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The belt and road initiative: Industry 4.0 in sustainable and smart cities

Summary of the BRI session on urban industrial solutions

In September 2013, President XI Jinping of China formulated his foreign policy priority, a revitalization of the ancient trade networks known as the ‘Silk Roads’ in the new Belt and Road Initiative (BRI) to strengthen economic ties, improve communication, encourage trade and enhance monetary circulation throughout Asia, but with a vision reaching far beyond the region, offering economic opportunities in Africa and Europe.

The scale of the BRI is unprecedented, with almost a trillion dollars in commitments to infrastructure projects, including transport (roads, rail, aviation, maritime, ports and airports) and energy supply. So it was not surprising that, at the Belt and Road Forum for International Cooperation held in Beijing in May 2017, President Xi called it “the project of the century”. Nearly two-thirds of the world’s population falls within the scope of the BRI, so it has the potential to change the lives of billions of people for the better and offer them new economic opportunities.

It was within this framework that the United Nations Industrial Development Organization (UNIDO) initiated a large-scale annual event, together with the Finance Center for South-South Cooperation (FCSSC), called the ‘BRIDGE for Cities – Developing Green Economies for Cities’, with the objective of advancing the implementation of the Sustainable Development Goals (SDGs) and the New Urban Agenda. The inaugural event was held in October 2016 and the second was held in Vienna in September 2017.

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SYNOPSIS

This year's Bridge for Cities event brought together mayors, policymakers, industry experts and academics from across the world to discuss the issue of pursuing sustainable and smart cities. Under Module 2: 'Showcasing Urban-Industrial Development Demands and Solutions', UNIDO's Department of Trade, Investment and Innovation organized a panel discussion on *Urban-Industrial Solutions and Business Opportunities* with the theme 'Urban Innovation and Smart Solutions'.

The panel's objective was to highlight the challenges and opportunities for cities during the transformation to Industry 4.0 and towards inclusive and sustainable industrial development. The panel discussed technologies, challenges and policies, and put forward recommendations for developing countries on how best to harness the potential of Industry 4.0, particularly for city planning. It focused on two megatrends: the smart city concept and Industry 4.0, and how they intersect.

The smart city concept is an urban development paradigm integrating new innovative ideas, concepts and emerging technologies, such as: the Internet of Things (IoT); the Internet of Services (IoS); the Internet of People (IoP); the Internet of Energy (IoE), in other words the Internet of Everything, also known as Industry 4.0 or the Fourth Industrial Revolution. The concept aims to provide effective and high quality public services and infrastructure in real time and thereby a better quality of life for citizens and a move towards sustainable cities.

The proliferation of sensors on machines, grid networks, cars, and ultimately people, has opened up new business opportunities in cities. More interconnected networks have emerged out of the possibility of collecting and analyzing large quantities of data and informing decision making in real time. Many of these technologies are derived from their industrial origins, and have become an integral part of city development.

Increasing urbanization puts pressure on city planners to maximize resource efficiency in their cities. Currently, cities are the main consumer of the planet's resources and are the highest emitters of greenhouse gases (GHG), although they only cover a fraction of the world's land mass.

Cities will be pivotal in achieving the UN's 2030 Agenda for Sustainable Development and its 17 SDGs. By 2030, almost 60 per cent of the world's population will live in urban areas, while 95 per cent of urban expansion in the next decade will take place in the developing world. Without taking action and bringing smart cities to developing countries, the SDGs will not be achieved. Rapid urbanization exerts pressure on water supplies, sewage, the environment and public health, which can then lead to increased migration if these issues are not addressed. However, the high concentration of resources in cities can bring efficiency gains through technological innovation. The challenge is to transform the cities of today into the smart cities of tomorrow.

The panellists represented the different components required for this transformation, bringing together the providers of technological solutions and city planning practitioners, as well as researchers on Industry 4.0 and its transformative character.

The key conclusions from the panel discussion were:

- Partnerships are essential for bringing Industry 4.0 technologies to cities to transform them into smart cities. Multiple stakeholders and views are also more effective for identifying common problems and common goals.
- There are countless opportunities to make cities smarter through Industry 4.0 technologies, but the goal should always be to improve the quality of life in cities, rather than implement a purely technologically driven process.
- There is the potential for developing countries to leapfrog to higher levels of development. Traditional infrastructure may be insufficient in some cities, but is still essential for ensuring a high quality of life in cities.
- New technologies could help bridge some gaps and improve the functioning of existing infrastructure. They can help to use energy efficiently by: controlling traffic congestion and cutting CO₂ emissions; reducing food waste and improving waste management in general; improving safety and security; enabling urban vertical farming; improving health and education services; and bringing modern manufacturing back to the cities.
- Smart cities will be pivotal in achieving the 2030 Agenda. Rising urbanization rates indicate that a majority of the world's population will live in cities by 2050. Strategic planning, integrated policies and interventions are vital. Therefore, addressing global challenges in a city context through Industry 4.0 technologies will help realize not only inclusive and sustainable industrial development through the nexus of industry, infrastructure, and innovation in cities, but the whole 2030 Agenda.

INTRODUCTION

The Urban-Industrial Solutions and Business Opportunities panel addressed urban challenges in the context of rapid technological change and the new industrial revolution and explored business opportunities, harnessing the potential of partnerships in urban-industrial development. The session showcased best practices in leveraging Industry 4.0 technologies and multi-stakeholder partnerships for the development of sustainable and smart cities.

The city-level setting was selected as the primary focus of this year's UNIDO BRI event. Industry and cities have always evolved together. Industrial development is a key engine of growth with its strong potential for job creation and income generation, and has always played a big role in city development. Cities are also integral to their countries' industrial development and structural transformation. Industrial revolutions not only changed manufacturing, trade and services, but the fundamental set-up of cities. Industrial technologies that fostered major transformations have also improved quality of life in cities. The first industrial revolution brought steam power to factories, improving productivity, while steam engines enabled mass transportation across and between cities. Electricity brought illumination, while enabling the second industrial revolution's mass manufacturing paradigm. Information and communications technology (ICT) and automation technologies that shaped the third industrial revolution enhanced modern city planning. Inevitably, the ongoing transformation triggered by Industry 4.0 technologies will leave its own footprints on cities. These technologies will make cities smarter, more sustainable, and improve the quality of urban livelihoods. The 'DNA' of cities has always been strongly linked to industrial heritage, while the challenges industries face fundamentally affected cities.

Globally, urbanization is rapidly rising, particularly in Asia and Africa, and cities will have the greatest and most lasting impact on an ever-growing world population. Making cities sustainable is an imperative and UNIDO has provided a platform for municipalities, industry leaders and enterprises to foster partnerships for the advancement of inclusive and sustainable urban-industrial development.

The importance of developing sustainable and smart cities has begun to receive widespread recognition by governments and other stakeholders around the world. This is particularly true in developing countries, with growing urbanization trends and inefficient and insufficient infrastructure and utilities unable to provide sustainable solutions for structural transformation. The way cities have been governed and developed in the past cannot continue in the future, and smart solutions for reducing the environmental footprint and urban poverty, as well as for addressing increased vulnerability from the effects of climate change, will be pivotal to achieving the SDGs.

The 2030 Agenda, and SDG 11 in particular, underline the need to "make cities and human settlements inclusive, safe, resilient and sustainable", while the interdependent nature of the SDGs becomes particularly evident in a smart city environment, given the potential linkage effects from the infrastructure–industry–innovation nexus (SDG 9) on SDG 11 and other SDGs.

The development of sustainable and smart cities requires integrated interventions in planning, investment, and the uptake of new technologies. Industry 4.0 technologies, and especially Artificial Intelligence (AI)-enhanced urban transportation, smart grids, renewable energy, waste and water management, and urban farming, will not only reduce CO₂ emissions, but may also improve energy, water and food security, and effectively address climate change and environmental issues.

The introduction of renewable energy will hugely benefit from frontier technologies, such as AI, through smart grids and the efficient allocation of energy where it is needed. More efficient waste management and water supplies can also be achieved by using AI. Water pipes, sewage, and the location of utilities can be improved by using AI algorithms (sewage and electricity reaches many more people in cities than in rural areas). AI could be applied in transport, such as in: (autonomous) electro-mobility; using drones for urban delivery of goods; and planning traffic systems, resulting in more efficient traffic light controls, transport routes and modes, thus reducing congestion and fuel consumption.

However, the provision of basic infrastructure and utilities is problematic for most people living in today's megacities, particularly in developing countries, where resources are scarce and the capacity to implement new technologies is lacking. This is where the biggest challenge will be.

Industry 4.0 and AI will reduce dependence on centralized production. Polluting industries can be located in semi-urban or suburban areas; other industries and industry-related services can be placed within city boundaries, such as pharmaceuticals, laboratories (for services such as standards and certification), research centres, vertical farming facilities, and logistics centres. Cities can be hosts to a vibrant start-up scene, with software companies or other related industries creating technology and innovation hubs.

Agribusiness will shift from rural areas to urban systems, as urban (vertical) farming could be much more efficient at allocating resources, thanks to AI. The AI analysis of weather patterns, soil and other parameters could be used to find the most suitable crops, automate irrigation, and enable timely interventions to optimize yields.

For cities to be sustainable, social dimensions such as inclusiveness, cultural adequacy, fairness and gender equality are crucial, in addition to economic, ecological and environmental dimensions. Smart cities, where Industry 4.0 technologies are tested and applied, have to aim for integrated solutions that use resources efficiently and effectively, and follow low-carbon and inclusive development pathways. Cities will be a key component for achieving the SDGs.



OPENING STATEMENT BY MODERATOR

Olga Memedovic, Chief of the Business Environment, Cluster and Innovation Division at UNIDO, emphasized the importance of smart city initiatives in achieving the 2030 Agenda. Cities are the highest consumers of planetary resources and producers of waste and pollution, and Memedovic highlighted their role in industrial development in general, and the symbioses between industrial technology and urban landscapes in particular.

Why are smart city initiatives important?

- Cities occupy less than 0.5 per cent of the world's land area and host 51 per cent of the world's population.
- Cities consume around 80 per cent of our planet's resources.
- Cities account for more than 70 per cent of global energy consumption.
- Cities emit between 50 and 60 per cent of the world's total greenhouse gases.
- Cities produce a huge amount of waste.



Cities are a powerful force for economic development and shared prosperity. Cities account, on average, for 75 per cent of a country's GDP. They are crucial for division of labour, productivity, knowledge spillovers, innovation, and technological change.

Accelerated urbanization is estimated to result in around 70 per cent of the global population living in urban areas by 2050, with 90 per cent of the urban population growth taking place in Africa and Asia. If rapid urbanization continues, it will put pressure on infrastructure and utilities, for creating decent jobs, for preserving the environment, and for addressing climate change. It will become a major challenge for city planners, policymakers, and the international community in general. Designing sustainable cities using intelligent technological solutions and approaches will be crucial in addressing global challenges and achieving the 2030 Agenda.

In Africa, the primary beneficiaries of urbanization so far have not been manufacturing industries, but informal services, with little productivity gains. This premature deindustrialization has resulted in precarious employment and has triggered migration waves. The problem with rapid urbanization in developing countries is the proliferation of informal neighbourhoods without quality access to electricity, sewage, waste management and other public urban services, significantly impacting the quality of life in cities. Industry 4.0 technologies can help address these problems.

Cities can reinvent themselves through leveraging the opportunities from Industry 4.0. However, Industry 4.0 alone is not the panacea to urban problems. Significant challenges lie ahead, particularly for developing countries. The international community will have to act to reap the benefits of smart city initiatives globally. In raising awareness UNIDO can facilitate knowledge exchange and technology transfer and prepare developing countries for the uptake of new technologies and business models.





KEYNOTE SPEECH

Sebastian Schlund, Head of Production Management at the Institute for Industrial Engineering, explored the following questions:

1. What are Industry 4.0 technology solutions (IoT/loE/loP/loS) for transforming current cities into smart and sustainable cities?
2. Can modern manufacturing revitalize cities?
3. What is the role of integrated planning and optimization?

Schlund explained the intersection of Industry 4.0 and smart city initiatives. Among others, the IoT is most likely to be the determinant of smart cities, as more and more sensors trickle into our daily lives. Most notably are current smartphones that increasingly pervade markets all over the world and can be used for the good of cities. The benefits could include analyzing real-time traffic data, crowd monitoring and optimizing traffic flows in metropolitan areas.

The adoption of Industry 4.0 technologies is gaining traction and bears the potential to address many of today's problems. Cities are well advised to become not only smarter and more sustainable, but ultimately more resilient, with increasing urbanization further straining the world's resources and causing substantial environmental degradation. The adverse effects of climate change are occurring more frequently and can cause massive damage in cities. The objective of smart cities is not only to reduce pollution, greenhouse gases and other substances, but ultimately to deal with the potential effects of climate change.

Quality of life in cities is not only threatened by pressure on resources, particularly water, sewage and electricity, but also by extreme weather events, which can have profound social implications.

Available data in cities can be powerful tools when applied and analyzed in the right context. The multitude of sensors available in cities allow for many 'Internets'. The IoT, IoP and IoS are all fed by multiple data sources, each with their own benefits, but also risks. Schlund described the growing interconnection between manufacturing, services, and people as a key feature of Industry 4.0.

Manufacturing has become much cleaner in recent years, which will trigger a relocation of manufacturing activities to urban centres. Much like earlier industrial revolutions, the fourth industrial revolution will leave its mark on cities. The modern, high technologies can bring manufacturing back to cities and create a virtuous cycle of growth with high-quality jobs.

The concept of smart cities has engaged policymakers, city planners and researchers across the globe and produced diverse concepts, with one core component: the improvement of citizens' wellbeing. Industry 4.0's transformative power will not only shape the future of cities, but will impact our daily lives. The increasing interconnectedness and the wealth of available data allows for new business models, applications and solutions that can bring the benefits of Industry 4.0 to an ever growing world population.

What are the opportunities?

Leapfrogging of development by embracing digitalization without having to fully implement other infrastructure.

Public and private investment in new technologies, meaning fewer discussions, doubts and resistance.

Potential talent pool of willing, well-educated and trained people (entrepreneurs, engineers, IT).

What are the challenges?

Infrastructure: stable infrastructure required (reconciling old with the new, such as power supply and broadband internet).

Privacy: IoT applications collect, analyze and relay data without the knowledge or agreement of the user, and thus require clear and enforceable privacy laws to prevent abuse and the infringement of personal rights.

Local IoT expertise: for adjustments, implementation and maintenance of IoT applications to the special needs of their developing counterparts.

Conclusions

- ▶ Industry 4.0, as part of smart city initiatives, will make cities and human settlements more inclusive, safe, resilient, and sustainable, and will help address global challenges.
- ▶ Industry 4.0 has the potential to revitalize cities and create new jobs; many kinds of high-tech clean manufacturing industries have emerged in recent years that allow small-scale production. Decentralized, modularized industrial production will be located in cities, helping to speed up industrial innovation.
- ▶ In developing countries with rapid urbanization and premature deindustrialization, there are opportunities to integrate modern industries and leapfrog technological development.



KEYNOTE SPEECH

Qunkai Liu, Partnerships at Alibaba Cloud, explored the following questions:

1. How can artificial intelligence (AI) be used to make cities sustainable and smart?
2. What is Alibaba Cloud's experience of smart city projects and how can it be deployed in less developed countries?
3. Can these projects be piloted in Africa, and if so, what are the preconditions?

The Alibaba Group, a Chinese firm, is one of the world's largest e-commerce companies and the importance of smart city initiatives is rooted in the spirit of Alibaba. The company wants to ensure inclusivity and bring these technologies to poor people who otherwise would not be able to access the benefits, such as payment services. The 'Alibaba Cloud' is the application of AI in a city context. Liu gave a detailed analysis and overview of the Alibaba Cloud in the city of Hangzhou, where it has helped to significantly reduce congestion and commuting times for its inhabitants. The technical component relies on a dense network of interconnected devices, ranging from smart traffic lights, cameras, taxis, public transport services, and smartphones.

The data that is available to cities is often unused. Hangzhou has learned from that and now has the capacity to monitor traffic flows in real time. The technological solution to integrating all the different datasets requires close cooperation between a range of private partners, as well as public institutions, which then use the data for the purpose of traffic monitoring. Liu stressed the importance of partnerships to successfully apply the Alibaba Cloud and collect the data: without the data (for example from Chinese telecommunication providers), an essential component would be missing from bringing the solution to a specific city context.

These technologies have enabled Hangzhou to analyze and optimize traffic flows. The city now has a real-time traffic monitoring system that can quickly communicate with local police stations and intervene to avoid heavy traffic jams. The system automatically detects unusual traffic patterns and sends an alarm to the operators. Forward planning is vital in bringing the technology into full use and the city has demonstrated its commitment and vision to fully utilize Alibaba's technologies to improve traffic in the city.

The technology applied here is not confined to a city context. Alibaba Cloud is increasingly investing in applying similar methodologies to industry, healthcare and security. The benefits are self-evident: industrial technologies can proliferate in any context, as long as proper planning, management, and partnerships are established. Without partnerships with telecommunications providers, as well as taxi and public transport enterprises in Hangzhou, the whole process would not have been possible.

Conclusions

- ▶ The integration of technologies in a smart city context requires close coordination between the technology provider and decision makers in cities. Once the systems are in place, it is crucial to have a constant data flow between the different stakeholders to ensure the optimum conclusions from available data.
- ▶ Cities can be host to a vibrant start-up scene aimed at creating technology and innovation hubs which boost innovation. Cities must ensure a business environment conducive to building innovative small and medium-sized enterprises (SMEs) and start-ups that create jobs for women and youth. Critical to their success is an open public-private dialogue to demonstrate their interest in policymaking.
- ▶ AI-enhanced urban transportation, smart grids, renewable energy, waste and water management, and urban farming, may not only reduce CO₂ emissions, but will also improve energy, water and food security, and effectively address climate change and environmental issues.
- ▶ Special attention must be given to the needs of cities in developing countries, where access to technologies and knowledge through knowledge-sharing platforms are pivotal in enabling cities to benefit from new technologies.

OTHER PANELLISTS

Okan Geray, Co-Rapporteur, International Telecommunication Union Study Group 20 Question 7; Smart Dubai Office

Markus Kottinger, Solutions Architect, Smart Cities, IBM Vienna

Necmettin Kaymaz, Chief Project Director, Prime Ministry Investment Support and Promotion Agency of Turkey (ISPAT)

Florian Ansgar Jaeger, Research Engineer, Siemens

DEBATED ISSUES

Industry 4.0 solutions related to energy, water, waste and transport in a smart city context

IBM has been a partner of public institutions for several years, applying its technologies in urban contexts to allow for the best possible allocation of resources. The major technological breakthrough for IBM is its Watson system, an AI system that can process huge amounts of data to perform assigned tasks. **Marcus Kottinger** provided insights into the problem-solving potential of big data analysis. Managing the critical infrastructure of cities can enhance their resilience and ensure reliability, while also reducing costs. Connecting otherwise isolated systems can lead to a range of positive outcomes, such as improved emergency responses, thanks to reduced congestion, which eventually translates into improved public health, lower crime rates, early interventions into problem-affected areas, improved water supply, and many more.

Kottinger echoed other keynote speakers by highlighting the need for a close and integrated partnership approach. Public institutions should involve citizens to identify problems, with the private sector proposing solutions. This can be done from a very early point in the planning process. IBM Watson has already helped several cities address their most pressing problems.

Stockholm, for instance, together with the Royal Institute of Technology, has integrated real-time data analysis into an intelligent toll system which has reduced congestion, travel times, CO₂ emissions, and increased the number of public transport users. In the United States, IBM Watson has assisted police officers in New York to improve their response times and help bring down crime rates. In Corpus Christi, the monitoring of critical infrastructure has significantly reduced failures and helped city-wide responses to gas leaks, burst water pipes, and other critical incidents, and this has resulted in an overall increased satisfaction of the city's inhabitants.

Kottinger noted that although some of the developments in modern technologies are picking up faster in developing countries than in developed countries, some technologies have become truly globalized, which has enabled a wider application in many different contexts.

Intersection of IoE and smart city initiatives

Florian Jaeger of Siemens in Munich, Germany highlighted the company's role in using industrial technologies to perform tasks to improve residents' quality of life. In energy management in developing countries, the IoE relates to predictive maintenance and resource optimization, resulting in the reduction of non-technical losses and downtimes. He said that Siemens focuses on decentralization and the inclusion of more renewable energies to increase the resilience of energy grids and the use of technologies to achieve certain targets.

The company is increasingly engaged in e-mobility, where it acts as a provider of hardware to produce energy, but also for the charging stations, billing and other related services. In addition, this enables Siemens to deliver services like load management to energy distributors, as they have the data available to predict and estimate expected grid loads.

Mindsphere, an aggregation of IoT applications, is Siemens' cloud platform which integrates data from different sources – not only from infrastructure – to deliver better services to its customers. The company sees it as “the intersection of the physical and digital world”.

Cities are the optimal place to apply these technologies. In Nuremberg, for example, air pollution was a primary concern in an initiative where Siemens could analyze the status of carbon emissions. Estimations of future emissions were based on statistical data from infrastructure and calculated over a period of six months. Through that, the forecasting could be broken up into several smaller contributors to enable targeted interventions, whether in an area such as transport, or with the major emission sources. Different infrastructure measures can be taken at city level and Siemens provides them with the modelling based on their calculations, enabling the city to have a better estimate of their planned intervention.

Despite this progress, Jaeger stressed the importance of recognizing that some of these interventions are long-term, while many cities in the world need short-term or immediate measures to make an impact. Therefore technologies such as Mindsphere need real-time data so that they can build applications based on the problems cities face.

Lessons learned from implementing smart city initiatives

Okan Geray from Smart City Dubai highlighted the importance of clear visions, targets and strategies when tapping into smart city implementation. Without a clear goal, such as people's happiness, these endeavours may not be successful. In contrast, clear targets that can be measured will help not only in creating transparency, but also in creating more efficiency in policymaking, planning and executing.

Governance is a key issue to successfully apply modern technologies in a city context. All panellists agreed that the inclusion of citizens is a prerequisite and must be the goal of all city planning. The use of technology can never be an end in itself, but a means to facilitate a higher quality of living in cities.

Geray said that impact is measured in three dimensions: customer (or social) impact; financial (or economic) impact; and environmental impact. The vision of an initiative for the city of Dubai, in the United Arab Emirates (UAE), for example, is “to become the happiest city in the world”. Smart cities are only realized when all aspects of city life are smart, namely smart cities, smart government, smart mobility, smart economy, smart society, and also a smart environment.

Key performance indicators (KPIs) are important for Dubai, measuring not only success, but the progress and impact of its initiatives. There are more than 40 KPIs that denote the strategic direction of the city, and another 50 or more KPIs that are ‘Tier 2’. These have been mostly developed by the United Nations Economic Commission for Europe (UNECE) and ITU. Dubai was the pilot city to apply this smart city index.

Among the most significant KPIs for the city, Dubai envisages 100 per cent digitally available and implemented government services, meaning that all services must be available through digital means, and carried out digitally by 2021. Dubai aims to make all its eligible government transactions through blockchain, and is currently testing this technology city-wide. Other targets include decreasing energy and water consumption, and further reducing greenhouse gases.

Impact investment in new technologies for realizing smart cities

Necmettin Kaymaz of the Investment Support and Promotion Agency of Turkey outlined the importance of bringing funds to fill the gap in the rural-urban divide. This includes not only partnering with private institutions to respond to the growing urbanization of major urban centres, but also bringing public institutions to rural- and peri-urban areas and the outskirts of major cities.

Foreign direct investment (FDI) has an impact on society and performs a crucial role in transforming cities into smart cities, especially considering the contributions of FDI to developing countries in terms of bringing know-how, technology, and most importantly, capital and funding, which are vital for projects to be realized in cities. The ultimate goal is to improve the wellbeing of society, hence FDI is assessed by looking not only at its impact on the economy, but also on people's daily lives. The impact of investments is critical in facilitating access to public services, such as transportation and healthcare.

The environmental impact is also important, whether direct investment in renewable energy or waste management, or an indirect impact, such as environment-friendly and pollution-reducing technologies that are employed in manufacturing.

Investing in inclusive growth can also have a significant social impact, especially in terms of creating jobs for youth and women. Kaymaz referred to Vodafone's collaboration with the government in Turkey to support women entrepreneurs and help them access funds and technologies. Public-private partnerships (PPP) are crucial in implementing impact investments and smart city policies, and Turkey has implemented many projects through PPP, for example, a comprehensive programme for the transformation of healthcare services. Dozens of integrated healthcare campuses, or 'city hospitals', that are also centres of science and technology, have been built across the country. Here, the most advanced technologies are used for improving public health, as well as for monitoring the buildings' own parameters. This reduces risk through faults in, for example, supply systems, as operators have real-time data to avoid outages.

FDI can enable project implementation in mobile communication infrastructure in regions that are currently disconnected. Kaymaz re-emphasized the fact that urbanization rates are rising; migration from rural areas to urban centres is a major trend and challenge. One way to respond to this challenge is to bring services to rural areas where people can easily access them.





FURTHER DEBATE AND QUESTIONS FROM THE AUDIENCE



Will the definition of the KPIs – and how they are measured – be shared with the public? How does the city of Dubai plan to decrease its dependence on fossil fuels? How do you see this embedded in the context of smart cities, energy efficiency, and renewable energy?

Okan Geray: In terms of the KPIs, more than 50 are publicly available through United 4 Smart Sustainable Cities (U4SSC) and ITU. Dubai is using these definitions to align with international smart sustainable city indicators. Cities can develop their own specific KPIs in alignment with the city-specific vision and goals.

The city of Dubai has clear targets to reduce its environmental footprint, such as reducing greenhouse gases by 16 per cent and reducing demand on water and energy by 8 to 10 per cent by 2021. Demand-side actions have been put in place to achieve this, such as restructuring tariffs, building codes, retrofitting existing buildings, district cooling and renewable energy, among others. In fact Dubai expects to achieve 7 per cent of renewable energy in its energy mix by 2021.

We operate a citizen innovation platform – after starting a smart city business it was decided a year ago to include citizens into this project. In the case of Dubai, at what stage are local people included?

Okan Geray: Dubai has introduced electronic solutions for engagement, but in terms of engaging the people of Dubai, there are several structured means which were undertaken, for example, surveys, and face-to-face discussions. Dubai has ‘reverse engineered’ happiness – it wanted to profoundly understand what makes people happy. Even AI was applied to identify important parameters. Over 5,000 people have been contacted and were asked very detailed questions concerning their educational background, overall health conditions, employment status, and so on, and these were linked with happiness through mathematical correlations.

This detailed study enabled the smart city initiative to strongly align with people’s needs so that Dubai could allocate resources most efficiently to serve its citizens.



Olga Memedovic: To representatives from Siemens, Alibaba and IBM – when is it best to engage citizens in smart city initiatives?

Florian Jaeger: Siemens is a company serving large infrastructure projects in cities and has initiated a platform where people can directly give feedback on carbon-related issues, providing the city authorities with estimates of where infrastructure is needed most. The communication, however, has been more strongly linked to city governments, as the municipalities are the customers of Siemens, so the company acts mostly as a technology and service provider.

Qunkai Liu: Alibaba merely provides the platform with technology building blocks, although it brings data scientists and they will work with local partners recommended by the cities, as each city has different ways of interaction with their residents. Interaction with local institutions is important for Alibaba, for example with local universities to train data scientists. Alibaba’s start-up programmes help cities identify particularly innovative start-ups that could be among the solution providers to a city’s problem, meaning that local engagement and local expertise is used wherever possible.

Markus Kottinger: IBM’s role in partnering with leading companies such as Siemens, ABB and others, means that it relies on its IoT expertise and software being applied by other companies. This partnership approach is at the core of IBM’s smart city initiative worldwide. Each city requires unique solutions and, therefore, the different partnership and engagement schemes will work out differently depending on the context. In IBM’s case, the bulk of work is consulting services, based on understanding the needs of the people living in the city.



Olga Memedovic: Can you explain what blockchain was used for in the case of Dubai, as IBM is providing the solution to the city of Dubai?

Markus Kottinger: This is an excellent example to showcase the differences in culture when it comes to the requirements of a city. The blockchain project is still in progress as the goal is the digitalization of all government services. The technology will be used to connect all available data, such as healthcare and other citizen-specific data, which would be unthinkable in some regions, like Central Europe, where data protection laws prohibit such a scenario. The main target is to reduce and break down different data silos that could help lower transaction costs among government agencies, significantly improve efficiency, and speed up workflows.



Questions from the audience: Are the concepts of smart cities and intelligent cities the same? Do we have technology-supported cities whereas human intelligence is not extended to the concept of intelligent cities?

Sebastian Schlund: The word intelligence in regard to machines should be used with caution. The terms 'intelligence', 'smart', and 'artificial intelligence' should remain separated, as it is still not entirely understood what intelligence in human beings actually is. Therefore, the term 'smart' in smart cities, smart devices, etc. is more appropriate and highlights the fact that we are adding features to existing devices and enabling their interaction, but not mimicking human intelligence.

Markus Kottinger: IBM has vast experience with AI with its Watson system. We have been working with it since 2006 and know that people are more than just bits and bytes. Also, mathematical equations cannot come close to the way humans think and develop ideas. The term 'intelligence' is not even close to being realized by machines at the moment, but we enable more human-like features that will smartly assist us in everyday life, just like smartphones have already done.

Qunkai Liu: AI will not replace human beings, particularly not in settings like interpretation, but it will assist humans in their worklife. The real intelligence is still the human behind the AI, as it needs to be programmed and trained. At the moment AI is only in its infancy and it is a powerful tool in certain settings. It will enable humans to focus on the really important things in their daily work, since AI can take over many simple, monotonous tasks.



What would be some of the major infrastructure investments necessary to enable cities in developing countries to leapfrog?

Olga Memedovic: What are the critical barriers to the uptake of these technologies in developing countries, and even more importantly, in least developed countries (LDCs)? Did you ever imagine how you could apply your knowledge in a fast-track manner in a LDC or developing country? What are the barriers that you could immediately address, or what advice can you give to the government of these countries so that they can quickly adopt this particular technology?

Florian Jaeger: Generally, IoT will give us the opportunity to more efficiently manage the small-scale interaction of energy grids, for example. Madagascar has very few areas with reliable power supply, so IoT could be used to manage small parts of the grids to avoid the whole power grid outage. On the other hand, a lot of the hurdles encountered in developing countries are non-technical losses. Basically, people are not really paying for power, thus the companies are not able to invest in the grid and grid technology. Renewable energy on a small scale could also offset some of the challenges and avoid grid overload.



Olga Memedovic: Could you address the issue of industrial districts in a city context? Is it possible to apply the ICT model of modularity in cities, for example, on a district level?

Okan Geray: Blockchain gives Dubai a competitive advantage today, but when looking from a technology life cycle point of view, almost all technologies eventually become a commodity. Consequently, some of the knowledge that has been built up from ‘early adopters’, which in the case of new technologies are mostly developed countries, could and should be transferred to developing countries. They can profit from technologies that have become much cheaper and much more accessible than they used to be for first movers. Therefore, developing countries could bypass and leapfrog much faster.

A second possibility is to use some of these highly advanced technologies as a shared service instead of reapplying them specifically to each organization, for example. There are huge financial advantages to be gained through technology as a shared service. Dubai has completely unified most of the back-office services of all the executive branches in its local government. There is just one system that runs for all agencies, only certain aspects are tailored to the specific needs of each agency. District-level development is possible for smart cities, as Dubai integrated smaller-scale smart districts and scales up to city level and beyond.

Sebastian Schlund: It is worth thinking about new infrastructure, but what would happen if we stopped repairing traditional infrastructure such as roads, etc.? The idea of leapfrogging and leaving out certain infrastructure developments is bold and hardly feasible. >>>



»» **Qunkai Liu:** The homework for cities is to ensure that the necessary infrastructure is in place, such as water, electricity, and transport, including roads and internet. These are the basic infrastructure requirements. In order to help developing countries, it is important to help small businesses to grow. One example is e-commerce. Alibaba has started rural e-commerce. Thanks to that and mobile payments, they help small agricultural villages sell their produce through the e-commerce platform to the whole world. This does not require huge investments from the village side, apart from a functioning internet connection. Through payment services provided by Alibaba they can help overcome finance shortages through micro-loans.

Markus Kottinger: There is already a telecommunications infrastructure provided out there; smartphone rates in developing countries are rising much faster than in industrialized countries. Therefore, partnerships with telecommunication companies are important for IBM. However, given that more and more people are connected to the internet, there could soon be a bottleneck in broadband infrastructure, not only in developing countries, but in developed countries, too. From a technology point of view, the question is: is it really necessary to connect all devices to the internet and instead do more analytics on site, rather than online.

Necmettin Kaymaz: In addition to infrastructure, education and qualified human resources are key to achieving and updating these technologies, as it will be people who have to use the technologies and they will only be able to do so if they are trained.





RECOMMENDATIONS

- ▶ Cities need to formulate clear visions and strategies, to best utilize available technologies. City planners need a concrete vision and to formulate specific goals, which allow technologies to serve citizens' needs, rather than applying technologies for their own good.
- ▶ The international community can help formulate KPIs so that progress in the adoption of Industry 4.0 technologies in a smart city context can better understand the obstacles and hurdles that are faced in each context.
- ▶ Each city should develop its own set of KPIs to track its progress transparently and efficiently. KPIs can also improve decision making to objectively verify cities' priorities to improve the quality of life of its citizens.
- ▶ Infrastructure, education, and qualified human resources are key to achieving and taking up new technologies.
- ▶ Developing countries need to specifically identify areas where they can move fast and exploit the low-hanging fruits first, to free resources for other innovative technologies.
- ▶ AI-enhanced urban transportation, smart grids, renewable energy, waste and water management, and urban farming will not only reduce CO₂ emissions, but may also improve energy, water and food security, and effectively address climate change and environmental issues.
- ▶ Integrated interventions in the planning, investment, and uptake of new technologies are required for the development of sustainable and smart cities. The complex interaction of different systems is particularly pronounced in cities, therefore planning needs to consider all aspects of people's lives, business needs and industrial requirements.



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