

Executive Summary

Our report is written on 46 pages and contains analysis, case studies, rubric and our recommendations regarding key technologies and best practices for Smart City development. While the digital revolution is offering an opportunity to improve the lives of millions of urban residents, there are challenges associated with Smart City implementation. **The primary objective** of this report is to investigate innovative Smart City technologies as solutions to improve urban operations, addressing Safety, Resource Management and Quality of Life from the perspective of society. **Our motivation** is three-fold: 1) investigate how to improve Safety, Resource Management and Quality of Life in smart cities; 2) analyze subdomains that affect multiple layers of the quality of life: mobility, security, healthcare, energy, water, waste, economic development, engagement, and community; 3) provide rubric and our recommendations to support city managers, municipalities, and technology companies as key stakeholders and beneficiaries.

In Chapter 1, we discuss what makes cities "smart", the potential impact of smart city innovations on people and communities, what measurements matter most, such as safety, resource management and quality of life. We also discuss new technologies that smart cities offer to residents and the potential risks of using them. "Smart" technologies transform urban systems and optimize the resources available. The level and nature of urban challenges across each of cities' core systems mean that business as usual is not a viable option. Despite these challenges, cities have specific outcomes they want to deliver for their citizens. Cities aim to provide a healthy, pleasant, and safe living environment for their residents. Therefore, cities must focus on systems on which they are founding their aspirations and make them more efficient and effective to deliver the planned goals - that is, smarter.

In Chapter 2, we provide an in-depth analysis of 7 subdomains that affect multiple aspects of safety, resource management and the quality of life: mobility, security, healthcare, resource management (energy/water/waste), economic development, housing, engagement and community. We discuss examples of cities with extensive, well-used transit systems that benefit from initiatives that restructure the experience for riders. For instance, digital signage or mobile apps enable riders to adjust their routes by receiving real-time information about delays. Furthermore, installing IoT (Internet of Things) sensors on existing physical infrastructure can help crews fix problems before they turn into breakdowns and delays. Real-time navigation alerts drivers and suggests the fastest route. Finally, smart-parking apps point them directly to available spots, eliminating time spent fruitlessly circling city blocks.

In Chapter 3, we investigate three case studies about smart cities: Hong Kong, Toronto and Rio de Janeiro. Each city has a unique ecosystem, and we selected them to show different categories of smart cities and their levels of development. Hong Kong represents a fast-growing high-tech city with a rapidly growing population and limited resources. Toronto represents a developed city that has plans to transform its environment and provide new smart technologies to its residents. Rio de Janeiro represents a city with a developing economy that has multiple issues, such as health and safety.

Hong Kong is one of the most densely populated cities in the world. It is home to 7.5 million people, which equates to some 6,300 people per square kilometer. To put things into perspective, that is half the Ontario population living in twice the size of Toronto city. Smart city technologies primarily aim to improve the flow and logistics of the population and the improved efficiency of its infrastructure in this concrete

jungle and is mainly born by necessity. Hong Kong has pushed innovation in smart cities throughout the start of the millennia. Covid-19 has also accelerated the need for smart city implementation but is facing pushback amid the current political environment.

The City of Toronto has proposed smart city projects primarily at the waterfront, which consider a transit system with a vast cycling and pedestrian infrastructure network to provide safe, convenient, connected, and affordable mobility options. This component included a self-financing light rail transit extension, a logistics hub, and a mobility management system. Through a "Digital Innovation", security and resilience challenges can be addressed using a connectivity network and published standards building on existing privacy laws. However, this project highlights the inherent failures in the trust of smart city technologies with the failure of Sidewalk Labs, a clean-slate smart city envisioned and spearheaded for implementation by Google, a subsidiary of Alphabet.

Rio de Janeiro has stood out in Latin America by implementing innovative initiatives and projects to improve its population's quality of life. One of the most important initiatives is the Rio Operations Center (COR). Many other smart initiatives are operated within this centre to address the most significant challenges, such as security, mobility, and community engagement. However, socio-economic inequality is causing concerns in applying smart city projects. Therefore, the government is working to transform the governance, gain the resident's trust, track funding, and encourage the private sector.

In Chapter 4, we address smart city sustainability and the social, environmental, and economic impacts of urban planning. It is important that these considerations are maintained; that is, not compromising the ability of future generations to enjoy a resilient habitat and experience the same benefits and quality of life. This chapter discusses environmental sustainability (responsible use of natural resources and carbon footprint reduction), impacts on society (addressing basic needs of the population while maintaining equity, diversity, and social cohesion), and the economy (supporting long-term economic growth). Finally, we discuss the privacy and security concerns of smart city technology.

In Chapter 5, we provide a conclusion, success stories and discuss the limitations of smart cities, including some insights from **Mark Fox research**. The denomination of "smart" in cities is a journey that comprises various innovative projects that contribute to solving existing urban challenges. What is common within cities pursuing smartness is that they focus on upgrading citizen wellbeing through coordination between the administration and operation of urban systems and the people responsible for public health and safety. During the transformation, cities may experience significant successes, limitations, and failures because of their complexity.

In Chapter 6, we formulated **our recommendations**, created a Smart City **rubric** to evaluate city development across 7 domains defined in Chapter 2, and discussed **action points / next steps**. A proposed rubric may be used by city planners and managers, government officials, and company representatives that are involved in creating smart city technologies. We found that across key technologies/dimensions, Hong Kong has the highest score of Smart City adoption, Toronto has the 2nd place, and Rio de Janeiro has the 3rd place. Using the Smart City Maturity Matrix as a reference, we assessed levels of city development, formulated recommendations and next steps to support decision-makers who are responsible for smart city programs. The report concludes by summarizing the findings as well as actions to help any cities incorporate smart technologies and best practice.