URBAN TECH

WHITE PAPER

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EXECUTIVE SUMMARY

The opportunity for urban tech is growing at a staggering pace. The proportion of the global population living within cities will grow from roughly 50% to 66% over the next thirty years. In Saudi Arabia, that ratio is expected to hit 97.6% by 2030.

Covid-19 has also impacted the proliferation of urban tech and smart cities. Having temporarily slowed down smart city spending, the pandemic has accelerated urban tech deployment to help stem the spread of the virus.

But the swelling of cities is also giving rise to economic social, cultural, and environmental needs and challenges. In the kingdom of Saudi Arabia, low density and horizontal development have created unique challenges as well -- notably related to urban sprawl, traffic safety, carbon emissions, and inadequate infrastructure, and the country has already started exploring opportunities to transform its cities.

This whitepaper details key best practices for fostering smart city innovation in the context of emerging and fast developing markets, based on a proposed human-centric urban tech framework, while also highlighting challenges and opportunities in the sectors that stand to benefit the most from smart city use cases in Saudi Arabia and the region, namely e-government, tourism, healthcare, and transit.

A Human-centric Approach

Citizens are the focal point of the framework, entailing that the core aim of urban tech should be to improve the quality of life of residents. To achieve that, urban tech strategies must be able to deliver on three fronts.

First, it must create a seamless experience while delivering city services, preferably through a unified self-service portal, which helps ensure wide adoption.

Second, it must promote inclusivity and a fair distribution of opportunity and reward for residents. Doing so requires increasing digital literacy, greater access to high speed internet, and ensuring that recognized standards for accessibility are met. Third, it should regard individuals as core creators and seek to effectively involve relevant stakeholders - citizens, businesses, civic organizations, etc. - in the decision making process.

The Enablers of Human-centric Smart Cities

Theoretically, a successfully designed and implemented smart city would exhibit traits of an intelligent, resource efficient organism, able to interpret data and respond to arising challenges and needs in a timely and effective manner. Key to achieving this vision are data and analytics, connectivity and infrastructure, as well as policy and regulation.

Data and advanced analytics should be leveraged to help policy makers plan strategically and enact required policies; artificial intelligence can augment decision-making capabilities and deliver true real-time efficiency, while significantly boosting a city's ability to make accurate projections and estimations and react quickly to needs and changes.

Reinforcing a data first culture, awareness building, and fine tuning organizational structures and cultures are paramount to a successful and effective adoption of data technologies. Cities should keep citizens informed about the benefits and security of data sharing.

Updating and maintaining an advanced technology infrastructure is also a necessary driver for successful smart cities. Focus should be placed primarily on digitization-enabling technologies, such as 5G and Wi-Fi 6, sensors and the Internet of Things, cloud computing and data & analytics, geospatial technology, augmented, virtual, and mixed realities, as well as digital twins.

Lastly, regulatory frameworks must be updated to cover vital considerations, namely safeguarding the privacy of individuals and regulating responsible data sharing between organisations, as well as fostering research and development.

The Drivers of Growth

Smart cities of the future should be inclusive – catering to every individual, particularly the most vulnerable and disadvantaged residents; resilient – able to successfully react and mitigate major shocks, from economic downturns to natural disasters; and happy.

To achieve those ends, smart cities must depend on forward-looking governance that creates and maintains regulatory frameworks which foster innovation and private/public sector collaboration, all while seeking to engage and satisfy each and every stakeholder.

Secondly, they must create financing models and incentives that allow for innovation to turn into an attractive investment. Lastly, with the two former drivers in place, cities must leverage the high quality of life it is able to offer and use it as an incentive to attract talent, without neglecting the need to develop and strengthen its own ability to produce talent.

Successfully delivering on those drivers will ensure that a city is able to compete on the global level and bestow prosperity, health, and happy living on its residents.

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I. INTRODUCTION

Over half the world's population live in cities today, and this is expected to increase to 66% over the next 30 years, according to Deloitte's ('Forces of Change: Smart Cities' report). This trend of urbanization has created tremendous opportunities for Urban Tech, the market for which has been growing in similar proportions and which is expected to increase from $81B in 2018 to $158B by 2022, according to data from IDC.

According to the United Nations Economic Commission for Europe (UNECE), 'a smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness while ensuring that it meets the needs of present and future generations with respect to economic, social, cultural, and environmental aspects.'

CB Insights expects that 'over time, a successful smart city should, in theory, be able to respond to incoming data much like a single intelligence organism, seamlessly and efficiently providing itself with exactly what the city and its citizens need, without wasting any resources and without any human error'.

As growing environmental, social, and economic challenges distress cities worldwide, urban tech is becoming increasingly necessary for making cities a better place to live through unified digital identities, seamless transactions, redefined public spaces and transportation mechanisms, and strong measures to ensure citizen privacy and data security.

To enable this transformation, city governments and municipalities are investing heavily in infrastructure, technology, and public-private partnerships in order to implement initiatives, advance their smart city agendas, and improve the quality of life of their residents.

Over the past decade, cities across the Middle East & Africa (MEA) region have made significant strides in urban technology: embracing digital transformation to diversify their economies, and accelerating the development and implementation of smart city solutions to enhance both current and future urban development.

According to KPMG, annual spending by smart cities in the MEA region is forecasted to double from $1.3B to $2.7B by 2022, powered by progressive smart city projects, plans, and initiatives across the region.

Saudi Arabia's mega-city, NEOM, is set to project the country into the future with its smart, connected metropolis powered by robotics and artificial intelligence. Egypt's New Administrative Capital is putting MENA on the cognitive cities map with its state-of-the-art technologies. Abu Dhabi's Masdar City is one of the world's most sustainable urban developments, and Dubai Digital Park, with its intelligent and integrated building management system, is the city's first purpose-built smart city.

With more than 83% of the population now living in urban areas, according to the Saudi Ministry of Municipal and Rural Affairs (MOMRA), and urbanization expected to grow to 97.6% by the year 2030, Saudi Arabia has witnessed a steep rise in its urban population. Its low density and horizontal development style have contributed to challenges such as high urban sprawl, traffic safety issues, high-level emissions, large automobile dependency, and insufficient infrastructure.

To overcome these challenges, the Kingdom of Saudi Arabia has been exploring new opportunities and ways to revitalize and transform its cities. In pursuit of its Vision 2030, which aims to fundamentally reshape the economy and society, the country has made significant qualitative leaps in digital infrastructure, investing around $4B to date.

At the same time, Saudi Arabia's presidency of the G20 in 2020 provided an ideal opportunity to highlight the role and potential for technology in urban development in the MEA region and across emerging markets. With

one of the youngest populations among the G20 countries and a host of social and economic transformations under its belt, Saudi's presidency theme of 'Realizing Opportunities of the 21st century for all' resonated well in the country and the lives of its people.

In the area of urban technology, the G20 explored practical solutions for urban smart mobility based on better infrastructure and good practices, as well as the sharing of experiences in establishing and developing smart cities. At the same time, the U20 Mayors Summit – the urban track of the G20 – brought critical urban issues to the forefront of the agenda. The final Communique of the U20 Summit stressed the significance of rebuilding cities in a more sustainable, inclusive, and naturally diverse way to achieve equitable, carbon-neutral, inclusive, and healthy societies.

The Communique also emphasized the need for national governments to 'devise visionary multilateral solutions and strengthen policy-making that fosters inclusive, sustainable, resilient, and smart urbanization and protects the rights of citizens and foundations of local democracy.'

Moreover, during the 5th Anniversary Future Investment Initiative (FII) in Riyadh, which was held under the theme "Invest in Humanity", Environmental, Social and Governance (ESG) principles and models were a recurring topic during many sessions, with participants highlighting the importance of ESG investment and policy to sustainability, growth, and a thriving future for humanity.

This year's City Possible Summit, organized by Mastercard in partnership with the Smart City Expo World Congress, showcases how city leaders, private sector companies, and others stakeholders are coming together to find solutions that enable innovation, accelerate digital access and foster an inclusive economic recovery. It tackles topics such as urban mobility, data & insights, identity and cyber security, inclusive urbanization, and financial inclusion.

The participants exchanged knowledge, shared best practices, and discussed strategies for fostering urban technology in emerging markets.

The discussions covered topics such as data as the new oil, urban mobility, citizens as co-creators, and inclusivity. The session also explored strategies for a cashless and frictionless experience, key enablers for smart cities, as well as the top challenges and opportunities for urban technology.

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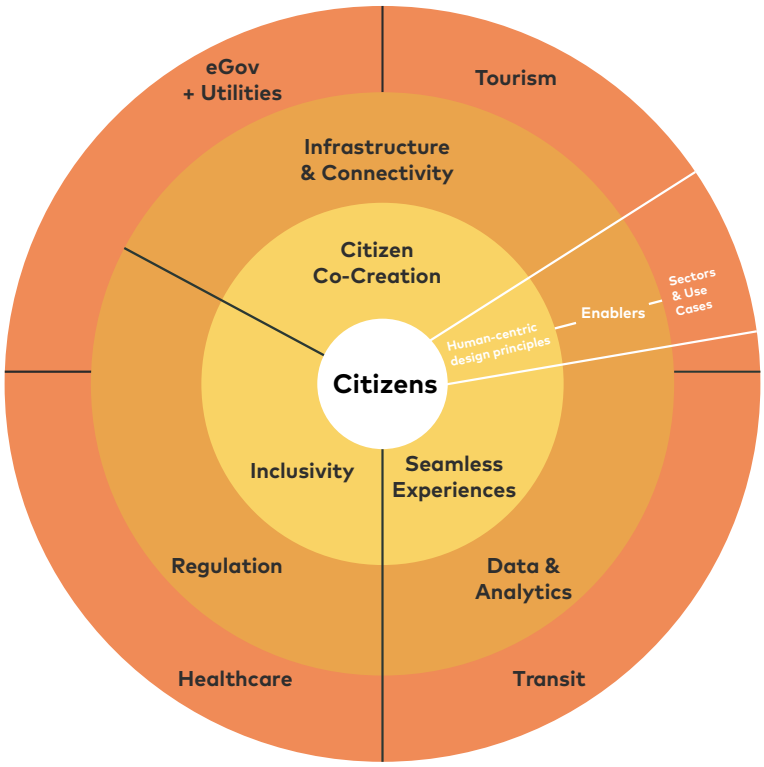
II. Urban Tech Framework Report Methodology

Leveraging the insights shared by the expert attendees and existing literature, this white paper will highlight the key best practices for fostering smart city innovation in the context of emerging and fast developing markets, based on the following smart city framework.

At the center of the framework are citizens, as the core aim of urban technology is to improve the quality of life of residents in cities.

In order to achieve this, smart city strategies must be built with human centric design principles in mind -- including co-creation with individuals, inclusivity, and developing a seamless experience.



Keeping those design principles in mind, cities must invest in the enablers needed to stimulate smarter cities -- most importantly connectivity and infrastructure, data and analytics, and regulations.

These necessary inputs are critical for the transformation of the various vital sectors of the city economy -- including eGovernment and Utilities, Tourism, Healthcare and Transit, to name a few.

Guided by this framework and Mastercard's international engagement in smart city development and implementation, the white paper will discuss the challenges and opportunities for fostering smart cities. It will delve into each of the human-centric design principles and review the key enablers in the urban tech space.

In addition, it will identify the maturity across a number of select sectors within the economy, and deep dive into the transformation taking place in transit in particular.

Lastly, it will highlight the opportunity for public-private partnerships to play a key role in the development of smart cities in emerging markets and in the MEA in particular.

III. Human-Centric Design Principles

Key Highlights

A strong urban tech strategy is human-centric and must rest on three key pillars: They must deliver a seamless experience, be inclusive, and engage individuals as co-creators.

Seamless Experience

Providing a seamless experience across city services is essential to the success and adoption of smart city projects and applications.

One primary way to do this is by centralizing online services through a unified self-service portal.

Inclusivity

Cities that effectively foster inclusion present individuals with greater opportunities and reap widespread economic benefits for doing so.

Cities must increase access to high-quality broadband connectivity, boost Internet adoption rates, and ensure that their digital channels and services meet recognized standards for accessibility and that all individuals have digital knowledge and skills needed to fully utilize smart city services.

This can be achieved by promoting digital literacy programs by partnering with educators, community centers, nonprofits, and businesses.

Individuals as Co-Creators

Cities should put residents, civic organizations, businesses, and other stakeholders at the core of decision-making and solution-creation processes.

Cities can tap into the collective intelligence of residents -- through various online and offline modes of information exchange such as resident advisory committees, town halls, focus groups, open data portals, etc. -- to produce solutions that more closely align with people's needs while promoting wider stakeholder buy-in for new digital initiatives.

One way cities are doing this is by partnering with 'GovTech' startups.

A strong urban tech strategy is human-centric. By adopting a community-driven, bottom-up approach where individuals are an integral part of design, development, and initiation, city leaders and managers can use invaluable feedback to improve existing services and power the development of new ones.

To keep individual experience at the center, city leaders should also prioritize initiatives that increase ease of life for residents and deliver seamless experiences.

Urban initiatives can improve quality-of-life indicators by 10-30% according to a report by McKinsey Global Institute. Beyond engaging people as co-creators, urban technology leaders should ensure that any initiatives developed should be inclusive -- across age, gender, income and race -- and keep in mind minorities and individuals with disabilities.

A. Seamless Experience

Individuals are digital customers – they transact and interact online on a daily basis with brands that put the convenience of digital service delivery at their fingertips. As populations become increasingly digitally savvy, their expectations are growing, and people now want and expect the same level of service from their cities that they receive from online retailers.

According to Accenture, 85% of citizens expect the same or higher standard of quality from government services as they do from commercial organizations. Therefore, in order to secure the success and adoption of smart city projects and applications, smart city managers must leverage data and technology to provide individuals, businesses, and visitors with a seamless experience across dozens of city services, making everything from finding parking to accessing healthcare more efficient and more satisfying.

One primary way to do this is by centralizing online services through a unified self-service portal. According to analysis by McKinsey, digital city platforms and applications can nearly double the share of citizens that feel connected to the local community, and nearly triple the share who feel connected to the local government. By building a single unified people-friendly smart city portal or interface, cities can disseminate data to individuals while increasing government transparency and trust.

Serving as hubs for both information and transactions, smart city platforms offer a myriad of benefits for both individuals and cities. With access to the city's services, utilities, and standardized data, individuals can use smart city platforms for everything from planning commutes using real-time traffic information to paying government utility bills and residency fees to reporting/tracking complaints and concerns.

On the other hand, cities benefit from improved management efficiency, optimized decision-making, improved data quality, and increased understanding of citizen needs.

B. Inclusivity

In 2012, the UN established Sustainable Development Goals to guide its development agenda through 2030, including the aim to 'make cities and human settlements inclusive, safe, resilient, and sustainable.' Cities that effectively foster inclusion offer greater opportunities for individuals and reap the widespread economic benefits of doing so.

A study by Urban Institute found that cities that are more inclusive have better economic health than those that are not. With the digital divide and widening inequalities between different population groups, providing all individuals with equal access to services while engaging them in decision-making has become a top priority.

Beyond improving existing infrastructure, urban technologies provide a unique opportunity for improving the lives of all segments of society. However, in order for marginalized groups like the elderly, the less fortunate, and those living with disabilities to participate in smart cities, cities must ensure that their digital channels and services meet recognized standards for accessibility.

To bridge the gap and digital divide that prevents these groups from accessing the full benefits of technology, city leaders and officials must empower communities by assessing the availability of internet infrastructure, increasing access to high-quality broadband connectivity, boosting Internet adoption rates, and most

importantly, ensuring individuals have the digital knowledge and skills needed to fully utilize and benefit from smart city services.

To help non-digital natives take better advantage of the internet, cities can leverage public-private partnerships with educators, community centers, nonprofits, and businesses to establish and promote digital literacy programs that train individuals in basic skills such as operating a computer, navigating the Web, and sharing data securely.

Digital Attaa and Saudi Digital Academy (SDA), are two examples of such initiatives. Launched by the Ministry of ICT in Saudi Arabia, the initiatives aim at developing the digital capabilities of the Saudi youth in the field of modern and advanced technologies with the support of public-private partnerships.

C. Engaging Individuals as Co-Creators

In addition to empowering individuals with resources, skills and knowledge, smart cities are also tackling digital inclusion by embracing new community engagement models. Based on data, technology, and citizen-centered design, these models put residents, civic organizations, businesses, and other stakeholders at the core of decision-making and solution-creation processes.

By gathering pain points, ideas, and feedback through various online and offline modes of information exchange such as resident advisory committees, town halls, forums, competitions, focus groups, open data portals, and incubators, multimodal crowdsourcing helps cities tap into the collective intelligence of residents and produce solutions that more closely align with people's needs while promoting wider stakeholder buy-in for new digital initiatives.

One-way cities are doing this is by partnering with 'GovTech' startups. By allowing individuals to share ideas, report and monitor issues, fill in requests, as well as co-create solutions, GovTech startups make public agencies more effective while helping individuals interact more efficiently with their government.

In the New Administrative Capital (NAC) in Egypt, open competitions and focus groups were used in the early stages to involve citizens in the planning and solution creation process. In addition, earlier this year, the NAC signed a contract with Honeywell and Etisalat Misr to develop a city management system that will include data analytics, a city-wide management dashboard, smart city services citizen engagement portal, and mobile application capabilities.

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IV. Enablers

Key Highlights

Three enablers are critical to bringing human-centric smart cities to life: data and analytics, digital infrastructure and connectivity, and enabling policy and regulation.

Data & Analytics

Data-driven technologies have the potential to increase a city's per capita GDP by 21%.

AI-driven, real-time decisioning capabilities will enable cities to optimize the citizen experience in real-time as well as anticipate and react quickly to sudden challenges.

Advanced analytics should inform policy making, strategic planning, and business case development.

Changing organizational culture and raising data awareness are essential for the adoption and widespread use of data in urban tech.

City planners should communicate the advantages and benefits of data to all stakeholders and address privacy concerns through discussion forums, open houses, town hall meetings and public talks.

Infrastructure

Key technologies driving digitization include 5G and Wi-Fi 6, sensors and the Internet of Things, cloud computing and data & analytics, geospatial technology, augmented, virtual, and mixed realities, as well as digital twins.

Policy & Regulation

Any legal and policy framework should comprise 4 key elements:

- An international legal framework that protects individuals' rights whilst enabling the free-flow of data
- An international regulatory framework that allows organizations to hold proprietary rights in data and its analysis
- Continued regulation of specific data uses
- A competitive environment that fosters innovation and private sector investment in data development, analysis and use

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By utilizing these human-centric design principles, cities have more tools to engage diverse stakeholders in solution creation and can ensure that individuals are the chief beneficiaries of smart city improvements. Three enablers work around these core principles and are critical to bringing human-centric smart cities to life: data and analytics, digital infrastructure and connectivity, and enabling policy and regulation.

A. Data & Analytics

Data-driven technologies -- such as big data analytics, machine learning, artificial intelligence (AI), Internet of Things (IoT), and data visualization -- have become essential to the digital transformation of cities. Data is at the heart of urban technology; Susan O'Connor, former Global Director of Smart Cities at Oracle, highlighted that 'data is the rocket fuel for smart city transformation.'

According to a study by ESI Thoughtlab, these data-driven technologies have the potential to increase a city's per capita GDP by 21%.

They give city stakeholders the insights they need to manage changes, optimize operations, inform public policy decisions; they also enable city leaders to drive smart decision-making across all aspects of public service and city operations -- from smart security and electricity, to city planning and improved urban mobility.

From Data to Information to Intelligence

In the realm of smart cities, leveraging data effectively is paramount for both real-time optimization and intervention as well as long term planning and forecasting. With the number of connected devices forecast to grow to 42Bn by 2025, according to the IDC, and the demand for IoT, automation, and 5G on the rise, cities are generating an overwhelming amount of data.

AI-Driven Real-Time Decisioning

As their populations expand, cities must be able to anticipate and react quickly to challenges in many vital areas, including health, environment, energy, and transportation. Cities that are able to track and analyze data from the multitudes of IoT devices and sensors in real-time will be able to automate millions of decisions each day to optimize citizen experience and will be best equipped to react to major situations where timely intervention is critical, such as extreme weather events or major traffic congestions or accidents.

To be able to generate timely insight, cities must rely on artificial intelligence (AI) and machine learning, as well as complex algorithms that are able to draw connections across various data sources and process them into useful and actionable information.

Advanced Analytics and Big Data-Driven Policy Making

In addition to being able to make instant optimization decisions, captured data should be stored and analyzed to identify patterns and trends over time, which would then inform policy making, strategic planning, as well as business case development. This enables cities to capture potential opportunities, and preempt bottlenecks, badly designed or under-capacitized consumer journeys, or even potential crises.

Building a "Data Culture"

Changing organizational culture and raising data awareness is recognized as one of the essential elements for the adoption and widespread use of data in urban tech. However, in order to build a culture of data, smart cities need to build trust in data – for both the sources of data and consumers.

Engagement with authorities, organizations, communities and other stakeholders is needed to spread knowledge, education, and awareness around the use of data.

By communicating and demonstrating the advantages and benefits of data to all stakeholders, through discussion forums, open houses, town hall meetings and public talks, city leaders can address concerns around privacy and security while remaining transparent and accountable.

Moreover, in order to improve data privacy and security, urban tech must incorporate ethical practices and make privacy a priority, whether that be through market-based regulation, technology solutions, policy changes, governance mechanisms, legal interventions, or a more fundamental rethinking of the logic and aims of smart cities.

Tackling Data Challenges

While the need for establishing digital infrastructures and implementing data strategies and projects is clear to many urban leaders, bringing it all together can be a lot more difficult.

Some challenges faced by decision-makers include maintaining data security and transparency, funding smart city projects, and changing mindsets around data use.

Data security and privacy are critical factors to consider as cities work to implement urban tech projects. Large amounts of data being uploaded onto the cloud and being made widely available through city systems creates substantial cybersecurity risks.

In order to minimize the risks, it is vital for cities to apply appropriate digital security measures to safeguard the digital infrastructure as well as the private information of all stakeholders involved, from individuals to public and private institutions.

It is also extremely important that individuals and service users are made aware of the uses to which their data may be put, by ensuring that Privacy by Design is encouraged and applied throughout the lifecycle of Smart City projects.

Flexible, accountability-based privacy regulation can ensure that organizations that collect, share and process data do so properly by: informing service users about how their data will be processed; collecting the consent of each user where appropriate; and implementing organizational policies and procedures to enable privacy controls at the point services are designed.

Another key challenge is securing funding for smart city projects and resources, especially considering COVID-19 and the economic implications. To enable and scale urban tech projects, city leaders are increasingly looking for opportunities to monetize data through various business models. One way is through data exchange marketplaces or platforms that give the private sector access to raw, anonymized analytics-based data.

Another way is by combining individual datasets from city sensors into meaningful applications such as ITS (Integrated Transportation Services) and monetizing the resulting new data. A third way is through smart parking meters with dynamic pricing or other data applications that provide opportunities for direct revenue streams.

Moreover, public-private partnerships as well as Build Operate Transfer Models (BOTs) are popular investment types that can be considered for managing financial challenges.

Finally, resistance to change is a key hurdle for the adoption of urban tech, and some of the efforts to address this need to focus on **changing mindsets and enhancing skills**. In order to drive change and trust from the top down, city leaders need to understand and communicate the benefits urban tech can deliver.

They also need to foster a more competitive and forward-thinking mindset -- a “can-do mindset”.

It’s critical to support city employees -- especially in middle management -- to build the necessary skills and tools to implement successful smart city projects.

SMEs also need to support in building the skills to manage, process / clean, and utilize data in an intelligent sense. Technology education and training programs must be made available across the city for all stakeholders.

B. Infrastructure

Technologically advanced infrastructure is a critical input needed for the development of seamless smart cities. Key technologies that are driving digitization globally – including 5G, sensors and the Internet of Things, cloud computing, and data & analytics among others – are needed to develop cities that can collect and respond to data in real-time, and can make decisions, learn, and optimize based on changing inputs and environment.

Internet of Things

By 2025, there will be 41.6 billion connected IoT devices generating 79.4 billion terabytes of data, according to IDC; by 2021, spending on IoT will have reached 1.4 trillion dollars globally. IoT technology is fundamental to the development of smart cities and successful smart city initiatives.

Comprised of a network of physically connected devices, IoT creates opportunities to converge cities' physical and digital infrastructures, improving efficiency, driving economic benefits, and improving people's quality of life.

Sensors

Sensors are at the core of every device in the IoT system, from connected cars to traffic lights to smart homes. Attached to various physical assets that generate data, sensors monitor these assets in real-time and collect the data, using applicable variables to adjust operations accordingly.

As their cost falls (GE estimates to under 0.5 cents in 2020), and as cities become more connected and data-driven, sensors will play an increasingly vital role optimizing city infrastructure and enabling an even wider range of smart city applications.

Cloud Computing

The vast amount of streaming data generated from sensors and other devices requires significant computing capacity. Therefore, to operate more efficiently, smart cities must deploy Cloud Computing alongside IoT.

Using a network of cloud servers to analyze and store data and information, cloud-based IoT applications can implement automated predictive and prescriptive processes to develop enhanced capabilities, business models, and services while reducing costs.

Big Data

The combination of IoT and big data plays an important role in the feasibility and implementation of smart city initiatives. Deployed either on premise or on the Cloud, big data provides cities with a way to study and handle large volumes of data.

By using big data to analyze and process the structured, semi-structured and unstructured data collected through various IoT devices, cities can uncover patterns, extract valuable information, and generate actionable insights.

5G Connectivity

5G is set to deliver data a hundred times faster than the typical cellular connection, quicker even than any physical fiber-optic cable, giving it a critical role to play in the real-time transmission of smart city sensor data to central monitoring locations.

With the capability of supporting up to a million connected devices per square kilometer, compared to two thousand connections for the same surface area using 4G, the foremost beneficiary from this development will be IoT applications in smart cities – like self-driving cars and video-monitoring.

Geospatial Technology

Smart city planning requires geolocation accuracy and detailed geographic data.

Smart cities rely on technologies such as Global Positioning System (GPS) for transportation management and connected vehicles and Geographical Information Systems (GIS) automate geospatially related workflows like mapping with georeferenced data as well as monitor various networks in real-time.

Wi-Fi 6

Wi-Fi 6/6E improves fixed networks in many of the same ways that 5G advances mobile networks. It promises higher speeds, lower latency, and an increased capacity for multiple, high-bandwidth devices, ideal for deployment in public venues where large numbers of people gather, such as sports arenas, shopping centers, and school and university campuses.

Wi-Fi 6 will enable a multitude of new application and services for edge computing, connected cities and industry 4.0.

Augmented Reality and the Metaverse

The metaverse represents a new iteration of the internet, where users are able to access online 3-D virtual environments via conventional personal computing, virtual or augmented reality devices.

Advances in cloud computing, 3D modeling, cloud mapping, and the advent of lighter, more capable headsets will significantly reduce barriers to entry in the coming years, making metaverses more accessible to businesses and consumers.

Virtual Reality

The use of VR is expected to increase across the smart cities sector with the growth of 5G and Wi-Fi 6.

Although adoption is still limited outside of the gaming and entertainment sectors at the moment, the technology has potential applications across numerous sectors, including automotive, education and training industries, manufacturing, robotics, healthcare, retail and hospitality, with notable applications within smart cities that include emergency management and disaster preparedness.

Digital Twins

Digital twins are real-time, virtual representations that act as digital counterparts for physical object or processes. Digital twins are essential to the realization of smart cities, as they enable the planning, management, and optimization of a range of applications such as utilities, mobility and infrastructure, using tools like IoT sensors and IoT analytics platforms.

Digital twins allow for far more complex and accurate scenario building and predictions than what is currently possible with physical and 3D models.

C. Policy & Regulation

Strong data ecosystems and cutting-edge digital infrastructure are still not sufficient to achieve the development goals of urban technology. In addition to these requirements, a regulatory framework that protects the privacy of individuals, enables responsible data sharing between organisations and encourages research and development by private entities will be vital to enabling successful Smart Cities.

Mastercard recommends that any legal and policy framework should comprise 4 key elements:

An international legal framework that protects the rights of individuals whilst enabling the free-flow of data across international boundaries.

An international regulatory framework that allows organisations to hold proprietary rights in data and its analysis.

Continued regulation of specific data uses, such as by credit reference agencies and healthcare providers.

A competitive environment that does not penalise innovative organisations, but rather fosters and promotes innovation and investment by the private sector in data development, analysis and use.

1. An international legal framework that protects the rights of individuals whilst enabling the free-flow of data across international boundaries.

Mastercard is an international organisation that benefits from (and contributes to) the international free flow of data to bring reliable and affordable services to its customers and consumers around the world. This is possible largely due to the international digital infrastructure, supported by Mastercard's round-the-clock team to service it.

The use of international infrastructure can achieve business continuity for services far more effectively than when international data flows are restricted. It is imperative that any regulatory system does not include restrictions on data flows across international boundaries, as this creates technical, financial and administrative burdens that challenge both private and public sector adoption of data for public good.

Mastercard believes that an international legal framework that supports the free movement of data both enables the digital economy as a whole, and allows public sector organizations to benefit from the insights and innovation such an economy may produce.

2. An international regulatory framework that allows organisations to hold proprietary rights in data and its analysis. Mastercard is fully supportive of "Open Data" initiatives – a set of agreed data points about an individual, formatted such that the data is accessible by several systems – and is working with the international financial sector to enable several Open Banking Solutions.[1]

These include Mastercard Open Banking Connect, Open Banking Protect, and Open Banking Resolve, all of which seek to enable business customers to maximise innovation and security in the financial sector.

However, proprietary data sets, comprising data not identified as core Open Banking elements, also have a part to play in fostering urban technology and innovation.

Proprietary data sets represent a considerable business asset that is required for the digital economy to function, and that can be protected without jeopardising public interests.[2]

Allowing the development of such data sets as a business asset is not contrary to the aims of development, but rather fosters innovation and investment from the private sector that are crucial to its aims. In these circumstances, the long-term benefits of innovation may also result in techniques and processes that become more widely adopted.

3. Continued regulation of specific data uses, such as by credit reference agencies and healthcare providers. In addition to ensuring the free flow of data and enabling organizations to leverage their proprietary data, governments should continue to regulate specific data use cases, such as health data and credit score, to enable the digital economy.
For example, most countries place the regulatory requirements surrounding credit decisions upon credit reference agencies rather than payment service providers like Mastercard.

   Mastercard supports this approach and believes that responsibility for **decisions** made based on data should rest with such organisations – as this enables data processing to thrive and ensures that individuals are protected.

   This emphasis on regulating decision-makers for their decisions, rather than intermediaries, is one that allows innovation in the data space to thrive.

4. A competitive environment that does not penalise innovative organisations, but rather fosters and promotes innovation and investment by the private sector in data development, analysis and use.

   The final recommendation is that a competitive environment that protects innovation is key to enabling economies to realise the benefits of the digital world.

   In a global environment with growing concerns over single-entity market dominance, Mastercard suggests that the strongest defence against such possible dominance is to enable a competitive environment that allows innovation to be rewarded, including via proprietary rights for appropriate data and technologies.

   The "network externalities" inherent in some data businesses can be a source of benefit to individual consumers, when a competitive market is allowed to regulate them.

   For example, Hagiu & Wright suggest that companies invest billions when the "marginal value of data-enabled learning is high," and give examples of "systems designed to predict rare diseases (such as those offered by RDMD) and online search engines such as Google."

   Such investment and development cannot easily be replicated by public sector spending alone, particularly when the involvement of end-users is required for optimal data inputs.

   For example, when users' selection of preferences or provision of feedback on services is useful to the development of a system[3], it is in the business' interests to provide incentives to the users to provide such additional data.

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V. Sectors & Use Cases

Key Highlights

The e-government, tourism, healthcare, and transit sectors stand to benefit the most from smart city use cases in Saudi Arabia and the region.

E-Government

There is a significant opportunity for growing electronic transactions for government services in Saudi Arabia, which currently account for only 8% of overall e-commerce transactions in the country. Focusing on Digital Identity and Industrialized AI can help Saudi Arabia stand out and differentiate itself.

Tourism

Destination marketing organization (DMOs) are investing in creating their own data insights platforms and enhancing their travel apps with the objective of creating personalized, low-touch, in-journey experiences, and a "low-data footprint". Sustainability is a common agenda item among DMOs globally in two forms: carbon footprint and/or local ecology. There is a potential opportunity for a DMO to champion Zero Carbon Travel from a branding perspective.

Healthcare

Innovations are expected in the areas of rapid response, data sharing and analysis systems, tele-health, remote monitoring, and disease prevention programs. These will require a supportive infrastructure and legislation systems at the city level. Aging, high incidence of chronic diseases, and limited clinical capacity highlight the need for innovation in this sector in Saudi Arabia, particularly in tele-health services and electronic clinics, home care services, electronic services, payment and health insurance services, and cyber security systems.

Transit

Mobility as a Service (MaaS), or the concept of shifting various transportation solutions to a single on-demand service, is gaining momentum, alongside ride-sharing, dynamic pricing, smart parking, and autonomous vehicles Advanced Traffic Management Systems (ATMS) combine information from toll booths, traffic lights, car parks, and digital infrastructure to improve safety and significantly cut down traffic congestion levels and greenhouse gas emissions.

Taking into account the key Design Principles as well as the essential enablers that drive City Innovation development, we believe that each sector benefits differently from Smart City use cases. As such, we have selected four different sectors where we believe immediate impact will be felt in the context of Saudi Arabia and the region.

A. E-Government

The COVID-19 pandemic has changed the everyday lives of individuals everywhere, thus accelerating digital government strategies across the globe.

In fact, based on the 2020 UN E-Government Survey,[4] a growing number of countries and municipalities are pursuing digital government strategies, some of which constitute a radical change from those guiding earlier e-government initiatives.

Some of the new approaches governments are taking in pursuit of digital transformation include:

- The delivery of e-government as a platform
- The integration of online and offline multichannel delivery
- The agile development of digital services
- The expansion of e-participation and private public partnerships
- The adoption of data-centric approaches
- The strengthening of digital capacities to deliver individual-centric services
- The innovative use of new technologies in the development of smart cities

While this global acceleration of digital government strategies is taking place, the discrepancy between developed and developing economies remains evident.

As an example, based on the Global Competitiveness Report,[5] the responsiveness to change of advanced economies stands at 8.2% while that of emerging and developing economies is 6.8%.

Looking at the UN E-Government Survey for 2020, five of the six GCC countries are in the very high E-Government Development Index (EGDI) group.

The United Arab Emirates is ranked highest – in 21st place globally, maintaining its position amongst the 25 leading countries - followed by Bahrain (38), Saudi Arabia (43), Kuwait (46), Oman (50), and Qatar (66).

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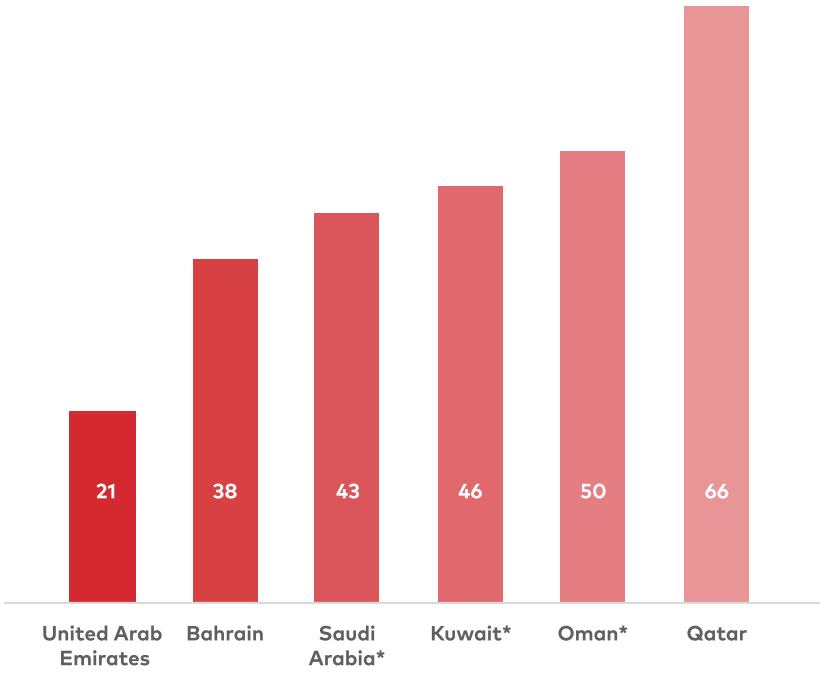
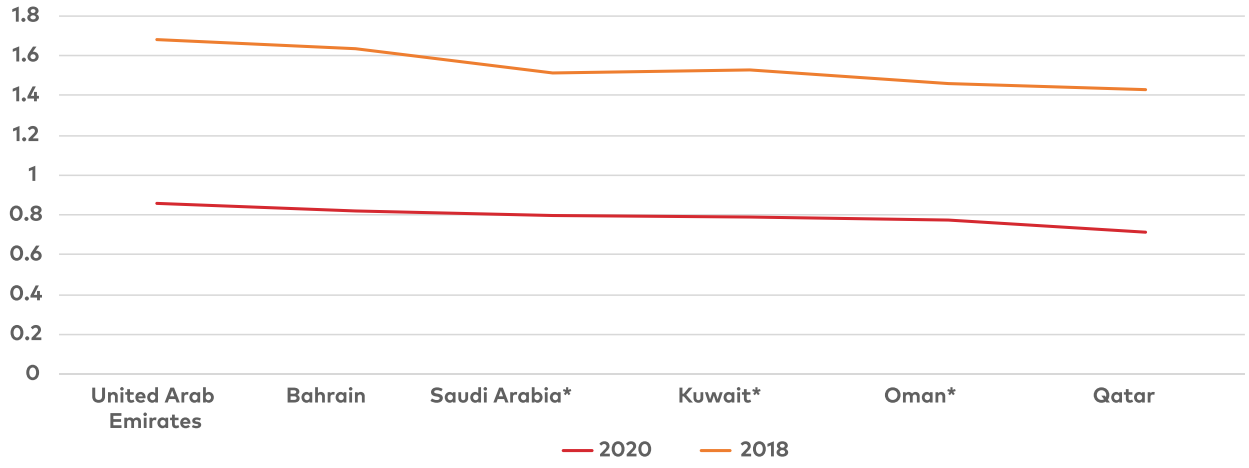
E-government development in the member countries of the Cooperation Council of the Arab States of the Gulf (GCC)

EDGI Rank



EDGI (2020 2018)



* Countries that moved from high to the very high EGDI group in 2020

Source: 2020 United Nations E-Government Survey

Zooming in on Saudi Arabia, overall e-commerce transactions have grown over 42% between 2019 and 2020.[6]

However, e-government services still represent a relatively small portion of total e-commerce transactions when compared to other countries:

approximately 8% of the overall e-commerce transactions in the country are e-government services, compared to 40% in the UAE and 25% in Singapore. This indicates a significant opportunity for further growing electronic transactions for government services in Saudi Arabia.

The advancement in e-government services in Saudi Arabia comes in the context of the strategic priorities set in the Saudi Vision 2030 and in the Financial Sector Development Program (FSDP), which include developing a digital economy and enabling Financial Intermediaries to support private sector growth through opening financial services to new types of players.

In this vein, the Saudi Central Bank (SAMA) announced that it is developing its Open Banking initiative and services through further collaboration with the market.

Furthermore, Saudi Payments, the operator of the national payment infrastructure in the country, under the supervision of SAMA, launched Saudi Arabia's instant payments system 'sarie' in cooperation with IBM and Mastercard. The system aims to improve the Saudi Arabia's financial ecosystem, mainly through the adoption of faster payments and improvements to banking reconciliation.

Nevertheless, governments continue to face a number of challenges, such as limited resources, a lack of digital infrastructure, and insufficient financial and digital capabilities. Governments also often struggle with data privacy and cybersecurity issues.

In response, top e-government transformations in the world have aimed to address efficiency, security and citizen experience challenges.

Among several technologies and emerging trends that are likely to disrupt the status-quo, Mastercard believe focusing on two of them can help the Kingdom of Saudi Arabia stand out and differentiate itself:

Digital Identity

The ongoing shift to digital, accelerated by Covid-19, has created a growing need for Digital Identity, especially for governments. Individuals being able to prove their identity in digital channels with high levels of assurance does not only unlock the potential of an elevated user experience, but also addresses various challenges such as access to government services and benefits (i.e. healthcare, financial services, etc.) and inclusion.

Having already taken steps towards establishing an interoperable Digital Identity ecosystem, this is one of the areas Saudi Arabia can differentiate itself, by applying advanced Digital Identity efforts across industries that are crucial to the national strategy.

Saudi Arabia has already launched a digital version of its national identity card as well as a digital version of the Muqeem, or resident, ID for foreign workers.

The country is well poised to be a leader in developing a future-proof digital ID framework that could grow into the region – by leveraging innovative technologies such as blockchain to seed the next generation of identity management, developing frameworks for both individuals and corporate entities, and enabling innovation across open architecture ecosystems such as the Multiverse and distributed token economies.

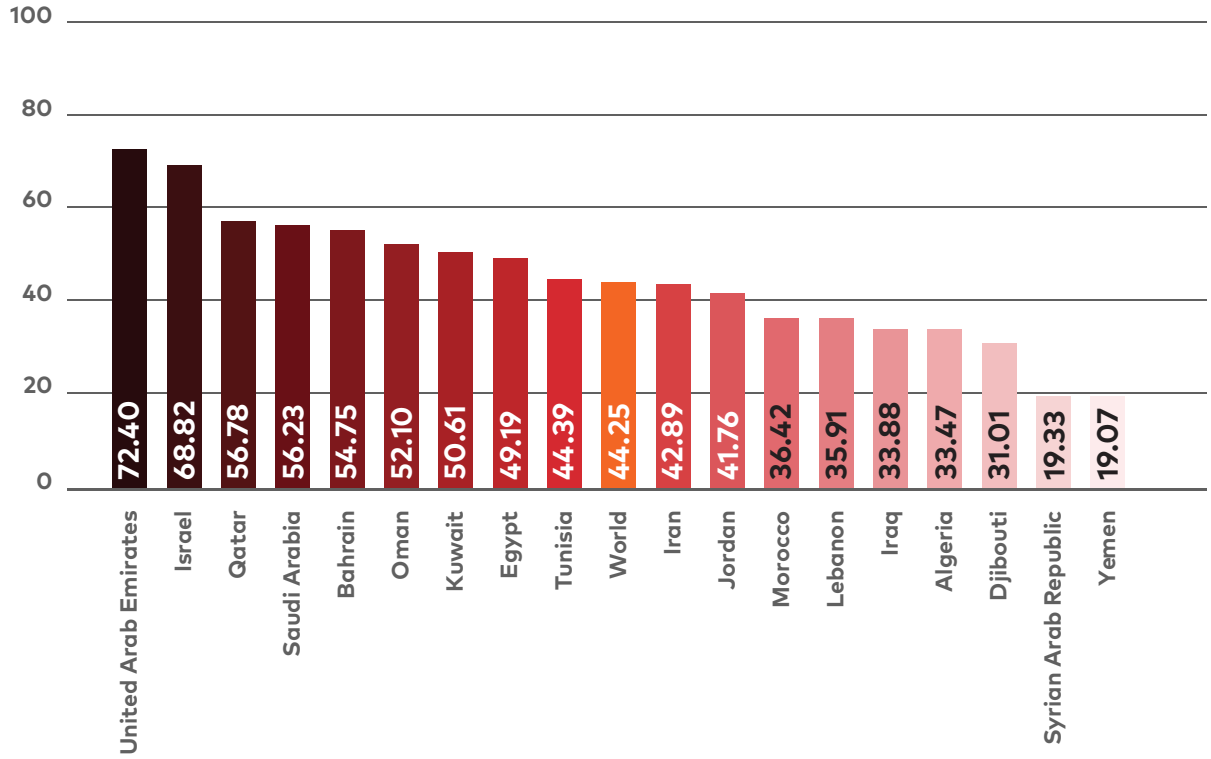
Industrialized AI

According to the 2020 Government AI Readiness Index,[7] Saudi Arabia is one of the top three countries in the MEA region leading in AI leadership and investment.

Using data driven technologies such as artificial intelligence and machine learning, governments can boost productivity in public services and positively impact citizen experience.

As both the user and regulator of AI, the Saudi Arabia government can pave the way to industrialize AI and fuel several other transformation efforts.

2020 Government AI Readiness Index scores for MENA region



Source: Oxford Insights

Furthermore, Saudi Arabia has been a pioneer at deploying 5G networks: by August of this year, the number of governorates covered with 5G reached 60.

Wide deployment of the 5G mobile network is a precursor to automation across sectors, real-time policy refinement, and self-regulating systems.

Moreover, it enables the creation of innovative and practical applications across people or process-intensive sectors, such as transit, healthcare, and tourism, including religious tourism.

B. Tourism

From 2009 to 2019, tourism grew twice as fast as world real GDP growth, whether measured in passengers or spend. This healthy growth meant that top global Destination Marketing Organizations (DMOs) – organizations that promote a location as an attractive travel destination, including tourist boards, tourism authorities or visitor bureaus -- could rely on their established global brand to deliver outstanding results, while up-and-coming DMOs benefited from the overall growth in global travellers.

Thus, from a DMO spend perspective, there was no urgent need to focus on optimizing Return on Investment (RoI): enhancing the efficiency of marketing spending through data-driven marketing & in-journey performance management (spend & offer optimization), as well as SME enablement (acceptance, credit, e-commerce).

While tourism will remain a high growth space from 2021 to 2024 due to an improving health context and a low base, the interim period will include a smaller pool of travellers with a different profile compared the pre-COVID period.

Top and flexible DMOs are now looking toward attracting travellers once international travel "reopens", revising their strategy based on post-COVID traveller persona preferences.

Given the pause in tourism traffic, DMOs are also working on addressing SME enablement and informing future decisions using data-insights—which would enable them to re-emerge more capable and resilient.

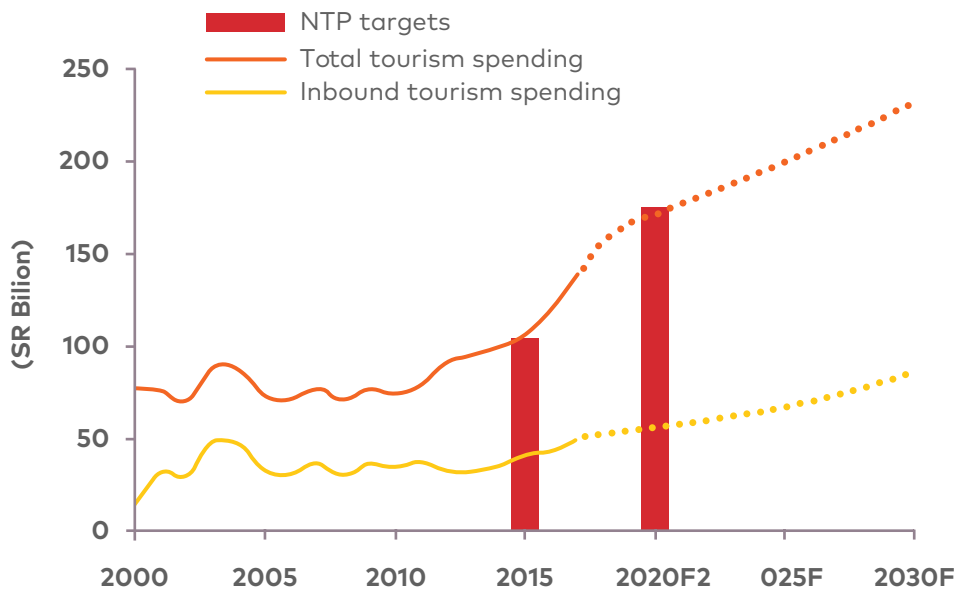
In particular, top, forward looking DMOs are investing in creating their own data insights platforms and enhancing their travel apps to best-in-class user experience—with the objective of creating personalized, low touch, in-journey experiences, and, in some cases, a "low-data footprint", reflecting data privacy concerns of travellers.

Sustainability, meanwhile, is a common agenda item among DMOs globally in two forms: carbon footprint and/or local ecology. No DMO has championed Zero Carbon Travel—a potential opportunity from a branding perspective (first mover = owner), which is feasible given the emerging ability to do activity-based carbon footprint tracking and offset in real-time.

Saudi Arabia is in the early stages versus its ambition to become a top global destination. The Saudi Ministry of Tourism has stated its ambition is to attract 100M visitors by 2030,[8] create 100,000 jobs in tourism by the end of 2021, and over 1M jobs by 2030.[9]

The country is already making significant headway through its global marketing and awareness campaigns – a Facebook case study[10] of the Visit Saudi campaign highlights that it reached over 60M people on the platform alone, with a 31-point lift in ad recall globally (and an even higher lift in ad recall of 42 points in the US market).

Tourism spending in KSA[11]



Source: Jadwa Investment

C. Healthcare

The pandemic has had a significant impact on the health sector and the way services are provided to patients and employees – accelerating digital transformation and creating new channels for communication. It has also highlighted the importance of investing in and developing the healthcare sector as an essential part of welfare and social security.

The quality of the healthcare services and the level of health for a community is an important factor in raising the level of competitiveness of cities.

This is expected to drive more innovation to provide healthcare to all segments of society, taking into consideration the requirements of each segment and the best way to provide service to them.

At the same time, the pandemic has demonstrated the importance of a rapid response, so further innovations are expected in this area, as well as in the data sharing and analysis systems to help make decisions faster and provide solutions and recommendations for all healthcare stakeholders.

Other areas where significant innovations are expected include tele-health, remote monitoring, and disease prevention programs, which will require a supportive infrastructure and legislation systems at the city level.

In Saudi Arabia, the expected rise in aging, the high incidence of chronic diseases, the growing demand for healthcare, combined with limited clinical capacity highlight the need for innovation in this sector in order to be in line with international standards and best practices.

Among the most important needs that require innovation and development are: tele-health services and electronic clinics, home care services, electronic services, payment and health insurance services, and cyber security systems.

In addition to the importance of integration between services within the sector, it is very important to integrate with other sectors and to support data sharing between all relevant parties.

Saudi Arabia's Vision 2030 includes the "Health Sector Transformation Program", which aims to restructure the health sector to be a comprehensive, effective, and integrated health system.

It is expected that the "Unified Digital Health File" will cover the entire population of Saudi Arabia and that 88% of the population will be covered by inclusive health services by the end of 2025.

Achieving this requires the adoption of digital solutions, big data analysis, as well as integrating with other programs such as the "Quality of Life Program", the "Privatization Program", the Digital Infrastructure Development Programs, Traffic Safety Programs, and others.

The private sector is expected to have a greater contribution to the expansion of the medical centres and medical cities, in addition to more innovation in providing electronic health services such as mobile applications that facilitate consultations, health monitoring, prescription dispensing and delivery.

D. Transit

With expanding urban populations, aging infrastructure, inefficient and uncoordinated traffic signal timing and lack of real-time data, traffic congestion is costing the world's major cities tens of billions of dollars each year, according to a study from transportation consulting firm INRIX.

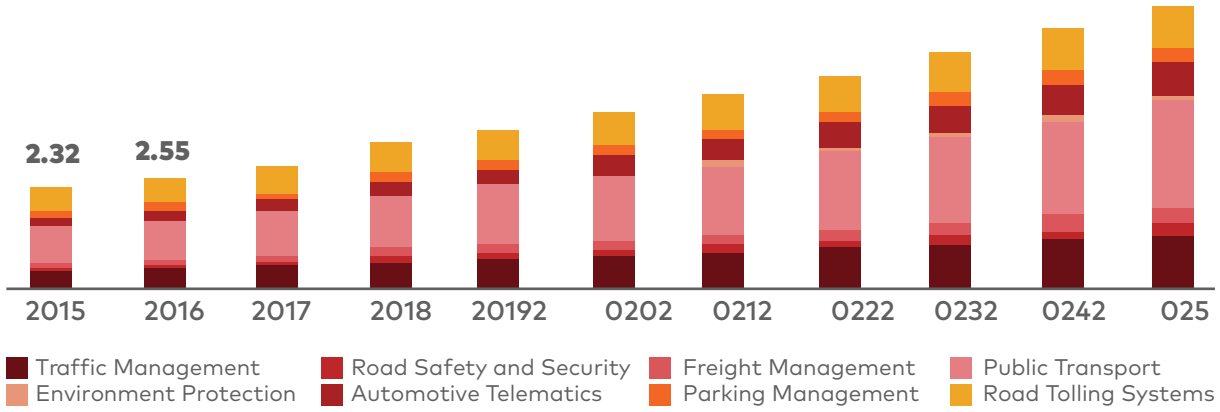
As levels of congestion and the resulting pollution increase, cities worldwide have started embracing and implementing urban mobility plans and innovations in an effort to solve their transportation problems.

Sustainable Urban Mobility Plans, or strategic plans designed to satisfy the mobility needs of people and businesses in smart cities, can improve the overall quality of life for residents by addressing major challenges such as congestion, air/noise pollution, climate change, road accidents, parking, and the integration of new mobility services.

Changing the Mindset – from Transportation to Urban Mobility

Digitization is transforming passenger mobility expectations and experiences in cities across the world. Driven by mounting concerns for public safety, growing traffic congestion, and increased adoption of eco-friendly automotive technologies, the Intelligent Transportation System market for roadways is expected to grow from USD 17.9 billion in 2020 to USD 36.5 billion by 2025 according to research firm MarketsandMarkets.

Middle East Intelligent Transportation System Market Size, by Application, 2015 - 2025 (USD Billion) [12]



Source: www.grandviewresearch.com

In building urban transit solutions, city leaders must shift from a mindset of developing specific transportation initiatives (a metro or bus network) to a more holistic approach of designing integrated urban mobility.

Urban mobility technologies, which include smart transport infrastructure, mobile apps and digital services, allow for more efficient use of existing and completely new transport methods.

They also include big data technologies that are improving mobility and enabling smarter city management on all levels through the collection of real-time data from sensors and other devices. A key trend is Mobility as a Service (MaaS), or the concept of shifting various transportation solutions to a single on-demand service.

Alongside other trends like ride-sharing, dynamic pricing, smart parking and autonomous vehicles, MaaS is gaining momentum as it starts to move cities toward a more user-centered mobility paradigm.

Advanced Traffic Management System (ATMS)

One of the most important areas within intelligent transportation systems is Advanced Traffic Management Systems (ATMS), the annual revenue of which is expected to grow to nearly $3.8B by 2028 according to Navigant Research.

ATMS combines information from toll booths, traffic lights, car parks, and digital infrastructure such as smart roads to improve safety and significantly cut down traffic congestion levels and greenhouse gas emissions.

By changing traffic lights and road signs in real-time, adjusting rates on toll roads, and relaying traffic information to city control centers, ATMS provide cities and drivers with real-time information about traffic conditions, and alongside MaaS (Mobility as a Service) and alternative modes of transport, fill in the gap of managing traffic flow and gaining better control of private car mobility.

Similar to the platform capabilities of other smart city sensors, layers of additional services can also be added to ATMS, such as public transport prioritizations and communication with connected vehicles.

Globally, cities vary in their maturity in terms of using advanced traffic management systems. In the MEA region, Saudi Arabia is one of few countries leading the way in the field of smart mobility.

Using state-of-the-art smart mobility technologies to manage its day-to-date transport services and cater to the needs of individuals, Saudi Arabia has plans to invest $36B in transportation infrastructure projects over the coming 11 years.

One example is a multimillion-dollar artificial intelligence (AI) based adaptive signaling project in Riyadh that has had a significant impact on day-to-day traffic management.

Transit in Greenfield vs. Brownfield Smart Cities – Case Studies

While the smart cities vary in size, scale, and characteristics, they typically fall under two stages of urban growth: brownfield cities and greenfield cities, each of which presents a unique set of opportunities and challenges.

Brownfield cities entail converting existing cities into smart cities, mainly by retrofitting the present infrastructure, include cities like Dubai and Riyadh; greenfield cities, meanwhile, are essentially new cities built from the ground up, and include the likes of NEOM in Saudi Arabia, the New Administrative Capital in Egypt, and Masdar City in the UAE.

Greenfield Cities

Urban planning with a whole systems approach is a crucial part of making a city transportation friendly, and involves carrying out numerous studies on everything from high/low capacity areas to traffic impact and citizen's transportation patterns.

This can make approaching smart transit in a greenfield city much easier due to the lack of limitations of previous or surrounding infrastructure, however it is also financially exhaustive with low initial ROI.

That said, it is a sacrifice that has to be made in order to encourage a public transportation culture and reduce pressure on transportation infrastructure.

Greenfield Case Study

Project:
New Administrative Capital (NAC), Egypt

Challenge:
Due to a very low initial population, establishing smart transportation networks requires high investment with no quick revenue or return

Solution:
To encourage people to take public transportation or use ride-sharing and other transportation methods, the NAC is establishing smart parking initiatives with pricing that varies depending on if the area is low capacity (> low pricing), or high capacity (>higher pricing)

Brownfield Cities

While brownfield cities can be less costly to develop, they are often faced with challenges deeply rooted in legacy infrastructure and urban planning mistakes.

That said, they do present some advantages when it comes to the establishment of smart transportation networks. For one, new public transport routes and infrastructure can bring in a wide range of economic benefits through the increase of land value and the wealth of property owners next to transportation lines.

Moreover, brownfield cities limit urban sprawl and are closer to existing transportation links and major business districts.

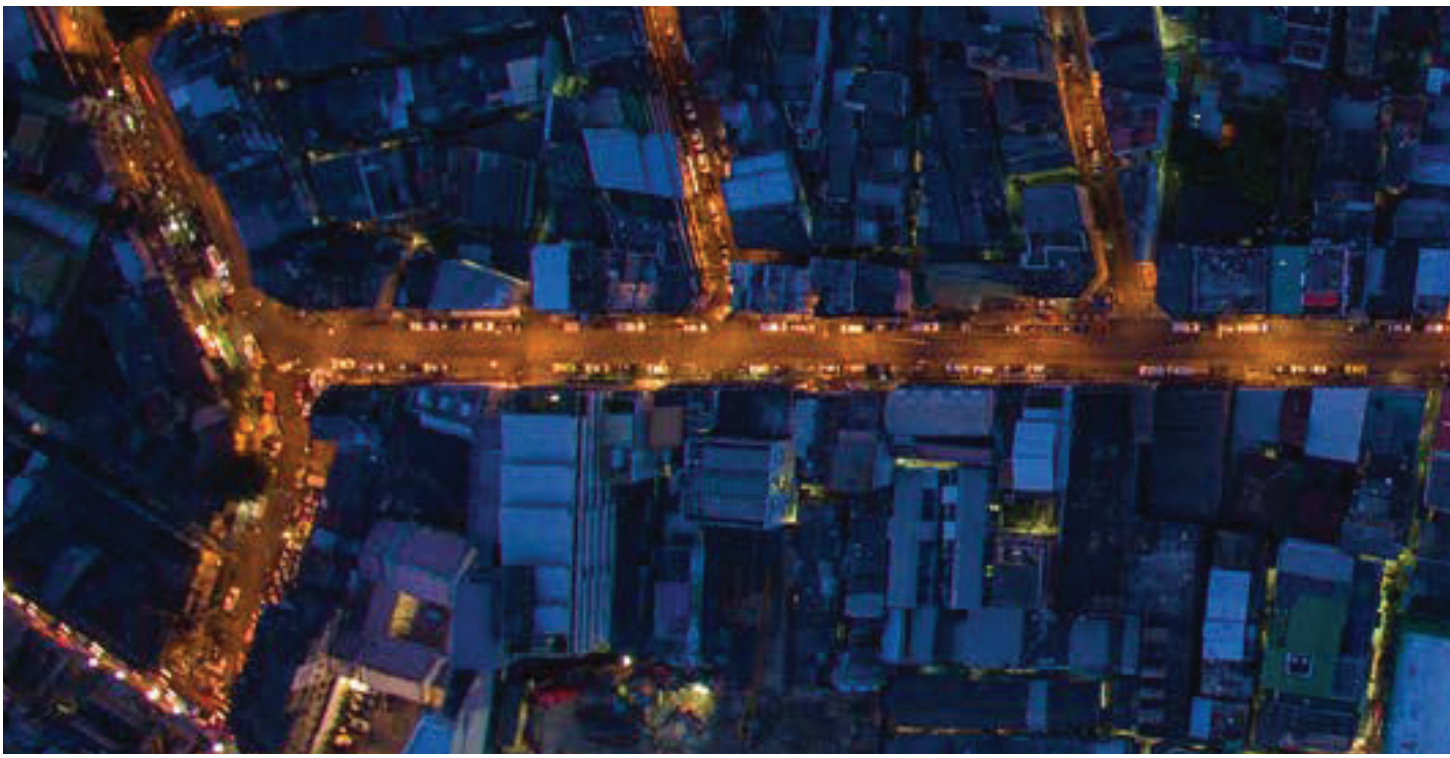
However, since public transport systems in brownfield cities, like metros, can only get commuters part way there, integrating alternative options like ride-sharing is crucial in making a brownfield smart city transportation friendly.

Brownfield Case Study

Project:
Riyadh Metro, Saudi Arabia.

Challenge:
Since Riyadh evolved without a comprehensive transportation system or integrated planning, some of the challenges that have been faced in building a new transportation network include a limited existing bus network, lack of proper pedestrian network, and limited data on people's transportation patterns.

Solution:
The limited bus network is in the process of being replaced with a proper urban bus network which will be revised as data comes in. Ride-sharing is also being integrated as a solution for urban traffic.



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VI. Covid Accelerates Urban Tech

Key Highlights

Covid-driven digital initiatives are shaping the future of urban tech

While the pandemic has temporarily slowed down smart city spending, cities worldwide are deploying urban technologies to fight the virus.

Saudi Arabia has led several initiatives to mitigate the repercussions of the coronavirus, including applications for medication delivery, remote medical consultations, green pass and contact-tracing.

The UAE adapted a system used to track mobile phone pings to cell towers to ensure social distancing and lockdown rules were obeyed.

Dubai's AI surveillance system was adapted to identify citizens leaving their homes without authorization during lockdown.

The COVID-19 recession will likely witness the entry of an increasing number of public-private partnerships in the urban tech space, allowing for more agile, flexible, and citizen-focused models of city governance.

By providing cities with innovative modes of funding and collaboration, public-private partnerships allow for more agile, flexible, and citizen-focused models of city governance.

Cities will need to look beyond investments in digital infrastructure and focus on organizational maturity, transparent data usage, digital inclusion, and trust in order to build long-term resilience against future shocks.

From tracking the spread of the pandemic to supporting the implementation of medical strategies, the Covid-driven digital initiatives are demonstrating the value of smart technologies while shaping the future of urban tech. In February, prior to the global lockdown, IDC's Worldwide Semiannual Smart Cities Spending Guide forecasted global expenditures of $124bn in 2020, up 18.9% from 2019.

While the pandemic has temporarily slowed down smart city spending and postponed projects, the trajectory remains positive with cities worldwide deploying urban technologies to fight the virus in innovative ways.

Saudi Arabia has led several initiatives to mitigate the repercussions of the coronavirus. In Riyadh, digital health initiatives led by Riyadh Health Affairs played a vital role in fighting the pandemic and curtailing the spread of the virus with applications like 'Your Medicine to Your Home' for medication delivery, the 'Seha' app for remote medical consultations, and the 'Tawakkalna' app for green pass and contact-tracing technology.

Moreover, as part of a $26.7m initiative in partnership with the Ministry of Health, Saudi-based telecom company STC doubled the operational efficiency and awareness outreach of 22 of its health care centers by enabling digital services such as advanced cloud computing-based health services as well as other digital solutions.

The UAE also deployed an array of smart technology applications as part of its containment efforts. By adapting a system used to track mobile phone pings to cell towers, the UAE was able to ensure social distancing and lockdown rules were obeyed.

In parallel, Dubai's AI surveillance system which is used to read license plates, was adapted to identify citizens leaving their homes without authorization during lockdown. Meanwhile, Masdar City, Abu Dhabi's flagship sustainable smart city, built a high-volume secure testing facility in two weeks with the capacity of completing thousands of daily diagnoses.

In addition to boosting the development of urban technologies and initiatives, the pandemic has presented several lessons and opportunities for the future of urban tech.

As cities are driven to collaborate with private firms to address urban problems and generate new sources of revenue, the COVID-19 recession will likely witness the entry of an increasing number of public-private partnerships in the urban tech space.

By providing cities with innovative modes of funding and collaboration, public-private partnerships allow for more agile, flexible, and citizen-focused models of city governance.

The pandemic has also highlighted the need to accelerate digital city planning, harness urban technologies, and establish more efficient communication with individuals. Cities that fall short in communicating the value of smart solutions to people will struggle in deploying large-scale, data driven technology.

Therefore, in order to build long-term resilience against future shocks, cities will need to look beyond investments in digital infrastructure, and focus on organizational maturity, transparent data usage, digital inclusion, and trust.

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VII. Building Resilient Cities of the Future

Key Highlights

Cities of the future strive to be inclusive, resilient and happy. Enabling such cities of the future will depend on three major drivers of growth: forward-looking governance, financing models and incentives, and talent and human wellness.

Forward-Looking Governance

Government policies and regulatory frameworks must help foster innovation and form the building blocks for private and public sectors players to innovate together.

This can include establishing AI-driven e-government platforms, developing regtech initiatives, and fostering decentralized technologies like blockchain and DLT (distributed ledger technologies).

Multi-stakeholder engagement should aim to satisfy and empower every individual constituent to the extent that is possible.

Financing Models & Incentives

Creating an environment that allows for innovation to turn into an attractive investment proposition to both local and international investors and corporations alike is key. Open Projects and Decentralized Autonomous Organizations (DAO) can reduce barriers to entry for creatives.

Talent & Human Wellness

Talent attraction is dependent on creating an environment of wellness and sustainability, as well as empowering minorities and promoting inclusiveness and diversity. Frameworks must also ensure that education is available to everyone to help drive the up-skilling of the local work force.

Cities of the future strive to be inclusive, resilient and happy.

To be inclusive they should endeavor to provide for all society, including the most vulnerable – the financially disadvantaged, the disabled, and the elderly.

To be resilient, they should establish strategies and frameworks to weather major shocks such as economic downturns, natural disasters and climate change.

Finally, cities should enable their diverse constituents – men and women, people of different races, companies, and even perhaps robots one day – to strive for happiness.

Enabling such cities of the future will depend on three major drivers of growth: forward-looking governance, financing models and incentives, and talent and human wellness.

Forward-Looking Governance

Governments and regulators in particular should mind that the policies and regulatory frameworks that they enact are designed to help foster innovation.

This can include establishing AI-driven e-government platforms, developing regtech initiatives, and fostering decentralized technologies like blockchain and DLT (distributed ledger technologies).

This would help reduce fragmentation and form the building blocks for private and public sectors players to innovate together.

Multi-stakeholder engagement will be key to these initiatives, and should include citizens as well as corporates and SMEs.

These engagements should aim to satisfy and empower every individual constituent to the extent that is possible.

Moreover, cooperation should not necessarily be limited to the edge of the city, as city-to-city engagement and partnerships can present ideal scenarios for mutual leaning and synergistic collaborative innovation.

Mastercard's City Possible program is a great platform that can facilitate such city-to-city collaborations, by bringing together cities, companies and communities to identify challenges, share best practices, and develop solutions to support innovative, inclusive and sustainable urban development.

Financing Models and Incentives

Innovation cannot be achieved without adequate funding. Creating the right incentives that improve the case for investing in these initiatives is paramount.

Reducing friction for investment can be achieved by increasing ease of doing business and putting in place frameworks that follow best in-class, tried-and-true models from around the globe.

The goal should be to create an environment that allows for innovation to turn into an attractive investment proposition to both local and international investors and corporations alike.

Governments can take the lead when it comes to investing in disruptive technologies and promote cross-sector technology integration, or use tax incentives to encourage investment into "last-mile" connectivity.

At the same time, governments should leverage the rise of Open Projects, which encourage innovation through collaboration and help accelerate product and services development by allowing different parties to freely use, study, modify, and distribute work.

Similarly, Decentralized Autonomous Organization (DAO) – or government-independent, member-owned organization encoded as a computer program – can also work to reduce the barriers to entry for creatives and use-case creators and enable them to innovate without borders or constraints, provided that these organizations are initially tested within controlled environments, such as regulatory sandboxes.

Talent and Human Wellness

After establishing forward-looking governance frameworks and robust funding models, cities then have the fertile environment to attract talent -- the third of the foundational building blocks necessary for building thriving smart cities.

Successful engagement of talent depends on fostering a high quality of life. This can be achieved by creating an environment of wellness and sustainability, as well as empowering minorities and promoting inclusiveness and diversity.

The search for talent should also include all segments of the population, from in and outside of the city, as teams made up of individuals from different backgrounds and walks of life ultimately lead to better representation and more comprehensive solutions.

In addition to attracting the best breed of talent, frameworks must also be established to ensure that education is available to everyone to help drive the up-skilling of the local work force.

Delivering on those three key enablers – governance, funding, and talent -- will ultimately lead to a thriving and balanced society, able to compete on the global level while also affording prosperity, and healthy and happy living to all segments and communities of its population.

The cities of the future will be home to empowered constituents -- from citizens to corporations and SMEs – and will be motivated to do well by doing good.

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ENDNOTES

IV. Enablers

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