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**ANNUAL
INDUSTRY
SURVEY 2019
REPORT**

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Looking back with satisfaction and forward with optimism

Dear Readers,

Welcome to the 2019 Telecoms.com annual survey report. As always, I trust you will enjoy reading the valuable insights on where the industry stands and where it is heading, provided by our fellow telecoms professionals.

Around this time a year ago we published the 2018 Annual Industry Survey report titled “Confidence, Change, Continuity”. Looking back now we are satisfied to note that the confidence was merited, that big changes have taken place, and that continuity is still as strong as any time. The single biggest change in the industry was that the waiting for 5G to happen was finally over. Commercial 5G services have gone live in over two dozen markets and have done so with plenty of fanfare. Such a momentous change has brought true optimism to the industry stakeholders, as well as those outside of the industry poised to benefit from it.

The optimism is reflected in the responses to our survey. There has been plenty to cheer about in the telecoms industry over the last year. The majority of survey respondents think the industry has either had a good or an excellent 2019, and even more are happy with the performance of their own business.

Bolstered by the fast rollout of 5G, which is both a service in its own right and a catalyst and enabler for other business opportunities, expectations are also running high in adjacent sectors. Companies going through Digital Transformation expect to vastly enrich their service offerings to capture the opportunities afforded by the new technologies.

IoT is one of the sectors that have built on the success of earlier years and expect to undergo big changes in the years to come. Meanwhile, to enable the transformation of businesses, the support systems need to be up for the task. Modernising OSS/BSS is therefore both a strategic imperative, and a competitive necessity.

Plenty is going on that keeps the telecoms sector exciting, and many of us in the industry are optimistic about the future. As a matter of fact, over three quarters of the telecoms professionals who answered this survey believed the industry’s business outlook in 2020 will either be positive, or very positive. So, once again, it is our privilege to share the journey with you and we hope you find the 2019 Telecoms.com Annual Industry Survey useful and enlightening.



Wei Shi

Content Manager
Telecoms.com Intelligence



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Modernising both the network-facing and the customer-facing support systems is a strategic imperative as well as a competitive necessity.



Who have answered the survey: companies reprinted



81%

Smart cities

Greatest IoT opportunities
outside of home

Satisfied with the industry in 2019?



70%

Believing providing
custom network
services requires
major BSS changes

2020 outlook?



28%
Very
positive



49%
Somewhat
positive



Telco's biggest competitors

35%
Other telcos



34%
Webscale
companies

Investment priority

66% 5G

49% IoT

Should we continue investing in 4G?

**88
YES**



INDUSTRY LANDSCAPE

Over half of the respondents are happy with their performance, while three quarters are confident in the industry's 2020 outlook.

KEY TAKEAWAYS

- Survey has attracted strong enthusiasm from telecoms professionals across different jobs and different places
- The telecom industry is confident in delivering a strong 2020
- 5G, IoT, Cloud are among the priority investment areas

Industry Landscape

At the end of another eventful year, 540 telecoms professionals seized the opportunity of this year's Telecom.com annual industry survey to once again share their views on where the industry stands and where it is heading. There has been plenty to be excited about over the past year, but there also remain formidable challenges. Looking at the overall sentiment, however, we see optimism outweigh concerns.

Before we delve into analysing the survey results, it is worth taking a look at the representation of the respondents. A quarter of them came from mobile operators, and a further 11% came from fixed and cable operators, making telecom operators by far the largest group of respondents by profession. This was followed by system integrators and consultancies, accounting for 20% of the total number of respondents, and hardware and software vendors at 19%.

When looked at by their job functions, the respondents were well distributed across sectors. The biggest group was mid-level management (23%), followed by C-level executives (18%), and engineers and developers (13%). In terms of working experience in the telecoms industry, three quarters of the survey respondents have been in the industry for over 10 years, including nearly a quarter (23%) of them having worked in telecoms for over 25 years.

Geographical distribution of the respondents was also the most balanced in years. The biggest group was those based in Europe but its weight is reduced, represented by 31% of all the respondents, followed by Asia Pacific (28%) and North America (18%). Africa's weight continued to go up, reaching 12%.

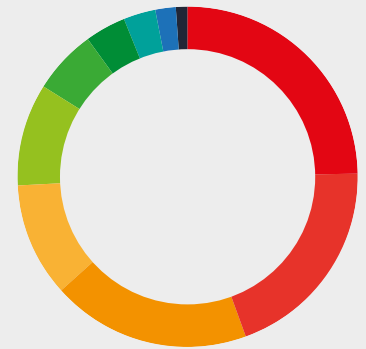
Overall, the demographics of the survey takers suggested that most of them possessed an intimate, often

first-hand understanding of the market, customers, and technologies, with rich experience in the telecoms industry. Many of them are decision-makers for the companies they work for. The views expressed in the survey can thus be treated with a high degree of confidence as representing the true attitude of the overall telecoms industry in the past year.

It has been a great year for the majority of the respondents. Well over half of all respondents would describe the telecom industry's overall business performance in 2019 as "good" (47%) or excellent (10%). Similarly, 40% of them believed their own companies have been doing as well as the telecoms industry as a whole, while more people believed their own companies had outperformed the industry either by a small margin (29%) or a big margin (14%). More optimism was on display when the respondents looked towards the industry prospect in 2020. Nearly half of them (49%) felt somewhat positive about the telecoms industry's business outlook in 2020, with a further 28% felt very positive. When asked to specify the market segment that would represent the biggest revenue growth opportunity, 52% went for enterprise market, with 32% choosing consumer market and the rest banking on the public sector.

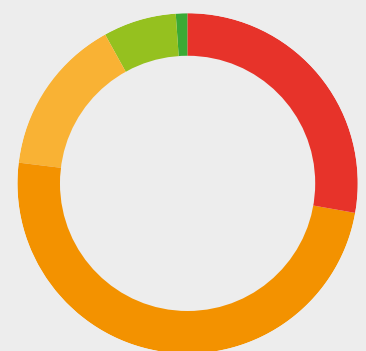
Such an overwhelming focus on the enterprise market may well be an outcome of the single biggest change in the telecoms industry landscape over the past year: 5G commercial services have been switched on, as 5G for the first time for a cellular technology will serve business use as well as it does consumer service, if not better. Indeed, the industry's enthusiasm, excitement, and expectations about 5G will only get stronger. It was the runaway leader, chosen by 66% of the respondents, on the list of priority investment areas in 2020.

Please tell us the type of company you work for



- Mobile Network Operator/MVNO 25%
- Consultancy/Integrator 20%
- Vendor 19%
- Fixed or Cable Operator/Internet Service Provider 11%
- Other 10%
- Government/Regulator/Authority 6%
- Cloud/Web Services/OTT 4%
- Value-Added Reseller (VAR) 3%
- Media/Entertainment 2%
- Enterprise User 1%

How do you feel about the telecom industry's business outlook for 2020?



- Very positive 28%
- Somewhat positive 49%
- Neutral 15%
- Somewhat negative 7%
- Poor 1%
- Very negative 0%

In the second place on the priority investment list was IoT (49%), with cloud (46%), digital transformation (44%), and artificial intelligence (41%) all garnered sizeable votes. See in the following chapters for more detailed reading and analysis of the survey data related to 5G, digital transformation, IoT, and OSS/BSS (which was also selected by 20% of the respondents, a significant number).

Despite the confidence and optimism, the respondents also acknowledge the threats the industry is facing. The leading threat, identified by over 23% of the respondents, was increased pressure to lower prices and profit margins. This has been a recurring theme in the telecoms industry in recent years, especially when faced with competition from outside of the telecoms world.

However, some latest market signals may be indicating a change for the better. Vodafone, once mobile communications' trailblazer but mired in indifferent performances for years, has published both a set of encouraging results lately, and a set of ambitious outlooks, suggesting the company has turned the corner in the new competitive dynamics. Consumers' high enthusiasm about 5G, including the willingness to upgrade, is another positive sign for the

telecom operators. KT is now generating half of its postpaid revenues from its 5G subscribers, despite that they only accounted for 5% of its total subscriber base. Even the widespread concern over the high cost of 5G rollout may have also had elements of exaggeration. A recently published research by Credit Suisse showed that the combined CAPEX of the four US operators came down slightly in 2019 and is projected to reduce even further, despite that all four of them are busy rolling out 5G networks.

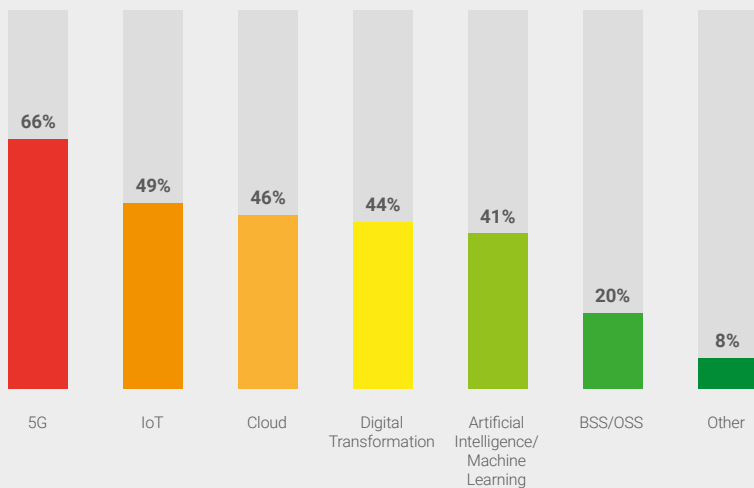
Related to the threat of price and profit pressure, in second place on the list but almost neck and neck, was the respondents' worry about the failure to roll out new technologies fast enough (selected by just under 23%). New technologies are often viewed as a catalyst for new growth, which would help alleviate the pressure on price and profit, and the first movers can often assume competitive advantage. 5G is clearly such a new technology the industry does not want to see delayed.

Ironically, 5G was also identified as one of the top two overhyped technologies today, selected by 47% of the survey respondents, narrowly behind AI and machine learning (just shy of 50%). Presumably the key reason a sizeable part of the industry sees them as hype

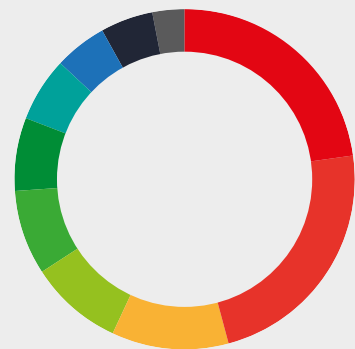
is that much of 5G's promise, especially the promise to serve industrial verticals, has not been fully delivered on yet, due to the lack of end-to-end 5G in standalone mode. AI and machine learning, on the other hand, owes its high score to both the less than optimal performance, for example the accuracy of AI-based predictions, and the nature that most of what AI and machine learning have done is under the hood. The measures to address the scepticism are not rolling back the investment, but rather to be more active in developing the technologies so that their true value can be delivered.

In summary, the industry is confident in the future, having strong consensus where the money should be put, and is fully aware of the challenges lying ahead of uS. ●

Which of the following are likely to be priority investment areas for your company in 2020? (choose all that apply)



Which of the following is the greatest potential threat to your company's long-term business success?



- Increased pressure to lower prices and profit margins.....23%
- Failure to roll out new technologies fast enough23%
- Competition from Webscale companies (e.g. Google, Amazon, Microsoft)11%
- Inability to adopt agile service model9%
- Inability to lower capital and operating expenses.....8%
- Regulatory restraints7%
- Lack of demand from the enterprise sector6%
- Failure to address network complexity issues.....5%
- Other (please specify).....5%
- Lack of demand from the consumer sector3%



5G

5G going live was the single biggest change in the telecoms industry over the last 12 months, and this is just the beginning.

KEY TAKEAWAYS

- 5G is rolling out fast in all parts of the world
- Media & Entertainment is set to benefit the most from 5G in near term
- Support is strong for continued investment in 4G

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5G



The single biggest change in the industry landscape since last year’s Telecoms.com Annual Industry Survey was the launch of commercial 5G services in different parts of the world. South Korea and the United States may continue to argue which of them was the real first to press the “On” button, but the world has been charging forward.

According to the tracking by the GSA, by the beginning of November, 50 operators in 27 countries have already switched on commercial 5G networks. While the US and Uruguay are the single 5G markets in their respective continents, two countries in Africa, five in the Middle East, six in Asia Pacific, and twelve in Europe have launched 5G commercial services.

Consumer enthusiasm for 5G has been strong. The 5G subscriber base in South Korea, the pacesetter in the first phase of 5G, grew faster than the corresponding period when 4G was first launched. Samsung announced at the IFA in September that it had already sold 2 million 5G smartphones, and expected the shipment to double by the end of the year.

But 5G is much more than just faster download speeds on newer smartphones. The survey respondents identified better customer experience as the leading benefit 5G can bring to mobile network operators, selected by 24% of the respondents. Following this, there were new business models (24%), selected by an almost equal number of respondents, and optimal network resource efficiency (19%).

It is worth noting that all these benefits do not only apply to services for consumers, but also to business

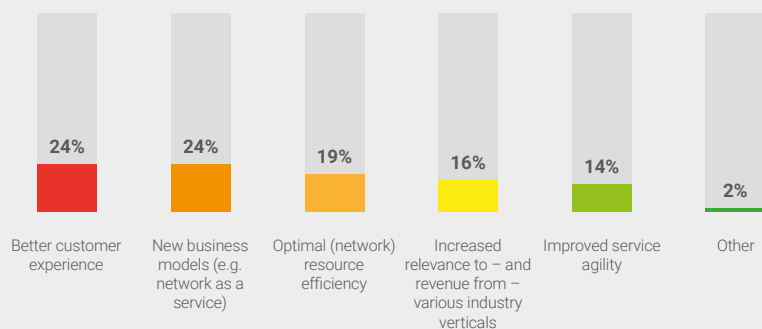
customers. 5G is the first time in the mobile telecoms history that industry use cases can be as important to operators as consumer services, if not more. Such a significance is well recognised by the industry professionals.

When asked to nominate the industries that 5G will be most relevant to, in addition to the communications industry itself, which was a runaway number one chosen by 34% of the respondents, media & entertainment and automotive were close, selected by 19% and 16% of respondents, respectively. This is a clear indication that the industry professionals are looking at 5G from both near and long perspectives. While media & entertainment can benefit from 5G almost instantly, the automotive

industry will feel the increasing impact of 5G in the long run. With end-to-end, standalone mode 5G more broadly deployed, 5G’s capabilities for low latency and massive machine-type communications will serve industries like autonomous cars and manufacturing automation in more pronounced ways.

Along similar lines, when drilled down from industry level to service and application level, 48% of respondents saw data (including fixed mobile access) and video as the number one 5G revenue generator for mobile operators. This is already happening. Two months after it launched 5G service, the South Korean operator LG Uplus announced that the average data consumption per 5G user had already gone up by 225% over

What are the top benefits 5G brings to mobile network operators (MNOs)?





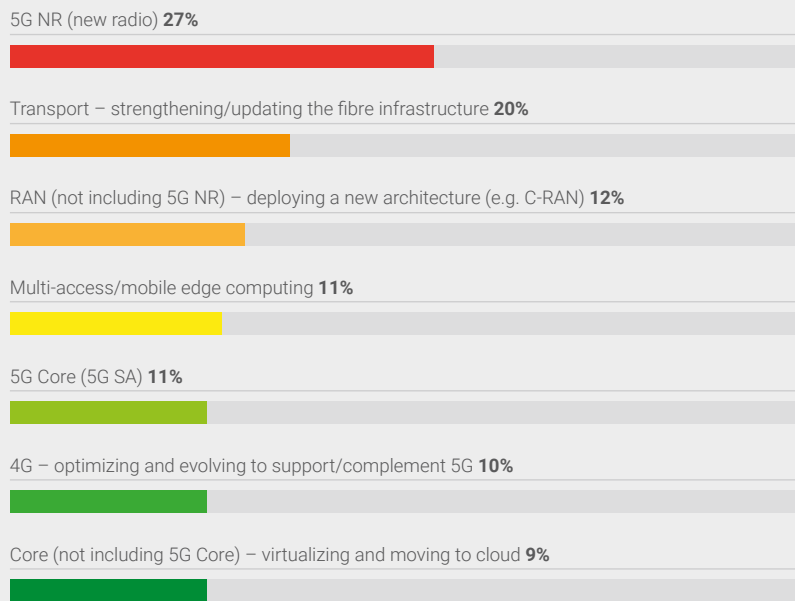
4G average, while the price of the unlimited package it offers on 5G started 68% higher than 4G. Driving such growth in data consumption were primarily entertainment services like ultra-widescreen broadcasting (12K UHD) over 5G, and live sports broadcasting.

Another high-ranking revenue generator, chosen by 22% of respondents, was industry automation or Industry 4.0. Again, it may take the industry a while to realise the full potential of 5G for industry use, as some scenarios will require standalone 5G. However, it does not mean the industry has to wait for standalone mode. Some industry cases can already benefit from the existing non-standalone 5G networks, while some cases that started in 4G environment can be hugely improved with 5G, smart homes and smart cities being the obvious examples. China Telecom, the world's largest integrated operator by subscribers, highlighted the 5G+Cloud+AI capability it will offer to industry customers, including industrial internet, smart cities, smart medical care, smart education, transport and logistics, and smart energy.

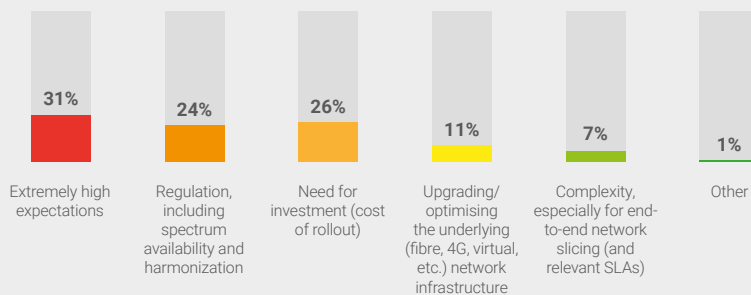
However, the industry needs to overcome some big challenges before these benefits can be realised. These include both technology and market challenges. On the technology front, 5G new radio (NR) is by far the biggest challenge identified by the experts, selected by 27% of them. This is to do both with radio access network (RAN) on new radio bands, and with related domains like network planning that the industry has yet to accumulate rich experience in. Transport systems related to upgrading fibre infrastructure (20%) and new RAN architecture like cloud-RAN (12%) were also seen as leading technology challenges.

When it comes to identifying the biggest market and business challenges, how to manage expectations was viewed as the

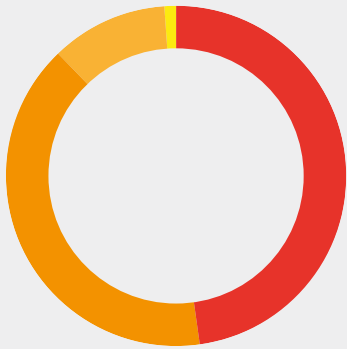
What are the top 5G technology challenges for MNOs?



What are the top 5G market challenges?



Should MNOs continue to invest in 4G evolution?



- Yes, 4G will continue to be key for years, even after the launch of (Standalone) 5G48%
- Yes, 4G is essential for the initial (Non-Standalone) 5G launches40%
- No, 4G will not be relevant for long11%
- Other1%

toughest task, chosen by 31% of the respondents, followed by the cost of rollout, selected by 26% of the respondents, and the regulation environment including spectrum availability and harmonisation, by 24%.

To overcome these challenges, the telecom experts believed that modernising legacy IT systems (25%), closely followed by investing in expertise (24%) and breaking down internal operational silos (22%) are the priorities for the industry in preparation for 5G. Furthermore, to ensure that 5G delivers, respondents picked end-to-end view of network performance and service quality (36%) and automation in all phases of 5G deployment (35%) as almost equal priorities.

However, not all legacies should be thrown out. The industry experts also recognised that, realistically, 5G will not achieve universal coverage any time soon. When asked if mobile operators should continue to invest in 4G, an



overwhelming majority of the survey respondents said yes. 40% of them believed 4G is essential for the initial non-standalone 5G launches, while a further 48% thought 4G will continue to be key for many years, even after the launch of standalone 5G.

Despite that legacy networks like 4G will be with us for a long time, 5G's momentum will not be hampered in any way. A most recent and extremely strong impetus to the 5G market is the simultaneous launch of commercial 5G service by China's three incumbent operators. Thanks to the sheer size of the market, China is poised to become the biggest 5G market shortly. According to the prediction of GSMA, an industry lobby group, China will have 600 million 5G subscribers by 2025, about 40% of the global 5G market. The momentum is definitely on. ●



Sponsor's Comment

5G is here, now. To a large extent, this survey reflects the telecoms industry expectations from 5G today (firstly) and in the future (secondly). For example, better customer experience is identified as the number-1 5G benefit. But if we count all responses and not just the first pick, adopting new business models (e.g. network as a service) comes out on top.

The survey respondents' views on the 5G relevance to verticals are interesting too. And so are the results on the revenue-generating 5G applications/services. While video and data dominate, industry automation shows up strongly to confirm the anticipated 5G role in robot/machine operation. Unsurprisingly, 4G is still significant for respondents. Investing in 4G, as part of an overall network transformation strategy, should not be overlooked.

Technology challenges wise, 5G new radio (NR) wins the first spot. But if we count all responses, the need to strengthen the – transport – fibre infrastructure leads. Undoubtedly, the underlying network infrastructure

is crucial for 5G. The results on market challenges and on how to best prepare for 5G (adding expertise, for example) are more-or-less in line with network operators' concerns.

Finally, to ensure that 5G delivers, the survey emphasises automation – in all phases of 5G rollout – and the end-to-end view of network/service quality. Network operators frequently refer to complexity, customer expectations and cost limitations as key challenges that call for advanced test, monitoring and analytics expertise, from deploying and optimizing network infrastructure to assuring and monetizing services.

The success of 5G, including end-to-end network slicing, mandates a unified view across layers and domains, built upon understanding network/service topology and relevance to customers/devices. 5G mandates actionable insights and intelligent automation to detect and resolve or to predict and prevent customer/device-impacting issues in real time. Can we make 5G a success? Yes, we can!



DIGITAL TRANSFORMATION

Deep understanding of what digital transformation entails, strong executive support, strategic shift, and a skilful workforce are all identified as key building blocks for digital transformation to succeed.



KEY TAKEAWAYS

- Telcos need to offer much more digital services to capture the new opportunities
- Deep understanding of digital transformation and strong executive support are viewed as key to success
- Cost alone is not a deal maker, but can be a deal breaker



Openet provides Digital and 5G BSS to enable service providers to create new revenues from digital services, improve customer engagement and be ready for the opportunities from 5G. Our solutions enable service providers to be more agile, innovative and enjoy a faster time to value. From monetising content and data services over 4G to enabling innovative enterprise IoT offers over 5G, Openet's Digital and 5G BSS offers a fast and agile alternative to the large legacy companies whose track record of over-charging and under delivering has resulted in high failure rates of large scale transformation projects. Since its foundation in 1999, Openet has been at the forefront of telecoms software development and innovation. Our success is personified by the many long-term relationships it has fostered with the largest, most progressive, and demanding operators across the globe. For more information visit www.openet.com.

DIGITAL TRANSFORMATION

Digital Transformation is such an inclusive concept that one is almost certain to receive as many different answers on the definition of digital transformation as the number of parties asked. However, one recognition is common among telecoms professionals: hardly any telecom companies would question the importance of digital transformation, no matter whether they see themselves already doing a great job, or still in the process of working out a plan.

The majority of the respondents to this survey also agreed that to succeed in digital transformation, a handful of key elements need to be in place at the same time: deep understanding of what digital transformation entails, strong executive support, strategic shift, and skilful workforce. All these options have been selected by over half of the respondents when they were asked to name the key success factors when their own businesses undergo digital transformation.

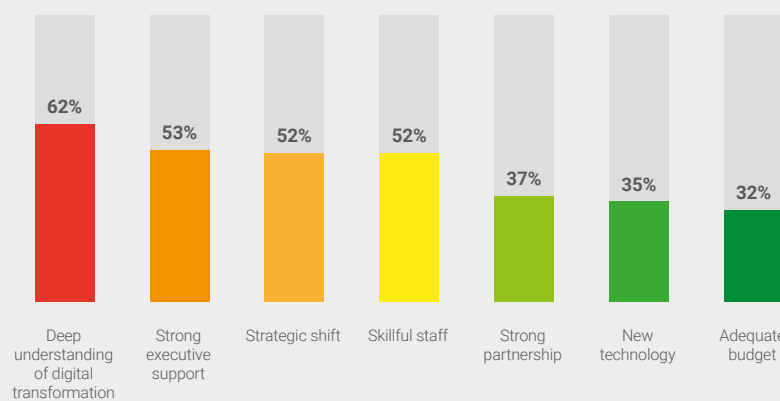
An example may demonstrate how the absence of sufficient understanding of what transformation means, coupled by the lack of skillsets among the staff, can be fatal to a company's transformation ambitions. A recent spectacular failure was the IT re-platforming to the cloud undertaken by TSB in the UK. Although cloudification of IT system is almost a default component of digital transformation programmes, the ill-prepared migration at TSB cost the bank £330 billion (including customer compensation, fraud, operational loss, waived fees and charges, and the cost to fix the new IT system), a churn of 80,000 customers, and the CEO his job.

Probably somewhat surprisingly, adequate budget ranks the lowest among all the key success factors on the list, chosen by less than a third of the respondents. This indicates that the majority of industry professionals recognise that money will not bring success without the bigger pictures in the right place. On the other hand, when it comes to judging the impediments to the success of digital transformation, cost of the transformation ranks almost as high as the insufficient understanding of the transformation, both issues selected by over 40% of

the participants. This in essence is the other half of the same recognition: although money alone is not enough to deliver success, the lack of financial commitment would almost guarantee a failure for any wish for a successful digital transformation.

Also seen as significant factors standing in the way of a company's successful undertaking of digital transformation are the concerns over legacy industries that may not be compatible with the desired status, and corporate inertia, both chosen by about one third of the respondents.

What are the key success factors when your company undergoes digital transformation? (Choose all that apply)

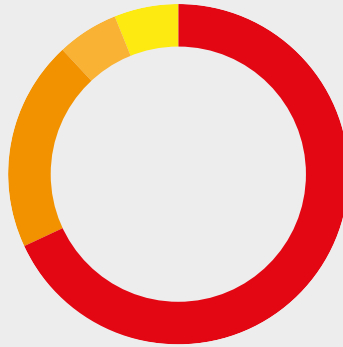


To transform, to move from connectivity provision to digital services requires telecom companies especially operators to rethink how they should organise their service portfolio. The large majority of respondents (69%) believed that operators should be prepared to offer many more digital services in the coming two years. Another 20% of them believed they should at least deliver the same number of digital services. This is understandable, because most operators are still largely focused on offering airtime, messages, and data packages, although more and more operators have started including digital services, in particular entertainment as add-on options. The content is primarily supplied by their OTT service partners.

In two years' time when 5G coverage becomes more extended, broader ranges of digital services enabled by 5G should be on the card. Naturally content partnerships continue to be seen as attractive, selected by 45% of the respondents as the most attractive options. Such partnerships have been tried and tested in 4G, and the experience will be even better in 5G. Meanwhile, thanks to 5G's technology properties, a sizeable number of respondents, one third of the total, saw enterprise partnerships, for example logistics, manufacturing, transport, as the most attractive

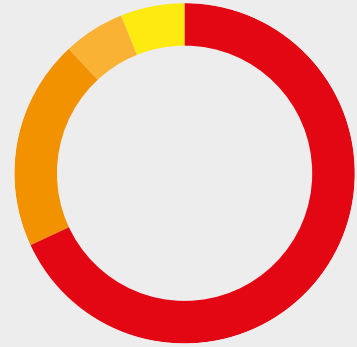
“ULTIMATELY THE OBJECTIVES OF DIGITAL TRANSFORMATION ARE TO DELIVER BUSINESS GROWTH THROUGH MORE EFFICIENT OPERATIONS, SHORTER TIME-TO-MARKET FOR NEW SERVICES, BETTER REVENUE AND PROFIT MANAGEMENT, AND IMPROVED CUSTOMER PROCESSES.”

To compare with current status, how many digital services (i.e. services other than voice, messages, and data packages) do you think operators should offer in 2021?



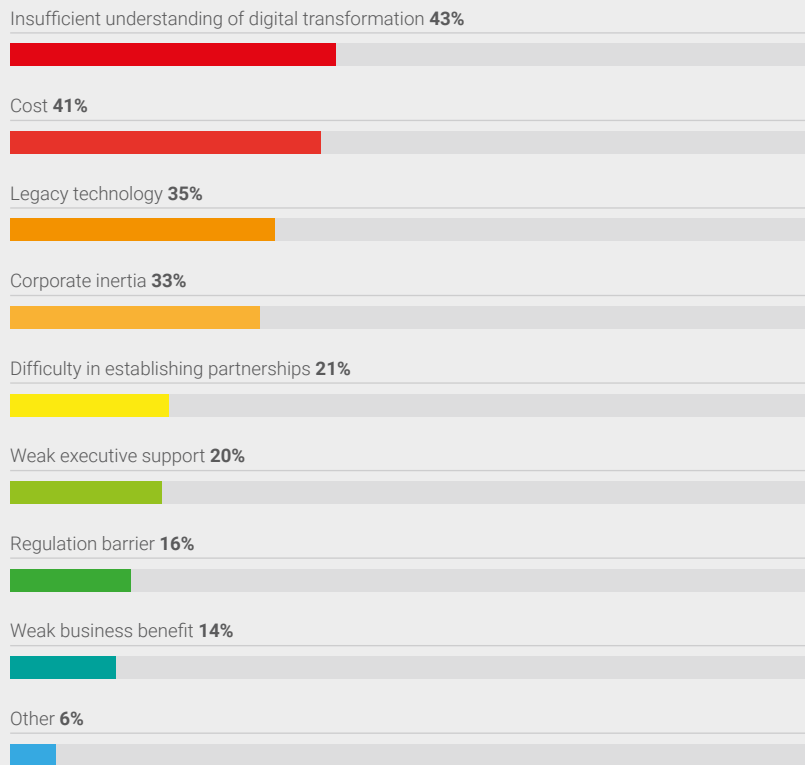
- Much more than the current number of offers.....**69%**
- About the same as the current number of offers.....**20%**
- Fewer than the current number of offers.....**6%**
- Not sure.....**6%**

What percentage of operators' revenue do you think will come from services that are provided by partners by 2021?



- Between 5% and 10%.....**38%**
- Between 10% and 20%.....**36%**
- Over 20%.....**16%**
- Less than 5%.....**10%**

What are the most significant factors standing in the way of your company successfully undergoing digital transformation?



partnering options. The key difference between the consumer facing content partners and the enterprise-centric partnerships is that the former can generate large volume of business with little customisation, while the latter may deliver much higher value for the telecom businesses but normally demand higher level of customisation and tighter time-to-market schedules.

When it comes to the expected monetary returns from the partnerships, the respondents showed cautious optimism. About three quarters (74%) of all those that answered the survey estimated that in two years' time, 5%-20% of all the operators' revenues would come from services that are provided by partners.

But the telecoms industry in general still adopts a mixed attitude towards the internet companies. While they generally see the content services, for example Netflix or Spotify, as partners, they tend to see the so-called "webscale" giants, for example Amazon, Microsoft, or Google, as the most formidable competitors. These are the companies that have in recently years overtaken the telecom companies both in customer relations

and in overall revenues, all while using the telecom networks to do so. Therefore, it may not come as a big surprise that this group came on top of the competitor list for over a third (34%) of the respondents.

Marginally more respondents (35%) identified other telecom operators as the main competitors. This raises a serious question for operators in competitive markets: how to differentiate from the competitors and to offer unique services to customers. This could be done by offering hard to copy services, for example forging exclusive partnerships. It could also be done through superior customer experiences, for example faster turnaround time using higher level of automation, one of the key goals of digital transformation.

Ultimately the objectives of digital transformation are to deliver business growth through more efficient operations, shorter time-to-market for new services, better revenue and profit management, and improved customer processes. Therefore it should be towards these objectives that telecom companies should plan how to optimise internally and how to transform at customer touch points. ●



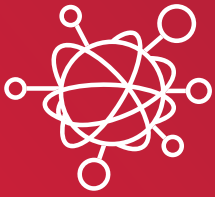
Sponsor's Comment

With 69% of respondents stating that operators need to offer many more digital services in the next two years underlines the need to accelerate transformation. Tie this in with the fact that 75% feel that 5% to 20% of operators' revenues will come from services provided by partners. The need to be able to deliver more services in a shorter space of time is more relevant than ever before.

This will be compounded by 5G. Operators have an opportunity to sell more partner sourced services that are enabled by faster 5G speeds. AR / VR sports and entertainment and gaming partnerships are just a couple of consumer services that can be delivered. But one of

the problems that operators will face is that many of the large content providers will probably not want to do exclusive deals. So operators need deliver the best experience with a wide range of tailored offers to help drive take up of content offers. These could include specific sports deals aimed at towns whose team reach a cup final, or for music services tied into a particular festival. These offers will have a short shelf life and a very targeted audience.

Being able to launch many focused offers will have an impact on BSS. Operators need to be able to configure these offers themselves in order to take advantage of the opportunities that are here.



IoT

The industry expects communication services to deliver end-to-end IoT solutions, while customers demand seamless user experience.

KEY TAKEAWAYS

- Smart cities are the greatest IoT opportunity outside of home
- Telcos should aim to provide end-to-end IoT solutions
- Standardisation fragmentation is a complicating factor



Incognito Software Systems Inc. provides service orchestration software solutions that help service providers manage the next-generation broadband and IoT experience. We offer a productized IoT solution that enables CSPs to provide value-added IoT services to enterprise customers. The Incognito solution provides remote device management of millions of IoT devices, streamlined device onboarding, big data platform for analytics, and storage of device telemetry data for business applications, coupled with extensive automation. With a proven track record of 20+ years of experience working with global service providers, Incognito brings best in class productized software solutions that deliver operational efficiency, time to market advantage, and a great service quality experience.

IoT

The concept of connected things has been with us at least since the 1980s, and the term Internet of Things (IoT) was already invented by the turn of the century. However, IoT as a massive business only caught the imagination of mainstream market since the telecom technology, including 4G, became widely deployed, and connected devices hit the market.

The 2019 survey highlights that survey respondents are well progressed with IoT. 46% of those that answered the survey claimed that their companies have already launched IoT, with a further 29% planning to invest in IoT businesses within the next 2 years.

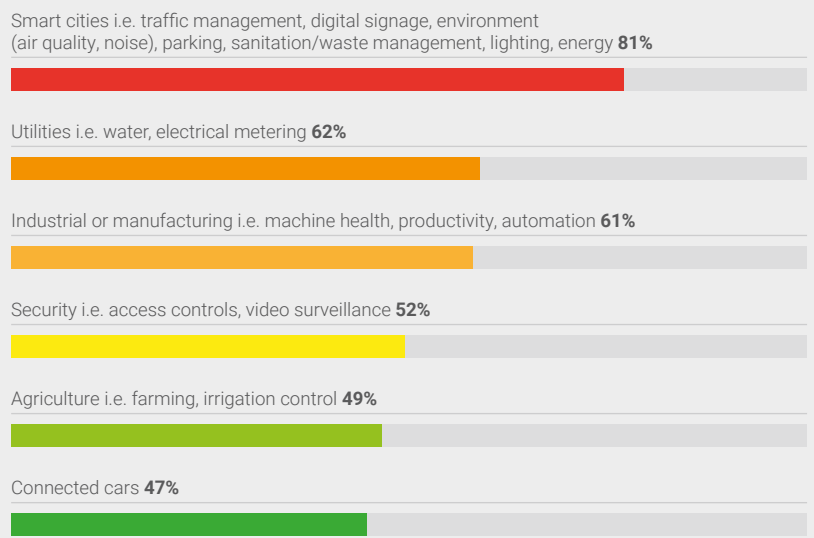
In the consumer IoT domain, the most broadly deployed use case is smart home. Apple is active in incorporating the smart home market in the iOS ecosystem, through its HomeKit software. Both Google, through its acquisition and integration of Nest Labs, and Amazon, with its Alexa platform, have also provided their own solutions to smart home management.

So what's next? 81% of the survey respondents believed smart cities presented the greatest IoT opportunity. Some of the prominent components of smart cities include applications such as vehicle to everything (V2X). From autonomous driving to preventive alert systems, we have seen different scales of trials carried out from California to Seoul, from Helsinki to Singapore. Additionally, we are seeing traffic management, digital signage controls, environmental platform management for air quality and noise, as well as smart parking, smart waste management, lighting and energy controls, even flood sensors in Asia.

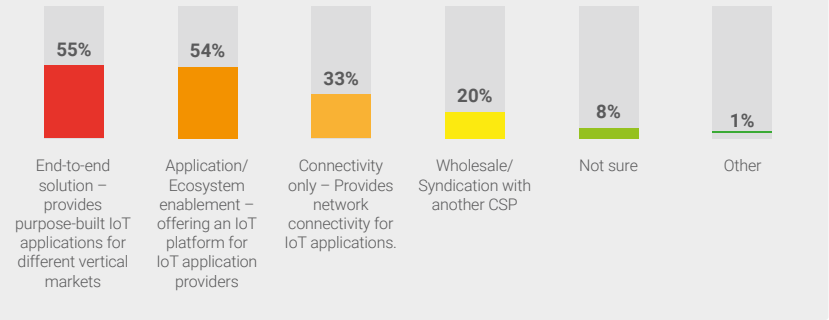
Coming second to smart cities, 62% of survey respondents chose smart metering for electrical and water utilities as the next biggest IoT opportunity. This would include both the customer premise devices, for example monitoring, alert, display, and the back-end networks, encompassing connectivity, security and operational support systems. Communication service providers currently play a key role supporting the wide-area smart metering networks with many of them starting

“ 81% OF THE SURVEY RESPONDENTS BELIEVED SMART CITIES PRESENTED THE GREATEST IOT OPPORTUNITY. SOME OF THE PROMINENT COMPONENTS OF SMART CITIES INCLUDE APPLICATIONS SUCH AS VEHICLE TO EVERYTHING (V2X). ”

Where do you see the greatest IoT opportunity other than home automation? (Choose all that apply)



Which IoT offering models from CSPs do you expect to see in the market within the next 24 months? (Choose all that apply)



to evaluate the business case for monetizing data telemetry from millions of devices.

Almost equal number of respondents (61% of all) selected industrial and manufacturing automation as a significant IoT opportunity spanning machine health, predictiveness maintenance, productivity and efficiency.

39% of survey respondents indicated in 2019 the most prevalent business model as an end-to-end full stack IoT solution. Application/ecosystem enablement scored second with 28% of responses, meanwhile connectivity arrived in a close third with 23% of responses.

But over half of all respondents (55%) expected to see such end-to-end offers from telecom operators in two years' time, by which they can provide purpose-built IoT applications for different vertical markets. Almost equal number of survey respondents (54%) expected to see communication service providers play a platform role to enable IoT application providers to deliver services. But a significant minority (33%) also expected that communication service providers would still be providing connectivity only services by that time frame.

These results could indicate that to capture the true value of the IoT opportunities, service providers should move up the value chain beyond

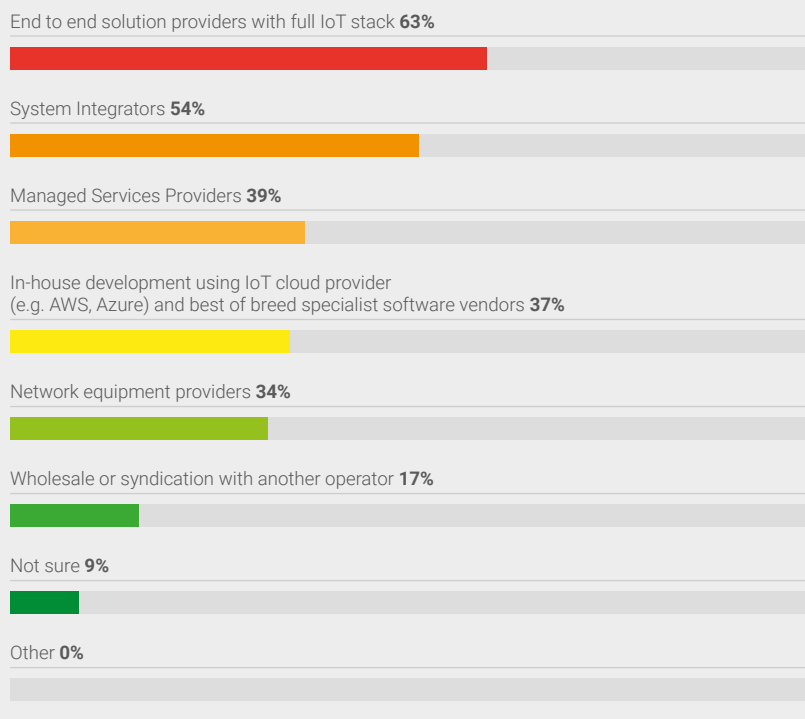
connectivity, to build vertical specific offerings with end to end platform solutions.

To achieve the upward movement on the value chain, communication service providers need to choose partners with IoT expertise to support their IoT strategies. Nearly two-thirds (63%) believed the best partners should be those delivering end-to-end solutions with full IoT stack. Over

half (54%) of the survey respondents also saw system integrators well-positioned to be strong partners. Indeed, providing end-to-end solutions or playing a prime aggregator role are paths for service providers to maximize their values in the IoT ecosystem.

The overall customer experience is top of mind when it comes to IoT services, where service quality and operational efficiency become critical to meeting stringent service-level agreements. This is where IoT device management plays a critical role. Respondents highlighted a number of critical functions to ensure service quality while keeping OPEX in check. Zero touch provisioning scored highest at 59%, followed by automated device discovery at 50%. The automation theme continued with 47% highlighting automated diagnostics and fault management. Remote visibility of device health scored at 45%. Overall the general

Which types of partners are best positioned to support communications service providers' IoT strategies? (Choose all that apply)

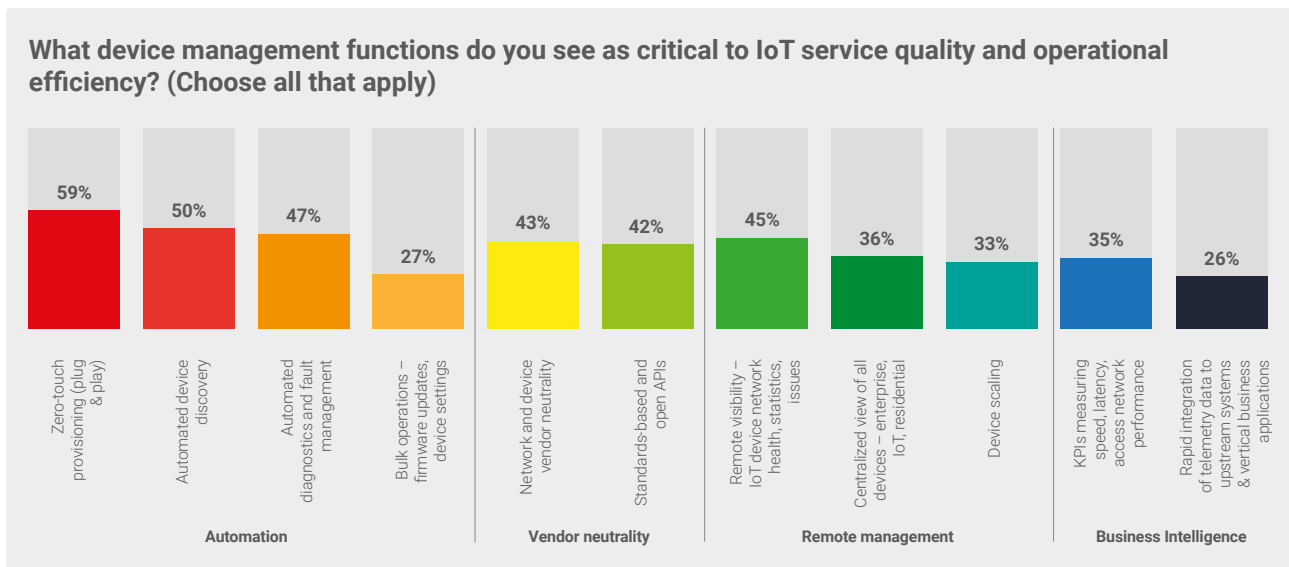


underlying themes were around automation, remote management, vendor neutrality and standards, also coupled with support for business intelligence applications with ease of integration and extensive KPI management functions.

Another IoT ecosystem complicating factor is standard fragmentation - unlike mobile technologies which are standardised across the industry. Even within the wide-area IoT segment,

which is projected to experience much faster growth than short-range IoT (albeit from a smaller install base), several standards are in competition. This is also reflected in the choices made by the survey respondents. Almost half of respondents (49%) saw NB-IoT and LTE-M as the most important standards, but a sizeable group (28%) also selected LoRa. MQTT (19%) and LwM2M (20%) scored nearly equal weights at the protocol level while CoAP scored low (9%).

Regardless of IoT standard fragmentation or convergence, the market potential is massive. Ericsson predicts 4.5 billion wide-area IoT connections by 2024, while Global Market Insights forecasts a wide-area IoT market worth \$65.5 billion in 2025. Communications service providers and partners are well positioned to capitalize on this global opportunity. ●



Sponsor's Comment

The enterprise or industrial IoT opportunity has the potential to be a game-changer for communications service providers (CSPs) who can bundle connectivity with other value-added services for enterprise IoT customers. CSPs will face operational challenges in managing millions of devices supported by stringent service-level agreements.

The 2019 industry survey highlights that automation, remote device management, vendor neutrality, and the ability to offer business intelligence applications are clearly top of mind in delivering an outstanding service quality experience. CSPs' IoT business models and strategies will continue to develop over the next

24 months. While 27% identified the enterprise service department as leading the IoT strategy, the CTO office still has a strong influence cited by 18% of respondents. In terms of business model, the "connectivity only" model garnered 33% of the votes, while IoT platforms for applications (54%) and purpose-built applications (55%) are considered to be the models that will dominate. These results reinforce the need for common multi-tenant platforms that extend multiple vertical market capabilities and control to enterprise customers. Core capabilities of these platforms will include remote device management across multiple device vendors, analytics engine to capture business insights, and a customizable user interface that can be adapted to serve multiple vertical markets.



OSS BSS

Modernising both the network-facing and customer-facing support systems is a strategic imperative as well as a competitive necessity.

KEY TAKEAWAYS

- B2B sector represents the greatest growth opportunity
- Customisable network service and self service will become highly demanded features
- Automation of BSS is the future, but first the support system should move out of silos



MDS Global is a leading BSS-as-a-Service provider of VNO, B2B and IoT solutions. We look after all aspects of monetisation, assurance and customer steering for complex products and services. We offer a digital operating model in a DevOps context, which enhances stakeholder experiences and provides unprecedented business agility. Headquartered in the UK, MDS Global's customers include BT Business (UK), eir (Ireland), iD Mobile from Dixons Carphone (UK), TalkTalk (UK), Telefónica (UK), Vadsa (Mexico), Parlem (Catalonia), Vodafone (Germany, Greece and Belgium), Orange (Belgium), KPN (Netherlands) and Telia (Denmark).

For more information, please visit www.mdsglobal.com.

OSS BSS

As telecom companies are going through digital transformation, one of the foundational functions to modernise is the service delivery and management infrastructure, including the Operations Support System (OSS) and Business Support System (BSS). Although the two components are often talked about in the same breath, they are two different systems and have very different functions.

OSS interfaces with the network, therefore, is tasked to provide service assurance, network configuration, provisioning, and network governance and usage control, among others. BSS is customer facing, which means the system is responsible for customer management including customer care and CRM, revenue management, product life-cycle management, and so on and so forth.

Telecom operators with legacy networks have accumulated layers of OSS as new network components, for example 3G, 4G, then 5G, are added. Also, when new services are launched, be they operators' own value-added services or through partnerships or acquisitions, they often come with their own BSS. Additionally, many operators use different BSSs for different business lines. The result is complex management systems, often running on different platforms, that need a large amount of human intervention, and are prone to errors and even network failures.

Therefore, telecom operators have every incentive to modernise their OSS and BSS to a higher level of automation and reliability. This is not only a means to minimise the risk of network failures, but also to lower the cost and complexity to serve customers, as well

as to improve the time and experience of customer management. Both OSS and BSS are critical for the success of business, but this section of the survey focuses specifically on BSS, its current status and its future.

A significant benefit of modern BSS is the capability to enable high degrees of flexibility and customisation for both the service providers and customers. This is especially important in 5G with its strong virtualisation and software centricity characteristics. All customers will find these capabilities beneficial, but it is more relevant in the B2B sector.

This is not only because business customers have higher demand for both assurance and customisation, but also because they represent the greatest business growth opportunity for most of the telecom professionals that answered the survey. 80% of the survey respondents saw B2B service as a strategic growth area for their companies.

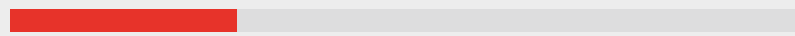
When asked to rank the types of customers that will generate the highest revenue growth in the future, 84% of them chose B2B sectors, including large enterprises (30%), small- and medium-sized enterprises (SMEs) (19%), small office / home office (SOHO) (17%), as well as public

sector customers, and wholesale partners, for example MVNOs. Most of the telecom professionals who answered the survey said their companies have implemented BSS stacks for their business customers separate from the consumers. Defined by service level agreements (SLAs), business customers often demand higher level of customisation, shorter time to market for new services, and tend to be less tolerant of failures. But, at the same time, they are also less sensitive to prices, to compare with the consumer market. Therefore, they demand a different digital engagement approach.

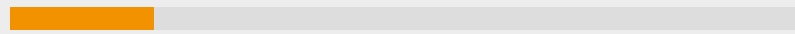
“ CURRENTLY, MOST OF THE BSSS RUNNING ON COMMUNICATION SERVICE PROVIDERS’ NETWORKS OPERATE IN SILOS TO SUPPORT SPECIFIC BUSINESS LINES AND SERVICES, WHICH REQUIRE STAFF WITH SPECIALISED KNOWLEDGE AND SKILLS TO CONSTANTLY MONITOR AND INTERVENE. ”

Which segment do you consider 5G will provide major revenue growth?

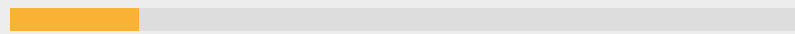
B2B Large Enterprise Services (including Networking, Voice, Mobile, IoT and Office Productivity) **30%**



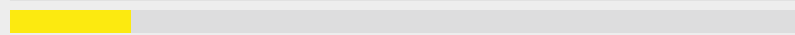
B2B SME Services (including Voice, Mobile, IoT and Office Productivity) **19%**



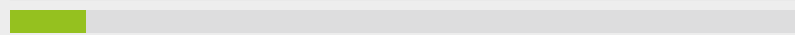
B2B SOHO Services **17%**



B2C Services **16%**



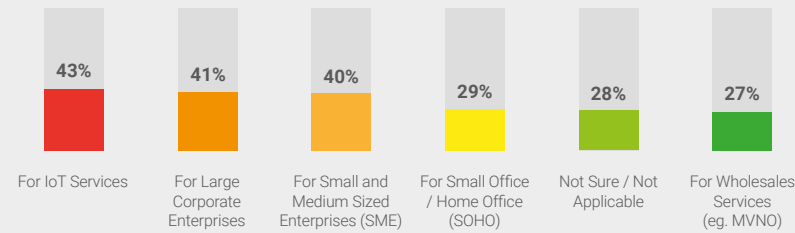
B2B Government Services (including Networking, Voice, Mobile, IoT and Office Productivity) **10%**



B2B Wholesales (including MVNO) **8%**



Are you considering allowing B2B customers to customise their network services, once you have an appropriate SDN/NFV network service environment? (Choose all that apply)

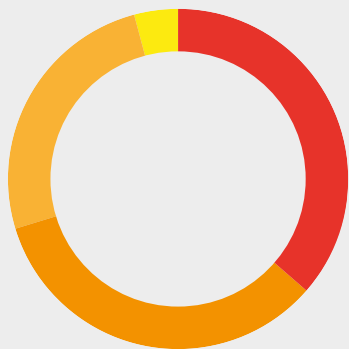


One element of such engagement is the ability to customise network service offers. This will become a highly demanded feature when end-to-end 5G is available. The survey respondents ranked three types of businesses they would prioritise such customisation offerings: IoT services, selected by 43% of the respondents, large enterprise customers by 41%, and SMEs by 40%.

One concrete example of this type of customisable network services is network slicing. With an appropriate SDN/NFV network service environment in place, 5G operators can let their business customers define and choose their own network slices. The main driver behind such demand is the difference between businesses. For example, an IoT service would need massive access but not necessarily low latency, an autonomous car operator would first and foremost demand low latency but not necessarily high throughput, while a live streaming service would demand high throughput and high reliability.



Does the ability to provide custom network services (via SDN/NFV enabled network and services) trigger major BSS B2B changes?



- Yes, within the next two years37%
- Yes, in the next two to five years.....34%
- Not sure.....26%
- No.....4%

Therefore, signing up to a generic purpose virtual private network, a “slice”, from the 5G operators does not necessarily satisfy the business’ specific needs. Instead, the business customer should be able to configure its own slice based on its demand as well as the SLA with the operators. Specifically, the parameters the customer can define should include bandwidth, latency, availability, and geographic coverage. Hutchison Drei Austria has tested a “Slice Store” specifically for this purpose.

Meanwhile, the survey respondents also recognised the enormity of the task in front of them if they are going to hand over the customisation power to their customers. When asked if the ability to provide custom network services would trigger major BSS changes in the B2B customer interface, 37% of all respondents believed big changes would take place in the coming two years, while a further 34% saw the change coming in the next two to five years.

The specific shape of the changes will manifest itself as 5G, especially end-to-end standalone mode, is more broadly deployed, and NFV and SDN enabled. However, the direction of the change is clear. Currently, most of the BSSs running on communication service providers’ networks operate in silos to support specific business lines and services, which require staff with specialised knowledge and skills to constantly monitor and intervene.

The future of BSS lies in automation, which should support self-service by the customers and be able to undergo continuous innovation. This first will need the BSS to move out of the siloed mode to an operating platform that enables automated workflow processes that follow business policies defined by the staff. The staff’s job will evolve from constant intervention to continuous improving business policies, relying on network-wide visibility of data and increasingly on AI and machine learning, to make the support systems agile and efficient. ●

Sponsor’s Comment

Most communication service providers (CSPs) today have separate monetisation stacks for their consumer and enterprise businesses, mainly because of the differences in the use cases, revenue models and underlying processes for these segments.

The consumer monetisation stack has attracted significant investment over the years driven by the need to automate and digitalise the customer experience in a highly price sensitive and data-focussed market, while the enterprise monetisation stacks have been mostly ignored. This has resulted in the enterprise monetisation systems falling behind in terms of service experience, efficiency and self-personalisation for many B2B segments.

There is now however an increasing focus on enterprise needs due to 5G, a growing SME market and the Internet of Things (IoT). Some CSPs are considering extending their consumer monetisation stacks to support emerging and essential business-to-business (B2B) use cases. While this

approach may seem cost-effective in the short-term, in the long run this will result in a highly complex and costly BSS solution that doesn’t service either sector optimally. Most incumbent monetisation stacks are focused primarily on business-to-consumer (B2C) processes that sell high-volume fixed products with basic controls for service personalisation, framework credit management, end-user group controls, group usage analytics and more – all core needs for enterprises who operate using different business workflows and via alternative routes-to-market. In addition CSPs also need to prepare for true service agility with the launch of 5G and SDN/NFV driven service architectures, designed predominately for enterprises services.

A ‘designed-for’ B2B BSS platform, delivered as a cloud service, enables cost-efficiency and dedicated service delivery. It features new digital engagement tools designed for efficient and personalised interaction with enterprise markets, resellers and partners.

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