The Urban Unconnected

White paper – IHS Markit and Wireless Broadband Alliance (WBA)

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The Urban Unconnected – challenging, efforts, and opportunities on the path towards a digital society

This research was commissioned by the Wireless Broadband Alliance (WBA) to the research and consulting firm IHS Markit. The white paper is the result of the research conducted on the topic of the digital divide and urban unconnected across eight leading countries (Brazil, China, Germany, India, Japan, Russia, the United Kingdom, and the United States of America) with deep dive studies provided for five global cities.

The cities researched for this white paper are Sao Paulo, Delhi, Moscow, London, and New York and they were selected because of their national and global significance and in order to provide a global picture with comparative insights collected from different regions. Each city's deep dive provides a qualitative analysis of the city's challenges and initiatives in regards to the digital divide and urban unconnected issues as well as a qualitative analysis of the impact of digital inclusion in the life of the city and its citizens.

This white paper delivered significant results providing insight and intelligence on many topics including the issue of the digital divide, the dynamics of urban and rural unconnected individuals, and on the impact of connectivity in the life of citizens. The research was carried out through primary and secondary research and was complemented by interviews with city authorities and experts on the issue of digital divide and connectivity.

For the purpose of this report an unconnected individual is defined as an individual who does not have access to or cannot afford broadband connectivity. Sources used for this white paper include, among others, national statistical offices, city statistical offices, national telecoms regulators, city departments websites, internet usage or adoption surveys, IHS Markit proprietary data, and other sources such as the International Telecoms Union (ITU), the United Nation, and the World Bank.

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Key takeaways and top level findings

The digital divide is still a global and local challenge: the digital divide between individuals who are connected to the internet and those who are not is a global problem faced by countries from all regions. In a world which is rapidly digitizing, ensuring that no individual is left behind is a common priority.

- **31.46%:** is the average percentage of unconnected population among the eight countries analyzed in this research (Brazil, China, Germany, India, Japan, Russia, the United Kingdom, and the United States of America). The United Kingdom has the lowest number of unconnected individuals (8.384 million) while India has the highest number of unconnected population (853.386 million).
- **Connecting the unconnected:** while internet adoption in cities has been faster than in rural areas, this does not mean that cities do not face the challenge of the digital divide. Individuals who do not access or cannot access the internet are present in both rural and urban areas, in both developing and more mature markets. The number of urban unconnected is higher than that of rural unconnected in all the researched countries with the exception of China and India.
- **23.76% and 44.17%:** are the average percentages of urban and rural unconnected population respectively found among the eight researched countries.
- **London is leading the way to a connected society:** among the cities analyzed in this research (Sao Paulo, Delhi, London, Moscow, and New York City), London has the lowest percentage of unconnected population (7.11% of total population), corresponding to 625.336 unconnected individuals.
- **Internet adoption varies greatly even among international global cities:** the average percentage of unconnected population in the five cities is 20.23%. Delhi and Sao Paulo have the largest number of unconnected citizens with 5.331 (29.20%) and 4.349 (36.13%) million respectively. Moscow's unconnected citizens are 1.231 million or 10.0% of population, while New York City's unconnected are 1.600 million or 18.74% of total population.
- **There are multiple barriers to digital inclusion:** various factors are responsible for people and individuals being unconnected; some are financial, for instance the limited spending power of certain segments of society, while others are related with the availability of adequate technology to access the internet or to the lack of awareness to internet generated benefits or the lack of adequate IT skills.
- **Bridging the digital divide is essential for the creation of truly smart cities:** ensuring that citizens are connected is one of the key pillars which are necessary for the creation of smart nations and smart cities. Connecting individuals is not the end target but is the base to create further opportunities.
- **National governments and cities are working to foster digital inclusion:** multiple initiatives have been developed to foster internet adoption both in urban and rural areas; from national strategies targeting society's digitization, to specific city's initiatives such as incentives and Wi-Fi kiosks, multiple actors are involved in bridging the digital divide.

Comparison and analysis of unconnected individuals by country

Highlights - unconnected individuals by country

- **Western Europe is leading the way to a connected society:** in the United Kingdom 12.83% of population is unconnected while in Germany 13.00% of population is unconnected.
- **India and China are the countries with the highest numbers of unconnected citizens:** in China 47.01% of total population do not access the internet while in India 68.55% of population is unconnected.

Table 1 - Unconnected individuals by country

Country	Region	Total unconnected individuals (Million)	Total unconnected individuals as % of total population
Brazil	Latin America	90.638	43.25
China	Asia Pacific	649.388	47.01
Germany	Europe	10.683	13.00
India	Asia Pacific	853.386	68.55
Japan	Asia Pacific	20.241	16.04
Russia	Europe	39.335	26.85
United Kingdom	Europe	8.384	12.83
United States	North America	78.401	24.18

Connecting the unconnected is still a major challenge for countries all over the world. Among the eight countries a total of 1.75 billion individuals are still unconnected with the average percentage of unconnected citizens being 31.46%. As proven by the mix of developing and more mature markets, bridging the digital divide is a task for all national governments.

There are significant differences among the analyzed countries. India is the country with the highest number of unconnected individuals with 853.386 million people who do not access the internet representing 68.55% of total population. China has also nearly half of its population unconnected as 47.01% of total population corresponding with 649.388 million individuals remains unconnected. As expected, among the countries in the Asia Pacific region, Japan has a lower level of unconnected population with 20.241 million individuals (16.04% of population) that are still unconnected.

Europe is leading the way in terms of digital inclusion with the United Kingdom and Germany's percentages of unconnected population just above 10%; the United Kingdom unconnected population is 12.83% of total population (8.384 million) while Germany unconnected population is 13.00% (10.683 million). Russia's unconnected individuals are 26.85% of total population corresponding to 39.335 million people. The digital inclusion in the Americas shows that in the United States 78.401 million individuals (24.18% of population) are still unconnected, while in Brazil, 90.638 million individuals are unconnected representing 43.25% of the country's total population.

Overall, barriers to internet adoption tend to be similar across the analyzed countries, with the main challenges to expanding internet users being: financial, technological, demand (i.e. perception of benefits), usefulness (i.e. relevant and localized content), and IT literacy. While these challenges tend to overlap, the impact of certain challenges is stronger in different regions and geographies. Each challenge has also many facets as for instance IT and tech literacy

barriers can be interpreted as the lack of knowledge how to use technology and digital tools to expand or create new businesses or opportunities, or not knowing how to be connected, or the lack of confidence in using online services.

There are multiple stakeholders that are working to solve the problem of the digital divide from national governments and city councils to the private sector and charities. With the main challenges known, initiatives are underway to increase connectivity at national and city level. For instance, India is actively looking to foster its digital sphere thanks to its Digital India Strategy. Another example of an initiative addressing the issue of the digital divide is provided by the European Union, which in May 2017 agreed to provide EUR120 million to fund the WiFi4EU project supporting the installation of free public Wi-Fi hotspots in communities and public spaces across Europe.

While many stakeholders work to expand digital inclusion, the challenge to bridge the digital divide and bring people online has not been overcome yet and it continues evolving. For instance, the type of connectivity and the speed available for users are key challenges that countries are currently facing along with the expansion of internet availability.

Comparison and analysis of unconnected urban and rural individuals by country

Highlights - unconnected urban and rural individuals by country

- **The digital divide is still a challenge for both urban and rural areas:** among the eight countries the average percentage of urban unconnected is 23.76% while the average percentage of rural unconnected is 44.17%.
- **The United Kingdom, Germany, and Japan have the lowest number of urban unconnected individuals:** with 7.054 million, 7.172 million, and 17.809 million respectively. In the majority of countries the number of urban unconnected is higher than the one of rural unconnected.

Table 2 - Urban and rural unconnected individuals by country

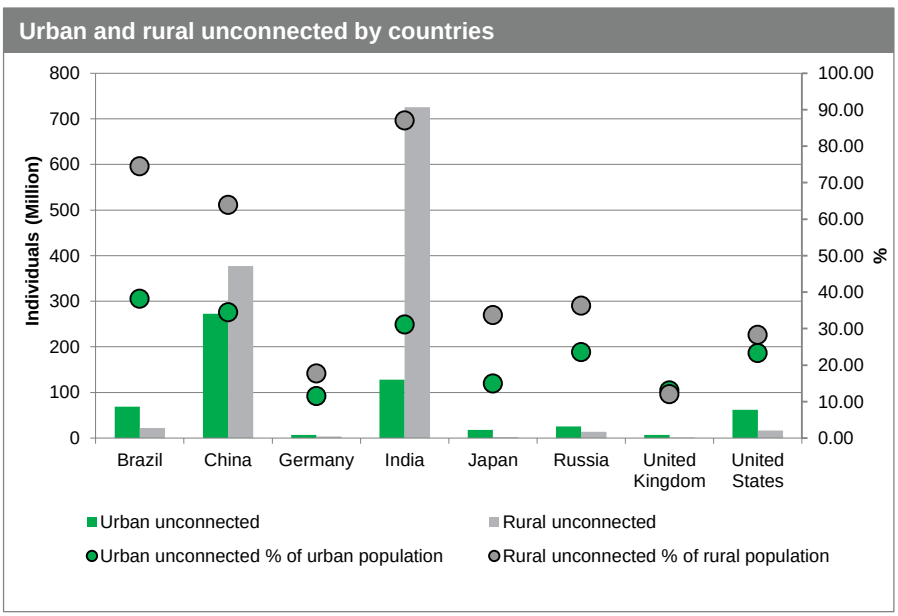
Country	Region	Urban unconnected (Million)	Urban unconnected as % of urban population	Rural unconnected (Million)	Rural unconnected as % of rural population
Brazil	Latin America	68.775	38.16	21.863	74.50
China	Asia Pacific	272.483	34.44	376.905	63.86
Germany	Europe	7.172	11.50	3.511	17.72
India	Asia Pacific	128.272	31.14	725.113	87.05
Japan	Asia Pacific	17.809	14.97	2.432	33.66
Russia	Europe	25.575	23.55	13.760	36.31
United Kingdom	Europe	7.054	13.00	1.329	12.00
United States	North America	62.125	23.29	16.276	28.29

Unconnected population is a challenge found in both urban and rural areas as multiple factors are influencing the countries' dynamics shaping this issue. In large developing countries, the likes of Brazil, India, and China there is a wide gap between urban and rural unconnected, while in more mature markets the gap between urban and rural unconnected is fading away.

While the lack of internet access will always be the result of multiple connected factors, selected features weigh more heavily in shaping the numbers of unconnected individuals in different countries. In more mature markets, technology availability may not be a primary barrier slowing internet adoption, while the high price tag of internet services may still be a defining factor opposing internet adoption, especially among certain segments of the population. Contrarily technology availability can still be a significant barrier in rural environments. The importance of the geographical extension and population density of a country should not be underestimated while assessing the number of unconnected individuals as they are key factors further complicating the issue of the digital divide. Bringing connectivity to large isolated areas presents significant technical and financial challenges. With network deployments and coverage usually prioritizing those areas that present a better return of investment (ROI) such as cities, it is no surprise that rural areas in developing countries tend to lag behind in terms of internet penetration. Delivering relevant content and services for citizens is also a key challenge which is affecting both urban and rural areas.

More mature markets have higher percentages of internet penetration in urban areas, but more significantly have also reached a more balanced scenario between the percentages of urban and rural unconnected. The United Kingdom presents an extremely low and balanced scenario regarding the urban and rural unconnected which are 7.054 million (13% of urban population) and 1.329 million (12% of rural population) respectively. Germany also presents a well-balanced scenario with 11.50% (7.172 million) of urban population unconnected and 17.71% (3.511 million) of rural population unconnected.

The total of unconnected urban citizens among the eight countries is 589.265 million while the total of unconnected rural citizens among the eight countries is 1.161 billion; however; it must be noted that the large rural populations of China and India are strongly influencing this result. High percentages of urban unconnected individuals as in the case of Brazil (38.16% of urban population) show that the issue of unconnected individuals is still a key obstacle for cities.

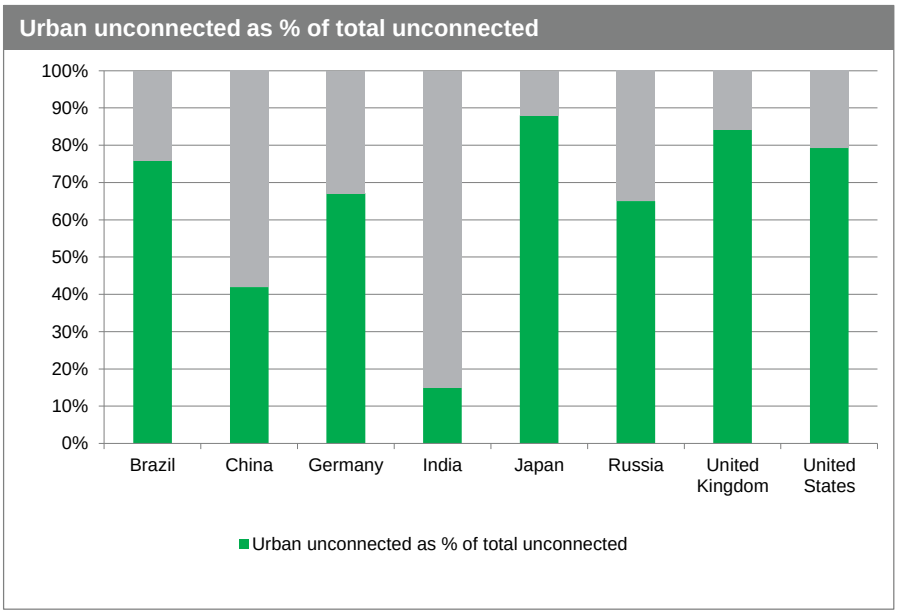


While the percentages of unconnected urban individuals are smaller than the percentages of unconnected rural individuals, the fact that in most countries the majority of population resides in cities means that the number of urban unconnected per country tends to be higher than the number of rural unconnected. The two significant exceptions are India and China, both countries with very large rural populations.

As shown in table three, unconnected urban population represents the majority of unconnected individuals across most countries, a fact that highlights that the digital divide of the urban unconnected is still a central issue that cities and governments need to solve to bring the full potential of the digital society.

Table 3 - Urban unconnected as % of total unconnected

Country	Urban unconnected as % of total unconnected
Brazil	75.88
China	41.96
Germany	67.13
India	15.03
Japan	87.98
Russia	65.02
United Kingdom	84.15
United States	79.24



Comparison and analysis of unconnected individuals by city

Highlights - unconnected individuals by city

- **London leads the way to a digital society:** with the lowest number of unconnected citizens (625.336), while Delhi has the highest number of unconnected citizens at 5.331 million.
- **Cities are working to increase digital inclusion:** the problem of the digital divide has many roots, from financial to socio-cultural reasons, and cities are tackling them with multiple initiatives from deploying Wi-Fi hotspots to free IT courses and financing programs.

Table 4 - Unconnected individuals by city

City	Country	Region	Total unconnected (Million)	Total unconnected as % of total city population
Sao Paulo	Brazil	Latin America	4.349	36.13
Delhi	India	Asia Pacific	5.331	29.20
Moscow	Russia	Europe	1.231	10.00
London	United Kingdom	Europe	0.625	7.11
New York	United States	North America	1.600	18.74

Unconnected individuals miss out on many benefits and opportunities from generating savings to personal development and civic participation. Among the main benefits of being connected stands out the creation of savings as the internet is a portal that can be used to purchase goods at a cheaper price compared to store retail. Besides goods, services can also be booked or purchased online in advance very often at a discount rate. Being connected also helps people's social

interactions. For instance, isolated people or people with limited mobility have the chance to interact with other persons through the use of social networks. Connectivity and the internet can also be used for personal and professional development looking for and applying for jobs and taking online courses.

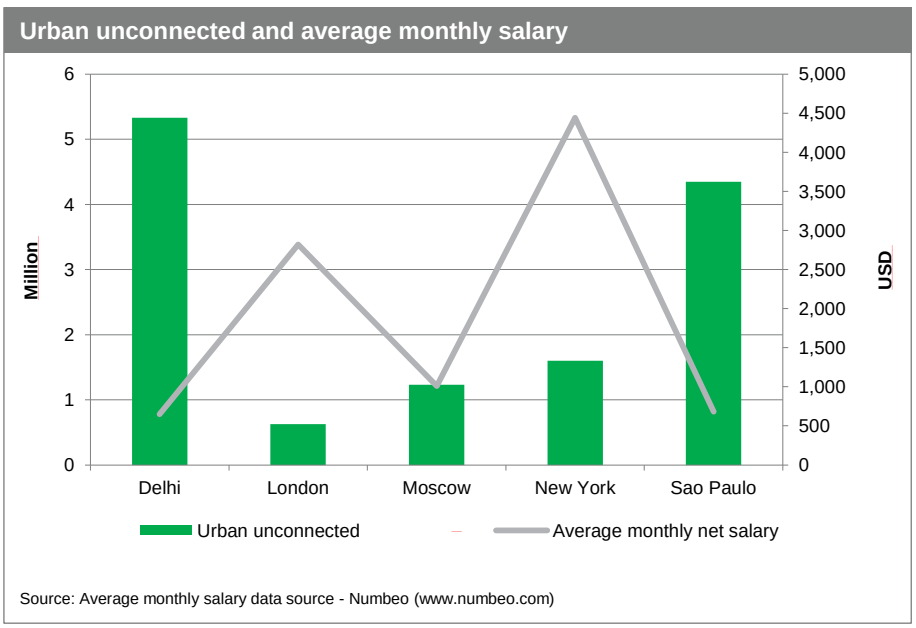
Connectivity brings benefits to citizens but also to cities as they can generate savings and improve their efficiencies by increasing the use of e-services. Digital inclusion is an engine for economic growth for the city, the nation, and for businesses of all sizes as it helps to attract investments, start new companies, and stimulate innovation. Being connected is also essential to provide a citizen-centric experience. Shaping the city to the individual's needs is pivotal in today's world where citizens across the globe expect the same level of service and experience from the private and public sectors. Cities are not alone in driving digital inclusion as they are often supported by the private sector, the national government, regional authorities, citizens and other organizations.

Table four shows that even among global cities the level of connected and unconnected citizens varies greatly. London is the most connected city with only 7.11% of population unconnected. Moscow has been working on many fronts to face this issue and its rate of unconnected citizens is of 10.0%; New York City unconnected population is 18.74% of total, while Delhi and Sao Paulo have 29.20% and 36.12% of unconnected population respectively.

While each city faces similar challenges such as financial, technological, demand (perception of benefits), usefulness (for instance localized and relevant content in the local language), and IT literacy, each city is unique and while global themes are shaping the number of unconnected citizens, local factors are defining the problems that each city is facing.

For instance, in the case of New York, one of the greatest barriers is the quality and affordability of internet connections, issue which mostly impacts those segments of the society with more limited spending power. For certain Londoners IT skills and an understanding of the benefits provided by being connected are, along with spending power, key challenges to internet adoption. Moscow has faced specific challenges related with infrastructure, developing an integrated approach to promote internet adoption, and ensuring a high standard and quality of internet services.

The digital divide, personal resources, and economic development are related. As shown in the chart below, those cities with lower average salaries tend to have a higher number of unconnected citizens highlighting the connection between the level of citizens' economic capabilities and digital inclusion. However, it must be noted that even among those countries with higher average salaries the existence of economic and social divides significantly shapes the issue of the digital divide.



Deep dive: Delhi (India)

Facing the issue of the urban unconnected towards digital inclusion

Among the cities analyzed for this white paper, Delhi has the highest number of unconnected individuals with 5.331 million unconnected citizens representing 29.20% of its population. As for many other large cities, Delhi needs to face multiple challenges to expand internet adoption and bridge the digital divide.

At a country level, India has developed plans to expand digitization and develop smart cities. In India, the process of digitization is built on various pillars including among others, universal access to mobile connectivity, e-governance, and information for all. Regarding smart cities, the Smart Cities Mission and Challenge are helping cities to launch smart city projects benefitting diverse areas of the cities, retrofitting and redeveloping existing areas and working on Greenfield projects and city-wide solutions. The strong government's interest in digitization and smart cities means that many stakeholders from the public and private sectors are now aligning together to solve these challenges.

Similarly to the rest of the country, Delhi has numerous obstacles that need to be solved to expand digital inclusion. Challenges include the need to have a robust communication infrastructure and reliable high-speed public Wi-Fi network, the implementation of a policy and operational framework supporting digitization, increase IT literacy, overcome the economic barriers which de facto prevent the low-income population from being connected, and expand awareness of the benefits of being connected. While the digital divide is a key challenge for the city, there are also other critical issues that the city needs to face while bridging the digital divide - including traffic, pollution, and access to healthcare, clean water, and education.

An essential part of Delhi's digital inclusion strategy is going to be ensuring that the expansion of digital inclusion and of its wider smart city initiatives will bridge existing socio-economic barriers bringing benefits for the whole population. As connectivity is an engine for economic growth, bridging the digital divide will not only help citizens but will also provide businesses with the connectivity tools to optimize their processes, reach new markets, and accelerate growth.

With the rapid expansion of smartphones able to access the internet and with multiple original equipment manufacturers providing devices catering for segments of population with diverse spending power, handsets will play a central role in expanding digital inclusion. Handsets will work with a mix of technologies with cellular and Wi-Fi technologies set to be key enablers supporting digital inclusion.

Economic benefits and self-improvement stand out among the multiple benefits brought by digital inclusion. For instance, connected people can access educational resources which can improve their daily life. Being connected eases access to information which is an essential tool for personal growth. In addition, the lack of connectivity hinders individuals by limiting their ability to interact with friends and family. Digitization and internet inclusion are also essential to provide citizens-centric services with e-governance being pivotal to create engagement between the citizens and the city.

From a political point of view, connectivity is the essential building block allowing citizens' engagement with the city's digital sphere in the form of political and civic participation; with digitization becoming a key part of the government's life the importance of digital inclusion and civic participation will continue to grow. For instance, as seen in other cities, Moscow has some 200 of its public services online while London has some 500 datasets open and available online which combined with connected citizens allow for a direct citizens' participation in the city's life. In Delhi, connectivity has a strong political relevance, and in 2015 the Aam Aadmi Party's political agenda included the deployment of Wi-Fi hotspots across the city to drive digital inclusion. Besides Wi-Fi deployment, to expand digital inclusion the government is also installing fiber optic cables in order to strengthen the core communication infrastructure.

From a socio-economic point of view, unconnected individuals are missing a key engine generating opportunities for growth and enabling the access to a new digital world, new markets, new customers, and new services. Unconnected citizens are missing from new opportunities created by connectivity and digital inclusion. Businesses also need

connectivity as it is a means to improve their operational efficiencies and to reach out to a wider market and customer base.

Among the initiatives to expand digital inclusion and create a smart city stands out the planned launch of some 1,000 public free Wi-Fi hotspots which are expected to be deployed from March 2018. Public free Wi-Fi is seen as a means to connect the unconnected enabling improved access to education tools and resources and helping businesses growth.

Deep dive: London (United Kingdom)

Facing the issue of the urban unconnected towards digital inclusion

While London's unconnected population is relatively low with 625.336 unconnected citizens, the city is still facing the issue of the digital divide. As in many other global cities, the digital divide is also a physical divide as the limited financial capabilities of certain segments of society are still one of the main barriers to internet adoption; however, this is not the only barrier as other major challenges are the lack of awareness to the benefits brought by connectivity, the lack of IT skills, and the lack of confidence to use internet and e-services.

The digital divide is a problem affecting all age groups. For instance, with connectivity and online assignments becoming a central piece of the education system, being unconnected may result in young individuals being unable to express their potential and to keep up with the school's program.

Key pillars that need to be in place to reduce the digital divide include awareness to the benefits and to the services available online, future-ready infrastructure, and open data. London has worked on many fronts to tackle the issue of the urban unconnected from launching IT literacy courses to providing affordable connectivity options and micro-loans to help small and medium enterprises (SME) with the cost of high speed internet connections. The expansion of IT and tech literacy is a task undertaken by many stakeholders: for instance British Telecom (BT) launched its Tech Literacy Programme back in 2015 and the charity GoON UK is also facing the digital divide by helping people to learn basic digital skills.

From a socio-political point of view, digital inclusion is essential for citizens to access city data and e-services. Digital inclusion impacts education, healthcare, and mobility as being connected allows for the provision and use of new services. For instance, more than 460 transport apps have been created using open data enriching the mobility options and choices of those Londoners who are connected.

Regarding citizens' participation and information, connectivity is essential to allow citizens' access to open data. Open data is available in the London Datastore which is a city's initiative making more than 500 datasets of city data available to the public and which is currently receiving over 40,000 visits a month. As London has been opening its data online, ensuring that citizens are connected is pivotal to ensure they can access the available information.

Another example, of the impact of connectivity on the social sphere is provided by the Talk London community, an initiative which brings citizens into the city's policy making process. Talk London hosts online surveys, discussions, polls, and focus groups on a wide range of topics allowing connected Londoners to take part in the policy dialogues and to generate new ideas.

From an economic point of view, individuals are missing on savings and on securing new jobs which more and more often are advertised online. According to national data from the Government Digital Inclusion Strategy, households that are offline are missing out on savings estimated to be around £560 per year generated by shopping and paying bills online. The impact of connectivity and related ICT skills as an engine for economic and personal growth can be observed from the ICM/UK Online Centres Survey 2013, where 72% of surveyed employers said they would not interview an entry level candidate without basic ICT skills.

Among the upcoming initiatives to expand digital inclusion, LinkUK is an extremely interesting example of a Wi-Fi deployment that will have a significant impact on multiple aspects of citizens' lives. The project which was announced in October 2016 by BT, Intersection, and Primesight will bring ultrafast connectivity to the street level. By replacing

outdated phone boots and providing individuals with internet access and other services LinkUK will drive digital inclusion and citizen engagement with the smart city. From a financial point of view, the project will be sustained by an advertisement-base revenue model. By providing high-speed broadband and access to services to the street level this project will drive further innovation by citizens and start-ups.

Internet use and digitization are a way to boost the local economy as well as a way for the city to deliver its services in a more efficient and direct way. By delivering e-services the city is reducing its expenses and is reducing the level of bureaucracy within its service delivery a feature which is often negatively associated with city councils. From a business point of view digital inclusion and the expansion of a digital society are pivotal in attracting new businesses and start-ups working in the tech sector, as connectivity facilitates doing business and provides tools to accelerate businesses' growths and access to multiple markets.

Deep dive: Moscow (Russia)

Facing the issue of the urban unconnected towards digital inclusion

In Moscow digital inclusion is a key element necessary for the creation of a smart city. Connecting citizens to the internet is not just the city's end target but is also the pillar supporting the future evolution of the city. The Russian capital's unconnected population is 1.231 million or 10.0% of its total population with only the city of London having a lower percentage of unconnected citizens (among the cities analyzed for this white paper).

Key challenges for Moscow to foster digital inclusion include deploying infrastructure, overcoming the barriers of IT skills, and expanding awareness to the benefits of being connected. To optimize its existing assets and expand connectivity, the city introduced dual purpose pillars to ease the deployment of communication infrastructure by telecoms operators. These dual purpose pillars are street lighting poles that can be used by telecoms operators to deploy their communication equipment, thus improving network coverage. The city has also faced the need to expand IT literacy and it has done so by providing free IT courses for specific segments of population such as for pensioners.

Besides the challenges of infrastructure and IT skills, addressing the lack of citizens' awareness of what are the city's services which are available online is a must for any city willing to expand digital inclusion. To drive awareness on the benefits of digital inclusion the city of Moscow has invested in promoting e-services and the use of mobile applications to access city services. By creating and launching various e-services and applications targeting various population's segments Moscow has generated awareness and driven applications usage among its citizens.

From a political point of view, citizens that are unconnected cannot contribute to the development of the city, cannot count on the city's e-services and therefore cannot benefit from time-saving and the efficiency of having a direct link to the city. With some 200 public services available online, being unconnected hinders people's ability to interact with their city in a fast and efficient way. Digital inclusion is essential for citizens to become involved in the socio-political life of the city. For instance, connectivity enables the citizen to participate in the city's crowdsourcing platform where citizens can contribute and exchange ideas about city developments.

From an economic point of view, individuals are missing on savings generated by using the internet and from a business perspective the lack of connectivity is a barrier preventing the development of new business models, the optimization of recurrent tasks, and the ability to reach new markets.

Connectivity contributes to create a better environment for citizens and businesses but it also creates a more efficient government. Connectivity impacts the citizens' social life: for instance in the healthcare sector, connected citizens can use services such as online scheduling and e-prescriptions while in the education sector connected citizens can benefit from schools' online enrolments. Connectivity is an enabler of citizens' engagement which takes many shapes such as e-voting about city development issues and online complaints.

Among the main initiatives developed by Moscow to drive digital inclusion stands out the deployment of a free public Wi-Fi network. The Wi-Fi coverage is now available across the city's transportation system and stops including in the subway, on trolley buses, and on trams. Wi-Fi has also been deployed in other public areas including, parks, pedestrian

areas, and schools. The city did not have to embark in the cost of deploying the Wi-Fi network which was deployed by telecoms operators and is supported by an advertisement-based revenue model.

The benefits of digital inclusion are taking many shapes for Moscow. Increasing citizens' internet adoption is helping to develop the digital economy of the city, but it is also creating a more inclusive society thanks to a direct and centralized contact point between individuals and the city. Driving inclusion is also benefitting the city thanks to taxes for businesses related to online services and thanks to cost savings obtained by reducing the expenditure for public services. Being connected is also a catalyst for businesses and innovation as connectivity is an essential requirement for new growing businesses.

Deep dive: New York City (United States)

Facing the issue of the urban unconnected towards digital inclusion

New York's unconnected individuals are some 1.600 million corresponding to 18.74% of population. Given New York's focus on opening its data online, digital inclusion is an essential element needed to fully allow citizens to access the available information. Affordability of internet services is one of the main barriers for internet use and broadband adoption in New York City with the lack of internet access affecting the lowest-income classes. Key pillars for the city of New York to develop as a digital city are broadband and internet access, open government, citizens' engagement, and collaboration with the industry.

To expand digital inclusion the city is facing many challenges from ensuring that all the departments within the city are working as a unit to securing funding and sustainability for large projects. IT literacy in a multicultural environment and across diverse age groups is also a challenge common to many large cities.

To tackle these problems, the city is focusing its efforts on expanding internet access, in training sessions and education, and in providing individuals with the required IT and tech skills. Overall, one of New York's main projects is to build a city wide broadband network to provide affordable universal high speed broadband to its citizens by 2025. Other initiatives include funds helping unconnected individuals to afford the cost of being connected.

From a political point of view, unconnected citizens cannot fully participate in the life of the city, as they are unable to access open data and cannot help to shape the city's developments as done for instance through a mobile reporting application. Unconnected citizens lack the opportunity to interact with the city's technology and digital sphere as in the case of Digital.NYC which is an online hub connecting and providing resources for start-ups, the technology ecosystem, and New Yorkers. Such an initiative is pivotal to boost the city's economy and create new opportunities, which are unfortunately missed by unconnected individuals.

From a socio-economic point of view, citizens are missing opportunities for self-improvement, for expanding social relationships, and for generating savings. Being excluded, risk re-affirming a societal divide and existing asymmetries in revenues and education levels. In the OneNYC plan one of the key areas to be tackled by the city is poverty and the growth of income inequality, consequently is no surprise that limited spending power is one of the main barriers to internet adoption in the city. Significantly, the lack of connectivity is highly affecting the lower-income segments with the city's OneNYC plan reporting 35% of households below poverty line being without internet service at home.

The issue of affordability is a central problem for the city which is in fact investing in networks to provide high-speed residential access either at low-cost or free for low-income communities. For instance, to address this problem, the city also launched an initiative to deliver free broadband service to 21,000 residents of public housing.

Another key initiative to drive digital inclusion is the Wi-Fi project LinkNYC. The advertisement-based project brings free high-speed broadband to the street level expanding digital inclusion while creating other benefits such as easing citizens and tourists' interaction with the city. The project started with the idea to replace the outdated phone boots while providing connectivity at the street level and the city is currently counting on more than 800 kiosks. Free public internet is not only stimulating the local economy but it is also a source for personal improvement as individuals can access educational resources and other online courses.

Another initiative to expand digital inclusion is the public private program Connect Home which is providing connectivity devices and internet plans to those segments of society unable to afford that expense.

Becoming a digital and connected city will generate numerous benefits such as helping local business with savings and new opportunities, but will also increase the city's transparency and its communication with its citizens. Being connected is necessary to provide a citizen-centric customer service that is shaping the city services to the individual's needs. Overall, the benefits of a digital society go beyond connectivity itself, as connectivity and the innovation that it supports impact all facets of a citizens' life from mobility to healthcare.

Deep dive: Sao Paulo (Brazil)

Facing the issue of the urban unconnected towards digital inclusion

In Sao Paulo, 4.349 individuals or 36.13% of population is unconnected. The rapid urbanization which is a feature of many large Latin American cities has contributed to the expansion of the city however such a fast growth has left some segments of the population living with very limited resources. Driving internet penetration in those segments of population amidst the country's recent economic recession is likely to be one of the key challenges for Sao Paulo going forward.

Compared to some of the other cities analyzed for this research, Sao Paulo is at an earlier stage in its path towards a digital society. In Brazil, among the various means used to connect to the internet, the mobile handset is the main device used to be connected. According to a national survey, 89% of individuals using internet at the country level are accessing it through a mobile device. With mobile technology bringing a wider coverage compared to fixed broadband technology and with handsets having numerous price points catering for a wider audience it is expected that handsets will remain the main means for individuals to connect to the internet for the coming years.

In Sao Paulo, the very limited spending power of certain segments of society is the main barrier to digital inclusion. As a consequence of this, internet penetration is significantly higher in higher income segments of population as seen from national data. As national survey data shows the percentage of internet users penetration accessing the internet in the last three months in low income classes is at 30% compared to 96% in the highest-income class. With price and spending power being key barriers to internet adoption it is no surprise that in Sao Paulo as in many other Latin American cities, the digital divide is also a physical divide.

In Sao Paulo being unconnected has a political and civic participation impact, which will continue to grow in significance along with the city's digitization growth. From an economic point of view, connectivity is a way to optimize a business' processes and to connect to wider national and international markets; therefore connectivity is an essential building block for the economic growth of the small and medium enterprise. With 36.13% of population unconnected a large part of population is missing on economic opportunities. The ICT enterprise survey conducted by the Comitê Gestor da Internet no Brasil showed that digitization of online sales and purchases as well as the ability to perform other administrative obligations online, reduce time spent and bureaucracy incurred by companies and are thus essential factors enabling the growth of the business sector.

Internet and connectivity are essential for the expansion of businesses but also for neighborhoods' economic growth: good connectivity is a key requirement for any new business and consequently those areas that are digitally excluded are not able to attract new businesses and miss out on economic growth.

Besides digital inclusion the city is facing other major challenges and this further complicates the city's efforts to expand digital inclusion. Among others, the two main challenges that Sao Paulo needs to address are violence and healthcare. Another major issue affecting Sao Paulo as well as numerous other cities in Latin America is the need for its infrastructure to keep up with the pace of its growing population. Ensuring internet adoption across the low-income segments of the population and driving IT literacy are set to be key challenges for the coming years. Among various initiatives to spread digital inclusion, the city launched the project Praças Digitais – WiFi Livre, offering free Wi-Fi to its population. The private sector is also playing a central role in the expansion of digital inclusion. Many stores provide free Wi-Fi, attracting new customers but also contributing to the expansion of digital inclusion.

While the city is still at an early stage of its transformation, the impact of digital inclusion is set to be significant. It will bring financial and economic benefits, social benefits, and new opportunities for businesses and individuals. Connected individuals can look for jobs, take online courses, work on school assignments, and access multiple educational tools and resources. Increasing digital inclusion will go hand in hand with the development of digital public services, open data, and increasing citizens' participation which are all pillars of a digital government.

Key takeaways and conclusion

The digital divide is a problem that is still affecting all countries and cities around the world. While internet adoption and digital inclusion are growing, there are still individuals in urban and rural areas who are unconnected. With societies becoming more and more digitized ensuring that none is left unconnected is one of the key priorities for both local and national governments. Digital inclusion benefits the individual but it is also essential for cities' growth as connectivity attracts businesses, brings new jobs, and creates opportunities to improve services and reach new markets and revenues.

- **London has 625.336 unconnected individuals:** corresponding to 7.11% of total population. Among the cities analyzed in this research (Sao Paulo, Delhi, London, Moscow, and New York City), London has the lowest percentage of unconnected population and is consequently leading the creation of a connected society.
- **Internet adoption varies greatly even among international global cities:** the average percentage of unconnected population in the five cities is 20.23%. Delhi and Sao Paulo have the largest number of unconnected citizens with 5.331 and 4.349 million respectively. Moscow's unconnected citizens are 1.231 million, while New York City's unconnected are 1.600 million.
- **31.46% is the average percentage of unconnected population** among the eight countries analyzed in this research (Brazil, China, Germany, India, Japan, Russia, the United Kingdom, and the United States of America). The United Kingdom has the lowest number of unconnected individuals (8.384 million) while India has the highest number of unconnected population (853.386 million).
- **In most of the analyzed countries, the number of urban unconnected is larger than the number of rural unconnected:** highlighting the fact that despite rapid internet adoption in urban areas, digital inclusion is still a key challenge to be faced by cities.
- **Connectivity shapes the life of the individual:** being connected shapes the life of the individual on multiple levels. Digital inclusion is a means for generating savings and for self-improvement as connected individuals can benefit from online courses and can look and apply for jobs. However, connectivity is also critical in easing citizens' participation in the life of the city, for instance by creating a direct channel of interaction with the city's e-services and open data.
- **The digital divide continues to have many causes:** there are multiple factors that are still affecting the number of connected and unconnected individuals. Limited spending power, unawareness of the benefits and services available online, and the lack of adequate IT skills are among the main barriers to digital inclusion.
- **Digital inclusion is an essential building block of any smart city:** ensuring that citizens are connected is fundamental for the creation of smart cities and smart nations. Connecting individuals generates new opportunities for civic participation, for economic development, and for personal growth. Cities have developed many initiatives and strategies to foster internet adoption, such as Wi-Fi kiosks, IT skills classes, and financial incentives.

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Alphonso Jenkins, Deputy Commissioner for Telecommunications Planning at the New York City Department of Information Technology and Telecommunications (DoITT), manages the agency's Franchise Administration, Telecommunications Planning & Resiliency, and Telecommunications Policy & Strategy units. Mr. Jenkins brings with him more than 15 years of public and private sector experience as a Senior Wireless Deployment Program Manager/Strategist, having worked on planning, designing, implementing, and optimizing various types of broadband networks and technologies (Wi-Fi, WiMax, GSM, CDMA, LTE, and more) for a range of domestic and international clients.

Most recently, he worked as a Solutions Architect at Alcatel-Lucent on various aspects of public safety broadband networking capability, including work on the First Responders Network Authority, or "FirstNet." At DoITT, Mr. Jenkins will be leading a team working with City Hall and partners across the city on one of the de Blasio Administration's top goals: deployment and expansion of affordable broadband to more New Yorkers in all parts of the five boroughs.

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Eldar Tuzmuhametov's current activities and responsibilities include: implementation of top innovative technologies in Moscow by identifying new opportunities, discovering and relocating best ideas, solutions, teams and firms from all over the world; delivery of one-stop-shop service to foreign tech teams and businesses looking for global awareness and new markets; organization of best practices exchange between governments of leading data-driven cities of the world.

Jonas Trunk - CEO of Linktel

Jonas Trunk is a Brazilian business man who had been performing on the telecommunications industry since 1980.

He is graduated in Electrical Engineering from UNICAMP-SP and has a Master's degree in Electrical Engineering from MIT (Massachusetts Institute of Technology).

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Natraj Akella - Vice President of Wi-Fi services at Tata Teleservices

Mr. Natraj Akella is the Vice President of Wi-Fi services at Tata Teleservices where he works on business and operating models around Convergence and Aggregation - of mobile data and WiFi services in particular and convergence of licensed and unlicensed bands in general.

In the past, he has successfully led several strategic initiatives and industry firsts including - Launch of 4g LTE, Carrier WiFi and Telco Cloud services platform. Having worked with industry leaders in both strategy and operations, Mr. Akella has a vast exposure in building and leading strong businesses and lean operating teams in both consumer and B-2-B markets.

Russ Shaw - Founder-Tech London Advocates & Global Tech Advocates

Russ is the Founder of Tech London Advocates and Global Tech Advocates, global advocacy groups of 5,000 senior leaders in the tech community, created to champion and accelerate the growth of London's technology sector.

Russ is a non-executive director for Dialog Semiconductor and Unwire ApS and on the Advisory Boards of E2Exchange, Teen Tech, BBC Make It Digital and Founders4Schools. He was appointed a London Tech Ambassador for the Mayor of London in 2014. He is an angel and venture capital investor and was Chairman of the Marketing Group of Great Britain.

Previously, Russ held senior management positions at Skype, Telefonica/O2, ntl (now Virgin Media), Charles Schwab and American Express and was CEO of a later stage mobile startup called Mobileway (acquired by Sybase).

He has a BSc from Washington University in St. Louis and an MBA from Harvard Business School. He lives in West London with his wife Lesley and three sons, and runs 5k every day to keep fit.