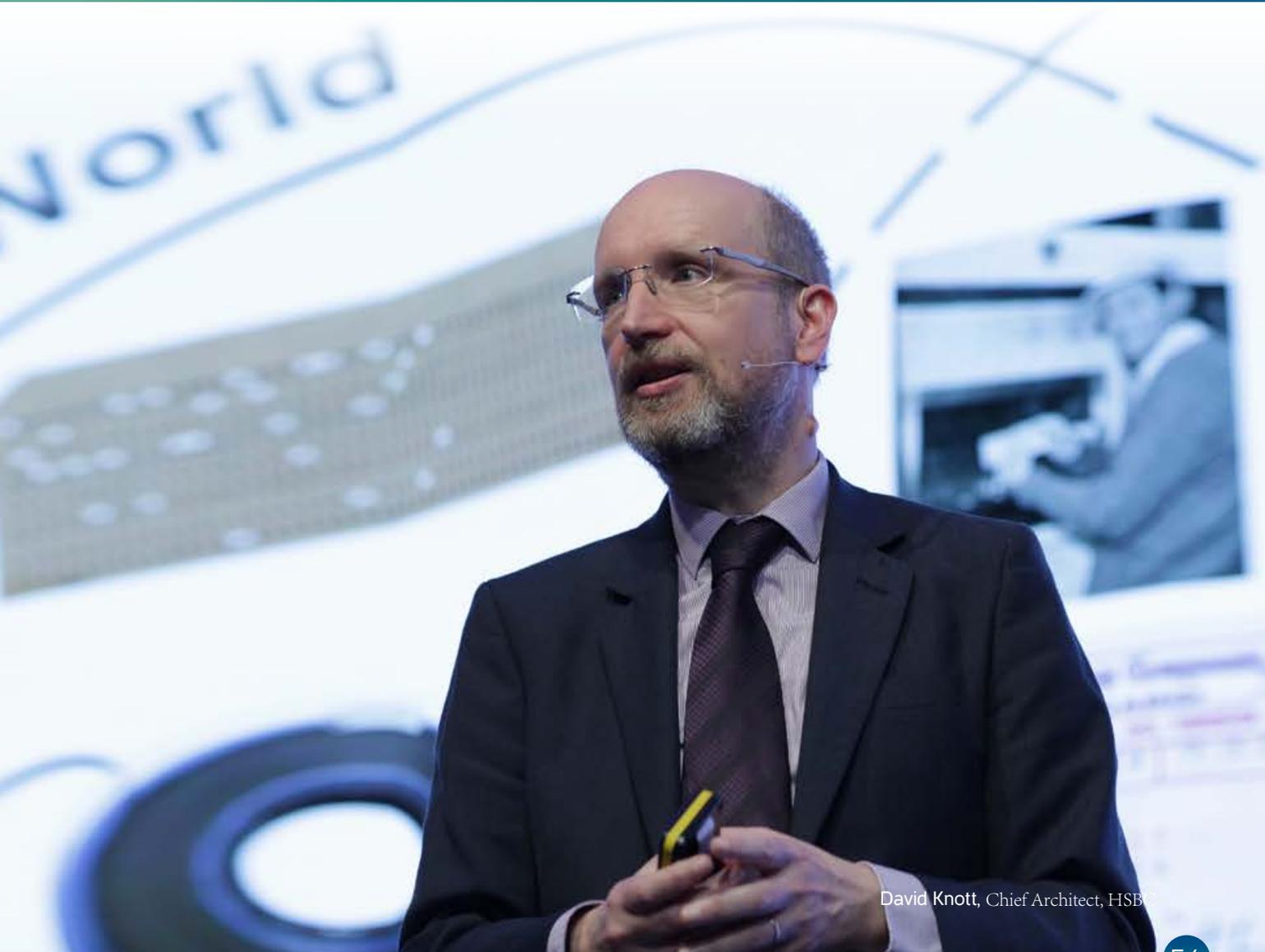
explains that Fintechs are bringing exciting tech to the market, which can provide a compelling offering for financial services customers, “For many years, banks have traditionally been customers of big traditional technology companies,” he says. “However, the market for technologies has been shaken up massively in the last few years. There are new entrants literally every day. I see a lot of partnership opportunities.”

Knott states that on the business side, HSBC operates a large network of partners and customers, “We’re very experienced at building relationships with companies and figuring out how our businesses mutually benefit each other.” On the technology front, he points out that new tech models are emerging. HSBC selects its approach based on desired outcomes, “There are



The world of finance has changed irrevocably. Tech-savvy customers are hungry for lower fees, greater transparency, and fast and easy mobile interfaces, and traditional banks are losing competitiveness and market share to OTT players. HSBC, however, is embracing digitalization and the nascent competition from Fintech startups. HSBC's Chief Architect David Knott outlines the banking giant's vision.

By Linda Xu & Gary Maidment, Huawei



David Knott, Chief Architect, HSBC



According to McKinsey, banks have three to five years to become digitally proficient if they wish to survive.

a whole range of models like revenue sharing and IP sharing,” states Knott. “We can be a straight customer...buying licenses, products and services. But we can also run a technology investment vehicle ourselves.” His view is pragmatic, noting that sometimes the right thing to do is be a customer, while at others it’s better to be an investor, finding out how Fintech companies operate and helping them succeed.

It’s all about digital

The new digital epoch includes rapid innovation in payments and the broader transformation of systems enabled by digital tech. The need to act quickly is acute: According to McKinsey, banks have three to five years to become digitally proficient if they wish to survive.

HSBC is an early adopter and quick to move. Knott explains that, “We’ve organized our business teams and technology teams into smaller teams, [with] highly empowered people working on new technologies with all the environment, skills, and capabilities they need to get stuff done.”

Knott is excited about the impact technology is having on the banking space, “Cloud provides us with a way

to both consume new technologies easily and provide massive and elastic scale,” he says. “Machine learning [lets you] put data to work to train algorithms to make decisions within your business.” He’s clear that AI will have huge influence on the sector and become “deeply embedded in everything we do, whether advising or detecting anonymous transactions or helping process normal transactions.” When it comes to security – a make or break feature when it comes to personal or business finances – he espouses the importance of biometrics. “It’s giving us a means to digitize physical identity, to store a digital representation of people’s physical markers that help us to identify them in a seamless, easy, and secure fashion.”

Be mobile, be agile

Avoka, a digital business platform provider, recently released its 2017 State of Digital Sales in Banking Report, which states that half of all banks lack a function that lets customers apply for most personal banking products online. Avoka concludes that most banks fail to capitalize on their investments in digital marketing and digital channels, resulting in abandonment rates of 70 to 90 percent when potential customers try to open an online account.



In contrast, HSBC provides a strong online and mobile customer service. Knott explains, “Mobile apps will potentially have a profound influence on our infrastructure. It has changed the ‘come to the front door’ way of doing business.” He also comments on how people’s behavior is changing. Where decades ago monthly statements would pop through the letterbox, people now check their financial status multiple times a day. As a result, “We have to make sure that our mobile apps are responsive, and also that our back-ends are tuned and responsive to our customers’ demand,” says Knott.

Being responsive and convenient is part of HSBC’s business ethos. Developed in partnership with the startup Pariti, HSBC’s SmartSave app lets customers put money aside without thinking about it. For example, they can set a rounding rule when they buy something on their card. A purchase of £9.66 would be rounded up to £10, and the remaining 34p would be sent to the customer’s savings account.

To achieve this sort of functionality, says Knott, “We can do caching. We can build certain throttling performance into our APIs.

We’re going to make sure [the system] is resilient and performs all the way down the stack.”

The future

Knott is optimistic about banking in the next decade. Not only will convenience increase, but people will have more control over their finances and “use research tools to figure out what they want by themselves,” he says. “With richer insights about what other people are doing, customers will be more informed and enact decisions in a far more seamless fashion.” He’s also aware that they don’t necessarily want to directly interact with their bank on a daily basis, “Paying for goods and services will be much more seamlessly integrated into our everyday experience, and technologies such as smart sensors, IoT, and 5G will make all that possible.”

Banks are coming around to the idea that building cross-industry partnerships is more productive now than ever before. Knott says HSBC will continue to partner with traditional IT product and service companies, but also team up with many smaller companies. “We have to figure out how we do that without

swamping them with big company processes,” he acknowledges.

Knott also talks about forming stronger connections with partners outside or on the edge of commerce. He’s responsible for the company’s applied and innovation labs, “Through those labs, we’re forming partnerships with academic and research institutes around the world. For example, in the UK, we have a partnership with the Alan Turing Institute. That’s particularly pertinent to data, because they’ve got a very strong data and machine learning focus.” HSBC is currently working on how to use its rich data assets for commercial and social value.

“We’ve also partnered with the Advanced Science and Technology Research Institute (ASTRI) in Hong Kong...in research fields such as biometrics, big data, block chain and other analytics technologies.”

His vision of the future, therefore, extends far beyond what we associate with traditional banks and is very much data- and partner-centric, “I see non-traditional, more academic, and richer network ecosystems becoming more universal as we move forward.” 



By Edwin Diender
VP, Government and Public Utility
Sector, Huawei

eGOVERNMENT SAFER, SMARTER, AND BETTER CONNECTED

We can't solve tomorrow's problems with today's economic models.

Every country has created some sort of digital agenda and most have a roadmap in place. Digital agendas evolve into digital transformation programs that will give structure and direction to smart services and power both governments and industries into the Industry 4.0 era.

Four stages to smart governance

The evolution into eGovernment that drives digital transformation and creates smart cities occurs in four basic stages.

Regardless of economic development, people's basic needs and wants are fairly universal: equal access to education, job creation,

healthcare, transportation, and sufficient food and water in a safe environment. Then, a robust digital infrastructure is the key to unlocking the potential of people and societies.

The main differences between nations are the legacy systems and information silos that are already in place. Choices from the past are now blocking forward progress, meaning that nations must take different approaches to digital transformation. However, our case studies show that when a city or area is safe, its citizens feel more secure and open to building expectations for value-added digital services and smart solutions.

Staying safe

Thus, the first program in smart city initiatives is safety. After all, how economically viable is a digital

agenda if a city or region isn't safe and secure? People don't want to live or work in an unsafe environment, and they definitely don't want to put their families at risk. Areas with high crime are characterized by a lack of unity, poor citizenship, and low quality of life. In the numbeo.com index, the highest-scoring countries for living standards also tend to be some of the safest. Crime also doesn't pay – it's estimated that violent crime, for example, costs the UK economy £124 billion per year. As such, does it make sense to follow a digital agenda and invest in smart city initiatives and smart services without resolving the safety issue first?

Safe cities in action

Connected devices and IoT benefit public safety and policing. Authorities can combine their own video surveillance networks



First Safe Then Smart

- Creates a safe and livable environment and a high quality of life by establishing safe cities
- Increases expectations for other digital infrastructure and public services
- Serves as the foundation on which to base smart cities



Government Cloud

- Increases efficiency and speed
- Breaks down silos between departments
- Creates a “digital by default” approach to governance
- Improves interaction between governments and citizens



Public Services

- Increases public satisfaction
- Raises quality of life
- Reduces costs and improves efficiency



Industry Acceleration

- Enables government cloud solutions, including video cloud, to be applied to other industries
- Promotes public-private partnerships that boost socioeconomic conditions
- Creates economically viable regions and sustainable models for growth



Four stages to smart governance



Overlaying cloud architecture can remove the barriers between government functions and departmental silos without necessarily upgrading or having to replace existing infrastructure.

with other public and private security systems alongside vehicle-mounted and portable solutions. With zero blind spots, these systems can monitor incidents like theft, civic unrest, and unauthorized access much more easily.

With smart devices running on private broadband networks, officers can pick up a live feed of, for example, shoplifting from CCTV before arriving at the scene, or they can receive feeds of criminals escaping a crime scene from cameras fixed to patrol cars or drones in the vicinity. Responses can be coordinated between central command and local patrols, while incident reports can be filed on the spot via mobile apps – all on a single device.

Police can store and organize surveillance data in a video cloud solution, and access, share and query vast video datasets with greater ease and accuracy. Sophisticated analytics tools improve the ability to identify, classify, and match stored video. These safe city solutions are secure against cyber attacks and cost effective as new infrastructure, especially when rolled out as part of broader smart city initiatives.



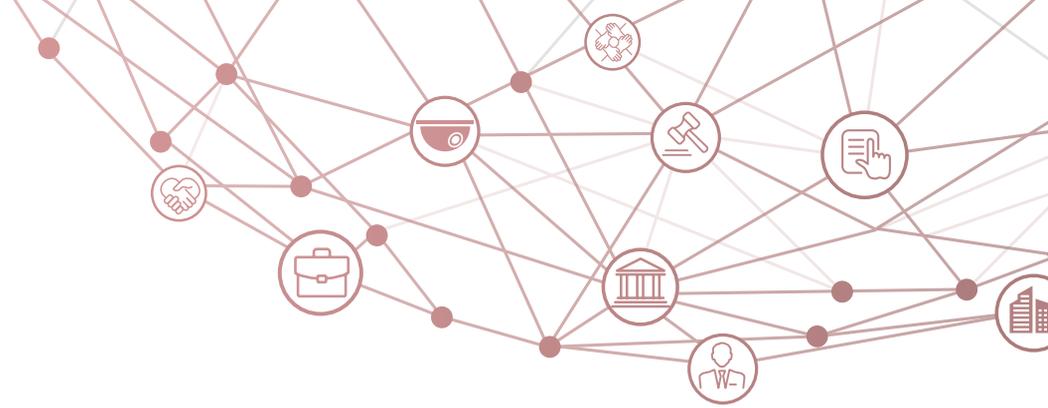
Transformation with government cloud

Governments have started transitioning from manual and paper processes to digital processes for all public services like tax, visas, housing, and citizen registration.

Paperless offices, high-performance workplaces, and self-service portals provide each government department with a unique system to digitally support its work. But, all these systems are verticalized. They're information silos, they're proprietary, they block progress, and they cannot seamlessly integrate with other systems.

Overlaying cloud architecture can remove the barriers between government functions and departmental silos without necessarily upgrading or having to replace existing infrastructure. Individual departments can access integrated, cross-functional application systems and staff can transfer access permissions to other departments.

Removing silos can make a once-only



model possible for individuals and businesses to access government services. Instead of having to register multiple times across government departments for different services, doing so once covers all services. Re-using information can also guarantee a much more personal experience. The same principle applies to contacting multiple departments for a single issue like registering a business, applying for citizenship or registering a birth.

eGovernment bridges information silos and makes them work as a single unit without replacing them or executing a forklift upgrade. Digital transformation is built on open standards and carried by Business-driven ICT infrastructure (BDII). With a focus on customer-centric innovation, BDII is leading the way into the next industrial revolution by deeply integrating ICT infrastructure and software applications, developing innovative infrastructures, and enabling joint innovation with partners.

As the engine of digital transformation, government cloud has a series of benefits:

- Shares data across departments

and enables service collaboration and diversification.

- Reduces costly and complex networking and computing resource duplication that occurs when each government agency maintains its own IT resources.
- Protects government information from a growing number of internal and external security threats.
- Serves as a scalable solution that adapts to expanded or downsized government functions.

Big data analytics and IoT

Enabled by cloud, data mining and the analysis of huge datasets can reveal insights that can help governments with extremely complex decision-making, especially when AI solutions add precision and insight to analytics. Data mining tools can process structured numeric data in traditional databases or extract relevance from semi-structured and unstructured data, such as text, graphics, images, and web data.

IoT and smart sensors have huge

potential for making connections everywhere in eGovernment and serving as the source of an incredible amount of data. While the most publicized applications of IoT tend to be in the areas of transportation and health, less obvious applications include wildlife protection, monitoring rivers to predict floods, and protecting against earthquakes.

In touch with the people

A strong digital infrastructure can also realize huge cost savings for governments and strengthen relationships with citizens. The European Commission estimates that online communication could cut costs by between 15 and 20 percent, while e-Procurement could save a staggering €100 billion per year.

Realizing cost savings through ICT is particularly important in the light of the austerity facing so many governments. According to the Institute of Fiscal Studies, Britain's time of austerity will extend through to the 2020s, while current plans in the US will see cuts of US\$10.5 trillion over 10 years. In July 2017, the BBC reported that the new government in



Extending the "digital by default" strategy can make services cheaper and easier to provide, and crucially, accessible to more people, as the costs associated with traditional phone, paper, and face-to-face contact are removed.

France will “cut €4.5bn (£4bn; \$5.1bn), primarily from defense, interior, foreign affairs, and transport.”

However, extending the “digital by default” strategy can make services cheaper and easier to provide and crucially, accessible to more people, as the costs associated with traditional phone, paper, and face-to-face contact are removed.

Industry accelerators

Once safe cities, digital infrastructure, and eGovernment solutions are in place, digital transformation can be more easily replicated in other scenarios such as transportation, agriculture, healthcare, and education. Digital transformation also encourages government-enterprise partnerships.

Looking ahead to 2025

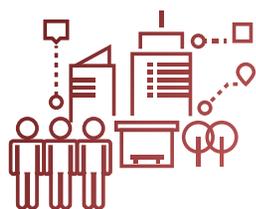
We’re likely to see a whole range of changes over the next decade. The advent of driverless cars, for example, may consign driving licenses to history and lead to the reallocation of land previously used for things like parking lots. Basic services like garbage disposal will become smart and on-demand, rather than waiting for city services to handle them at certain times of the week. Smart lighting will save money for electricity companies and enhance public safety with sensors that know

when you’re near, and light your way as required. Smart meters in homes will cut bills for consumers by enabling tailored adjustments to energy use.

Augmented reality is likely to have a widespread impact on public services. For example, a water leak today leads to roads being blocked off and dug up to locate the fault. In the near future, water pipe valves will provide real-time information to an intelligent operations center. Paper blueprints spread out on an engineer’s dashboard will be replaced by a smart device that displays the complete water network via an overlay of AR, thus visualizing the specific section of the water network and its faults.

Equally, police officers will have real-time information available in their helmet’s visor or in-vehicle display, allowing for a far quicker response, which is further accelerated by less congested roads. Civil engineers or services departments can use AR for maintenance and repairs rather than going through paper manuals.

The future is destined to be safer and smarter, with eGovernment enabling seamless interaction between citizens and the government and the efficient delivery of public services. A better connected city, region or nation makes public services economically more viable and sustainable. The result is a better quality of life for all. [www](#)





On a health kick with **CONNECTED HEALTHCARE**

The most challenging issues facing healthcare today include legacy systems, the uneven distribution of medical resources, non-transparent resources, and low patient satisfaction. But digital transformation promises a healthier future for all based on two pivotal advancements enabled by mobile networks: remote healthcare and IoT.

By Ding Jiangbo, Huawei

In poor health

The current system is designed for sporadic and acute diseases. It doesn't apply to the treatment and management of chronic diseases, which incur more

than 70 percent of medical costs. Moreover, the uneven distribution of medical resources, especially in emerging economies, concentrates the best resources in a few cities or hospitals. In China, for example, most first-class hospitals are located in tier-one cities. A lack of transparency

with medical resources also means that it's hard to quickly find suitable doctors. Another factor lowering patient satisfaction is waiting times. In Spain, for instance the average wait for surgery is more than 100 days. Healthcare is also costly. It currently accounts for 10 percent of global



GDP. And in the US, it's projected to reach 23 percent of GDP by 2023.

Always-on healthcare

Eliminating these issues through digital transformation is an industry-wide goal. IoT, for example, can connect people to healthcare. Monitoring devices, smartphone apps, wearables and implantable sensors – all with access to real-time information – will create a new era in how health is managed.

As a part of eHealth, m-Health is supported by mobile devices like phones, monitoring devices, digital assistants, direct care devices, and other wireless devices.

These devices address healthcare challenges in three ways:

Reduced costs: GSMA estimates that m-Health can save US\$18 billion in existing healthcare systems in Brazil and Mexico, and create 200,000 jobs in the emerging m-Health sector by 2017. The FCC predicts that remotely monitoring patients could save US\$197 billion in the US over the next 25 years if it focuses on the four following **diseases:**

heart disease, diabetes, pulmonary disease, and skin diseases.

Higher efficiency: M-Health solutions enable healthcare practitioners to diagnose, treat, and monitor more patients than face-to-face consultations, thus freeing up time and resources for complex cases. In 2011, trials in Nordic countries found that M-Health could reduce overnight hospital stays and re-hospitalization for chronic obstructive pulmonary disease (COPD) by 50 to 60 percent.

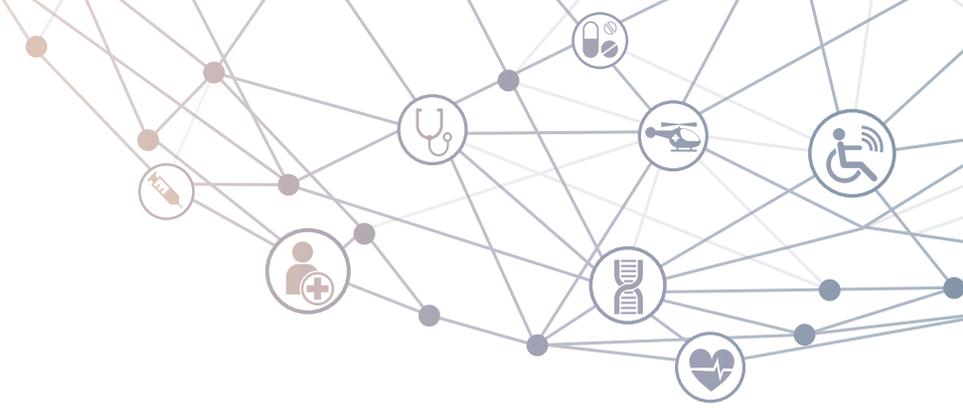
Better long-term healthcare: M-health enables comprehensive healthcare through real-time data capture and analyses, better accessibility to information, enhanced patient ownership and understanding of their own conditions, and support with diet and lifestyle changes. Patients can more easily manage their own health.

It can also bridge the gap between urban and rural healthcare disparities. For example, the Philips and Huawei partnership, which aims to provide cloud-based and IoT solutions, focuses on China's tier-two cities, which tend to lack equipment and qualified doctors.

Home is where the heart is

Pollution and unhealthy lifestyles are disastrous for global health. For example, WHO reports that obesity more than doubled between 1980 and 2016. In 2014, nearly 1.9 billion adults – 39 percent of the global total – were overweight. Of these, over 600 million were obese, causing an explosion in diabetes and hypertension. The ageing population is another challenge – perhaps the most pressing of all. The UN estimates that the number of senior citizens aged 60 or over will increase by 56 percent from 2015 to hit 1.4 billion in 2030.

It's uneconomical to keep all patients in hospital until they fully recover, especially those with chronic diseases who need extended, even lifelong, monitoring and treatment. This means that health monitoring will gradually move the hospital to home. For specific groups like the elderly or children who require carers, an online device that provides real-time data would be invaluable. For healthy people, the constant stream of biomedical data would preempt health problems and help respond to emergencies.



Monitoring technology can vary in complexity from tracking simple physiological data such as blood pressure, pulse, blood sugar, and body weight, to implantable devices like pacemakers and defibrillators, whose running status can be monitored remotely. In 2015, an astonishing 165,000 mobile health apps were available on the iOS and Android platforms – about twice as many as just two years earlier.

All types of monitoring services rely on mobile connectivity, which is great news for mobile network operators (MNOs). According to EY, the addressable market of remote monitoring for MNOs will reach US\$69 billion in 2022. Chronic disease management will be the biggest sub-segment in remote monitoring services, especially for target groups like the elderly, children, and athletes. By 2022, these sub-segments will account for 40 percent of the remote monitoring market.

Innovation drivers: Wearables

Wearables include embedded sensors, wireless communications, multimedia and other tech in eyewear, watches, bracelets, clothing, footwear

Healthcare accounts for
10% OF GLOBAL GDP

M-Health can save
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2015



and other daily wear. For example, clothing can monitor oxygen supply and posture, shoes can calculate calories consumed and distance moved, while glasses can record the surrounding environment.

According to Ovum, 277 million units of wearables will have been purchased by 2020, up from 97 million in 2015. Better battery and component design should help boost sales from 2017 onwards, as previously most wearables were alternatives to phones that people didn't view as necessary.

Soon, however, wearables will cause a healthcare revolution. As well as recording blood sugar, blood pressure, heart rate, oxygen content, temperature, respiratory rate and other health indicators, they will also treat diseases. Several MNOs are exploring the wearables market, including NTT DoCoMo, which launched Moveband health trackers with the electronics manufacturer Omron. Automatically transmitted to DoCoMo's app, the data collected enables full health management and, by year-end 2015, the service had attracted two million users in Japan.

For enterprises like Omron, the



Estimates hold that the global market for medical robots will reach US\$11.4 billion by 2020, up from US\$4.2 billion in 2015.

consumer healthcare space is wide open, as currently no iconic company is leading the way.

Remote care

Remote care aims to leverage ICT to use information for researching, diagnosing, treating, and preventing disease and injuries in a place other than where the patient is located. GSMA forecasts that the remote care market is expected to be worth US\$5.7 billion in 2017.

While remote healthcare can overcome geographical and time barriers between healthcare providers

(HCPs) and patients, several barriers hinder its mass deployment. First, remote schemes are usually non-profit programs designed for underdeveloped regions where ongoing investment isn't guaranteed. Second, no international legal framework exists to protect privacy or set out liability, so both patients and HCPs face risks. Third, language and cultural differences mean that patients and HCPs often can't communicate effectively, particularly in underserved regions such as Africa. Rural hospitals also lack critical maintenance support for the high-tech equipment used for remote care.

5G, the enabler

In the 2020s, 5G will take healthcare into a new world. Advanced robotics like the AI surgeon STAR – which surpassed human capabilities in 2016 – and remote care will continue to develop.

Estimates hold that the global market for medical robots will reach US\$11.4 billion by 2020, up from US\$4.2 billion in 2015. The pioneering da Vinci System uses a magnified, high-res 3D vision system to translate a surgeon's hand movements into precise





movements by micro instruments inside the patient's body. Currently, surgeons operate robots via a control platform located near the operating table. In the future, it's likely they won't even need to be in the same hospital thanks to next-gen mobile networks and real-time data transmission.

MNOs in m-Health

MNOs have unique advantages that enable them to thrive in the m-Health ecosystem, including stable and secure mobile networks that cover wide areas. They also operate legacy call centers. These two advantages enable E2E value-added emergency services and extend the reach of healthcare into underserved regions. Beyond technology, a huge customer base and close relationships with governments will help attract other stakeholders.

For example, MNOs could use the open door strategy for developing platforms for device providers. On specialist SIM cards, customers could activate tracking and emergency services, and MNOs could cooperate with governments and hospitals to promote emergency remote diagnosis and in-ambulance treatments

enabled by robust networks.

MNOs' analytics capabilities on big data could contribute to health risk control and disease prevention, while cooperation with key stakeholders could persuade governments to position m-Health as a regular treatment solution for chronic disease management.

In the mid-term, highly reliable, high-performance next-gen networks will contribute to some exciting advancements in healthcare, while the long-term aim is remote care for all.

2025 and beyond

By 2025, it's likely that a lot of the healthcare bottlenecks that exist now will have vanished, with primary care accessible to all citizens, including the world's large rural population, thanks to the increased availability of broadband, mobile devices, and apps.

Other exciting advancements will also have been made. Biofabrication, which involves growing living tissue, will have advanced considerably, as specially designed 3D printers will replace prohibitively expensive legacy

machines. Based in Philadelphia, the biotech startup BioBots has developed a 3D printer that can print living tissue by using a special ink that combines with biomaterials and living cells, offering the potential to grow mini human organs. Its immediate application potential includes replacing animals for drug testing and researching cures for rare diseases.

3D manufacturing robotics and artificial biology will improve tech like exoskeletons and mind-controlled prosthetics. AI will be able to spot subtle trends through massive datasets segmented into sub-populations and sub-geographies, encouraging research into diseases that were once felt to be too rare to research. Sensors will extend past wearables and begin monitoring health 24/7: your bathtub may screen you for tumors; the steering wheel in your car could warn you you've put on too much weight; and your home drug dispenser will remind you to take your medicine.

However, the most exciting advancements aren't necessarily medical advances; they're more to do with breaking down barriers and ensuring healthcare for all. [WINWIN](#)



By Eric Sheninger, Senior Fellow and Thought Leader on Digital Leadership & Learning with the International Center for Leadership in Education (ICLE).

LEARNING FOR THE FUTURE with digital leadership

Change is not coming – it's already here. While Edtech has gone through a period of over-hype, the time is ripe for disruptive innovation that improves learning outcomes for students. It's also necessary because education is behind the curve, preparing students for an industrialized world and jobs that won't exist for much longer.

A tough job

The rapid pace of technological change, especially in the areas of robotics and artificial intelligence, will mean that the job landscape will change over the next decade.

The on-demand model that we're starting to see today will become more prevalent, with shorter contracts geared towards specific skills and projects. Some current trends are likely to result in new careers in the 2020s. Examples include personal brand managers, urban farmers, remote healthcare specialists, smart

home technicians, and VR experience designers. Other emerging work opportunities, like neuro implant technicians, may result from advances in technologies that are now in their infancy, while traditional professions are poised to take on a greater IT and data emphasis. An example is the legal profession, where instead of lawyers we might see positions like legal knowledge engineer, legal technologist, project manager, risk manager, and process analyst.

Using tech the right way

Changes in technology are forcing schools across the

world to adapt. This is good news for students, as digital transformation can deliver authentic learning experiences that provide relevance, value, and tangible skills in an unpredictable world. But we need to ensure technology is geared towards learning and achievement.

Future-proofing by educators can create new areas of study and exploration. Revamped programs should afford students the opportunity to use real-world tools, for example, in makerspaces, to engage in meaningful work that aligns with a future-focused vision.



Re-envisioning learning spaces and environments

Research shows that classroom and school design impacts student learning. Leaders must have the vision and strategic plan to enable schools to create innovative learning spaces and environments such as BYOD, blended learning, flipped classrooms, gamification,

makerspaces, and virtual learning.

Digital infrastructure sits at the heart of many of these innovative education modes. Flipped classrooms, for example, depend on tech that a few years ago would have been a challenge – things like broadband access; processing power in devices; and multi-media production for sound, image, and film.

Today, we're seeing more institutions

investing in cloud solutions for their IT infrastructure. As well as email and calendaring, other functions are heading towards the cloud, including collaboration, enterprise resource planning, and learning management systems. However, there are few solutions that specifically target education institutions and new learning methods such as MOOC (Massive Open Online Courses). Examples that do so include Huawei's education cloud, smart campus





Applying Tech to Classrooms

What it is	What it does
BYOD	Lets students and teachers use their own devices in the classroom to access information on the school's cloud networks. Students are more likely to work outside of school on their own devices, schools don't have to invest in tech catch-up because students usually have relatively new devices, and apps can allow greater teacher and student interaction than ever before.
Blended learning	Mixes traditional classrooms and digital learning. Possible modes include face-to-face driver , where a teacher augments classroom learning with digital tools; online-driver , in which courses are primarily online with teacher check-ins; and rotation that rotates between f2f classroom time and online learning.
Flipped classroom	Prioritizes learning through activity. Instruction and lectures are delivered outside the classroom via, for example, short videos and podcasts. Homework is then done in the classroom to ensure concept mastery through group work and discussion.
Gamification	Applies video game design and mechanics to learning. Examples include Ribbon Hero 2, a game that teaches users how to use Microsoft Office 2007 and 2010; the World Peace Game; and Class Dojo, a game designed to connect teachers, students, and parents.
Makerspaces	Delivers a platform for students to design and make things. Examples of equipment and ideas that can be utilized include 3D printers, programming zones, computer repairs, and robotics.
Virtual learning environments	Uses a web-based platform to deliver the digital aspects of courses. Benefits include economizing teacher time, overcoming time and location restraints, and enabling instruction to be networked between different campuses.

and smart classroom solutions.

Education in 2020 and beyond

By 2020, digital infrastructure will enable cloud-based learning to become a dominant force in education. Cloud will ease the burden of knowledge transfer and underpin an education ecosystem that will expand beyond teachers, parents, and students, to include hardware and software vendors and teacher trainers.

We will begin seeing different learning forms emerge, including

learning simulations that supplement teachers, true mobile learning, seamless transitions between face-to-face and online learning, and personalized learning algorithms where data analytics hones a truly personal study experience.

The next decade should see some exciting innovations – biosensing tech that can measure things like heart rate and eye position will provide valuable data for educators, with AI able to look for patterns like whether exercise scheduling and duration might, for example, influence math

performance. Cloud VR will be heading towards creating fully immersive virtual environments and collaborative possibilities that we've never seen before.

It's not just about the tech

It's important not to get too sucked into the transformational aspects of the technology itself. We must focus on the transformation of teaching, learning, and leadership.

Placing a device in the hands of students and hoping for



learning miracles to happen will always be a letdown.

True digital leadership uses advances like ubiquitous connectivity, open-source technology, cloud computing, mobile devices, and personalization to empower learners through collaboration, communicating, reflecting, and engaging with their peers anywhere in the world. It lets them share work and demonstrate conceptual mastery in a variety of ways.

Access to information, tools, and people can now provide students with endless opportunities to grow like never before and own their learning.

Digital transformation in action: New Milford High School, New Jersey, the US

I wasn't always an evangelist for innovative change – I was the school leader who ran around taking devices from students, enforced no tech zones, and wrote policies to block social media.

It took a student in 2009 who had the

guts to tell me that school was like jail for me to finally begin to think about the error in my ways. Then shortly after I discovered Twitter. Once connected through cloud technologies I saw opportunities and where my school could be. We then embarked on a digital transformation that radically improved the learning culture of the school.

We were the first school in New Jersey to implement a BYOD policy. We expanded our Wi-Fi network, so students could access the free Internet from outside of the building, and partnered with local businesses to give students additional places to get online for free.

But digital leadership isn't about flashy tools – it's a strategic mindset that uses technology to improve what we do and cultivate a school culture focused on authentic engagement and achievement.

Student engagement and learning

Billions of dollars are spent on technology without regard to how

and if teaching and learning are changing. Digital learning requires a uniform pedagogical shift. Learning must always be relevant, meaningful, and applicable, and foster higher-order thinking skills. *The Rigor Relevance Framework* ensures that technology is integrated effectively. It lets educators look at the learning tasks that students are engaged in and redesign them in ways that move away from telling us what they know and instead showing whether or not they actually understand.

Grounded in rigor and relevance, instruction and learning with digital tools are limitless. This is the foundation of uncommon learning and a move to competency-based learning. While skills are an important part of learning and career paths, they're not rich or nuanced enough to guide students towards true mastery and success. Skills focus on the "what" in terms of the abilities a student needs to perform a specific task or activity. They don't provide enough connection to the how. Competencies take this to the next level by translating skills into behaviors that demonstrate what has been learned and mastered, relying less on time



as the measure for completion. Computer-mediated instruction gives us the ability to individualize learning for each student, reflecting the fact that students learn at different rates. The faculty moves from “sage on the stage” to “guide on the side.”

Professional growth and development

With the rise of social media, schools no longer have to be silos of information and educators do not have to feel like they are on isolated islands that lack support and feedback. The power of learning anytime, anywhere, and with anyone can motivate every person to be a life-long learner.

Educators can form their own Personal Learning Network (PLN) to meet diverse learning needs, acquire resources, access knowledge, receive feedback, connect with both experts in the field of education as well as practitioners, and discuss proven strategies to improve teaching, learning, and leadership.

Communication

Educators can provide stakeholders with information in real time through a variety of devices. Static, one-way methods such as newsletters and websites no longer suffice. Information can be communicated digitally through free tools and simple implementation strategies

to meet stakeholders where they’re at in the digital age, and engage them in two-way communications.

Branding

Businesses have long understood the value of branding and its impact on current and potential consumers. A brandED mindset focuses on telling, not selling, to build powerful relationships with the education community. Educators can leverage digital tools to create a positive brand presence that emphasizes the positive aspects of school culture, increases community pride, and helps to attract and retain families when looking for a place to send their children to school.

Opportunity

Digital leaders leverage connections made through technology and increase opportunities to make improvements across multiple areas of school culture.

Educators need to be catalysts for change and the pillars identified above provide the guidance. Each is critical in its own right to transform learning and sustain a positive school culture. So what does this digital and learning convergence look like? *Learning Transformed* sets out eight keys to drive change:

- Leadership and school culture lay the foundation

- The learning experience must be redesigned and made personal
- Decisions must be grounded in evidence and driven by a Return on Instruction (ROI)
- Learning spaces must become learner-centered
- Professional learning must be relevant, engaging, ongoing, and made personal
- Technology must be leveraged and used to accelerate student learning
- Community collaboration and engagement must be woven into the fabric of a school’s culture
- Schools that transform learning are built to last as financial, political, and pedagogical sustainability ensures long-term success

The way many of us were taught and assessed has little value in today’s world, let alone the future. The new world of work presents a wakeup call of sorts. A business- as-usual model based on efficiency, repetition, and knowledge acquisition will only prepare students for a world that no longer exists.

This shift will not be easy, but the outcome could pay off tenfold. 

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