A Guide to The Future Safe and Smart City

By Tech Research Asia

Sponsored by NEC

Executive Summary

It's a perennial hope for individuals, families, and communities across the world – to live in a safe and smart place. It's also a fundamental goal for all public leaders wherever they are. This Tech Research Asia (TRA) insights document provides public sector, business, and technology leaders with a framework for understanding what a safe and smart city looks like. We offer the main common traits of such places and present two scenarios as examples of what is possible. We also provide a list of strategic questions to help kick-start your own strategy.

Key Findings

- At their core safe and smart cities exist to help the people live the lives they want. These strategies need to be about far more than the technology that can enable their implementation.
- Public safety must form a core foundation of any smart city vision and strategy. Indeed, safety and security is integral to every part of every smart city project.

Recommendations

- Be inclusive in setting your smart city vision and strategy and especially when planning for public safety components. All citizens should feel ownership of the vision and strategy, otherwise feelings of alienation, and thus potential instability are possible.
- Look to engage external partners that have proven experience in delivering public safety projects as part of smart city efforts. Especially those that can help you develop the characteristics outlined in this document and your unique goals.

The Dashboard

Topic: Guidance for pursuing a safe and smart city strategy

Organisations: All related to safe and smart cities

Industries: Public Sector

Countries: All

Key Results:

39%

Of Singapore and Australian organisations intend to pursue an IoT project in the next 12 months. The most common projects are related to smart cities.

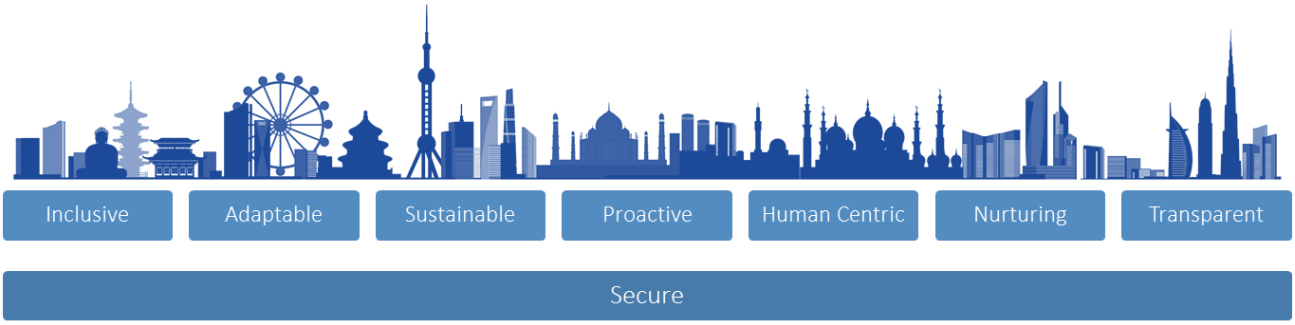
Future:

The core foundation of all smart cities is public safety. Yet true safety must be inclusive of all people in order to ensure stability and security. Dealing with privacy concerns and other potential stumbling blocks to public safety will be critical to smart city success.

TRA Tech Research Asia

NEC Orchestrating a brighter world

Introduction: What is a safe and smart city?



Just as every citizen wants to live in a safe and smart place, so too does every public leader want to deliver on this hope. From the smallest of villages and towns, to the largest of the urban mega-cities, there is a profound opportunity to leverage existing and emerging technology to establish a smart city strategy. But what exactly is a "smart" city? It's not an easy question to answer as this will be heavily informed by the unique circumstances of each location and how they establish their own vision and strategy. In simple terms, a "smart" city is one that consistently achieves or exceeds its stated and shared goals. At the core of every smart city will be public safety; you can't be a smart city if citizens are not safe. Below is a list of characteristics, albeit not an exhaustive one, that could define the safety component of what a smart city should be like. Tech Research Asia (TRA) contends these characteristics are common "smarts" to all cities and will either directly or indirectly assist in establishing safe foundations for achieving a true smart city goal. They should be considered as part of the public safety component of every smart city strategy.

- **Inclusive**: This principle arguably is the most important. Any implementation of a safe and smart city must begin with including everyone within the community's desires, hopes, and needs regardless what social status they hold or sections of the city they live in. To exclude any one group or location will immediately alienate and divide portions of the city and this is always a potential recipe for future or prolonged instability. In a safe and smart city implementation, there is a danger that one group of people or one part of the city be disadvantaged due to the concentration of services in one part of town or the inability of some to pay for the new services offered. Citizens must be the centre of any smart and safe city efforts. Services such as public transportation, water delivery and sanitation, public administration, education, healthcare, energy distribution, telecommunications, public safety and law enforcement, to name a few need to be affordable, effective, and accessible to all groups of people. This can be achieved if planners and policy makers ensure all relevant stakeholders – not just those within a given department, agency, or institution – are consulted from the start ensuring that any plans are understood, accepted and inclusive from the beginning of the project.

- **Proactive:** There are essentially two approaches to planning for smart and safe cities – greenfield or brownfield. Greenfield simply means that the planning and implementation are done from scratch while brownfield means building from within an existing city blueprint and legacy infrastructure. An example of a greenfield project is Seestatd Aspern, Vienna, where entire quarters of the city were built from ground up to achieve smart city status. In brownfield projects,

leaders would need to plan around existing infrastructure and citizens need to transform an existing city into a smart one. This is arguably a harder process because planners would have to take into account legacy infrastructure. The brownfield approach will however be how most developed cities today will be planned and offers a unique opportunity to upgrade existing systems and infrastructure to bring a city up to speed with new processes and technology. Principally, there should be no difference between the two implementations but the timelines to achieve smart city status may differ from project to project. In both circumstances the vision and strategy must be proactive and not reactive. It must have mechanisms in place for evaluating emerging opportunities and challenges with leadership willing to take action. Being prepared is always "smart", and this is especially true when it comes to emergency response and disaster management. And a smart city is a continuously evolving ecosystem that benefits from being prepared.

- **Adaptable:** The only truism in technology is that things will change and fast. New approaches, new tech, or new business models can positively disrupt the way we are doing things today and herald opportunity to either do things better, or create new experiences. Recent history should have taught all leaders well that we ignore technology-driven change at our own peril. Yet, it's not just technology that changes. Politics, economics, society, culture, the environment and many other elements can and likely will change in future. Can you adapt with holistic action? Different cities, of course, have different characteristics. As a result, the technology and solutions implemented as part of a smart city strategy will be unique to those characteristics. However, in order to adapt to change of any kind, you will need to make adjustments to the underlying technology. This demands adherence to interoperable standards to adapt. Without a uniform and standard-based approach, the deployment and roll out of a safe and smart city will be fragmented at best while and dysfunctional at worst. That means not being able to take advantage of new opportunities whether they be tech-based or otherwise.

- **Sustainable:** Any safe and smart city should have a three-pronged approach to sustainability: Economic, social, and environmental sustainability. Strength in each will result in a safer city as they are closely interconnected. In contrast a lack of sustainability poses greater risk – this has already been witnessed in countries and cities around the world. Economic sustainability means city planners and policy makers need to have the right frameworks and programmes in place by which the city can attract investment from public and private sources along with allowing individuals and companies to pursue their trade(s) equally and over the long-term. There also needs to be enough capital and operational funding to ensure that projects undertaken will last at least a generation to come. This kind of economic sustainability supports social sustainability and vice versa. A higher quality of life of the citizenry in terms of daily needs along with education, healthcare and leisure activities breeds jobs and social cohesion. Likewise, without environmental sustainability economic and social sustainability are challenged. With rising concerns in environmental challenges caused by geological and climate changes, any safe and smart city planning should include a holistic approach to managing and mitigating against these changes.

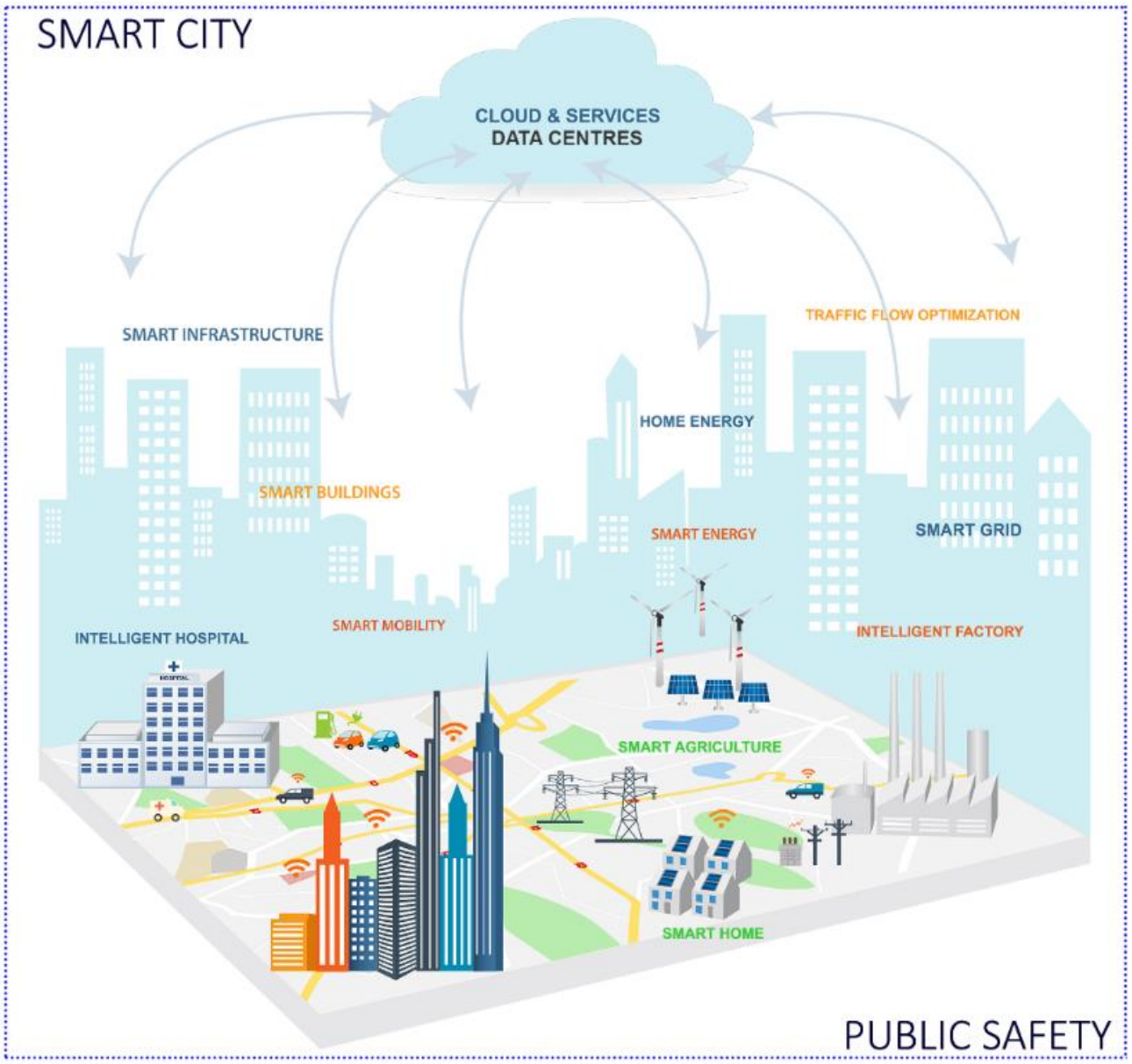
- **Human-centric:** As obvious as this sounds, all safe and smart city development must serve all the people who live there first and foremost. This will always result in the best outcome. Consultation before, during, and post projects with the citizenry is critical to achieving a human-centric smart city. Inclusively asking and

conversing with the people, rather than telling or deciding on their behalf may be harder, but it is inclusive, representative, and more frequently brings safer outcomes. It is common, however, (and particularly among those working in public safety or government) for there to be a focus on agency, department, political party, or institutional needs above all else. Or at least, this is a perception that can arise. TRA has observed that many smart city projects – especially public safety-related ones – are aligned with what an agency or department believes it needs first and not with the needs of the customer (aka citizens). It is TRA's view that this situation – real or perceived – is not sustainable and will result in citizen frustration that can lead to instability. Being human centric, or in other words putting the customer or citizen at the centre of a smart city, is the best course of action.

- **Nurturing:** Safe and smart cities are liveable ecosystems – they enable people, families, and communities to live the lives they want to pursue. They nurture the arts, humanities, education, sports, play, healthy living, sustainable commerce, social links, sciences, invention and innovation, and all of the wonderful other parts of a city's unique culture and identity. They nurture the very best of human ambition regardless of who that human is, where they have come from, and where they are going next. Smart cities help people play, live, learn, work, and grow. A key part of this is providing people with accurate information and enabling diverse entities to collaborate.

- **Transparent:** A safe and smart city encourages two-way participation between government and citizenry in an open, transparent, and honest manner. No government or organisation can go it alone with smart city development and having people on-side always helps with public safety. Leaders need inclusive input and collaboration on the part of all stakeholders including civil society and special interest groups. To do this effectively, there is a need to promote open data and communication as a means of holding all stakeholders accountable. Transparency has been shown to improve the quality of public services, while creating new opportunities for businesses. Large and small data sets shared openly can foster social participation in traditional and digital channels, as well as boosting open and mutually beneficial innovation. For instance, with open data and communication a smart city could: let consumers buy and sell electricity on a micro-grid according to data they access about demand and supply; law enforcement could capture case information and educate the public on emerging risks; start-ups can use open data to develop tailor-made mobile applications to aid in the transportation sector; drivers could use automated digital reporting processes for accidents or incidents. There are many, many more examples where open and transparent approaches are beneficial to all parties of a safe and smart city. It is TRA's view that the power of being open exceeds that of closed systems.

- **Secure:** The bedrock of any smart city is public safety – the ability to ensure that all its citizens, economy, and infrastructure are safe in all senses of the word. In planning such a safe city, security and privacy efforts and investment must come from both the leadership and the citizenry as public safety underpins all smart and safe cities. Everyone needs to be invested in public safety to make it successful and part of a virtuous cycle of continued safety improvements. In our view, security should not be a limiting factor in citizens' lives. I.e. security measures should not dictate the way we live, play, love, laugh, work, and engage with our communities and city. It should enable us to do these things across all physical, environmental, and cyber domains.



INCLUSIVE | ADAPTABLE | SUSTAINABLE | PROACTIVE | HUMAN CENTRIC | NURTURING | TRANSPARENT | SECURE

TRA
Tech Research Asia

NEC \Orchestrating a brighter world

What role does technology and IoT play?

Technology is critical to achieving a successful safe and smart city outcome. It's not the only aspect to get right by any means. But it should form one of the foundations which receives significant investment and attention from the beginnings of any strategy in order to establish the characteristics we outlined above. TRA has undertaken research on the Internet of Things (aka IoT) which is often considered a building block of safe and smart cities. The results of a survey of 250 IT and business leaders in Australia and Singapore undertaken in the second half of 2015 found that of respondents will be investing in an IoT project in the next 12 months. The most likely projects, in order of the percentage of those pursuing them are:

1. Smart cities
2. Smart homes
3. Smart buildings
4. Smart workplaces
5. Consumer products or services
6. Supply chain
7. Healthcare
8. Smart utilities
9. Wearable devices
10. Smart agriculture

39%

OF SINGAPORE AND AUSTRALIAN ORGANISATIONS INTEND TO PURSUE AN IOT PROJECT IN THE NEXT 12 MONTHS. THE MOST COMMON PROJECTS ARE RELATED TO SMART CITIES. IN REALITY, ALL "SMART" PROJECTS ARE PART OF MAKING A CITY MORE TECH-ENABLED. THE QUESTION IS, ARE WE MAKING THINGS SAFER AS WELL?

Although we deliberately asked respondents about specific types of IoT projects, and thus there is a wide mix of investments being made, in reality a smart city programmes will include many, if not all, of these projects. However, at present many cities do not have an integrated policy setting and plan in place. Individuals, communities, companies, and even government departments are often independently pursuing their own "smart" IoT project. This in itself is not a problem, but would it be prudent to plan a city- or nation-wide vision and strategy in a holistic manner? We would argue such an approach would help stimulate earlier investment and encourage innovation. Success across all of these types of projects should be welcomed. But they should not only be pursued in isolation.

Of course, these kinds of projects – let alone a city-wide strategy – will bring its own challenges. Survey respondents told us that their main challenges are: Establishing or optimising innovation capabilities in order to identify new business opportunities (28.8%); Improving analytics capabilities; Improving security capabilities; Establishing or optimising innovation capabilities in order to identify ways to improve what we already do with IoT; and Generating a business case and securing budget. This is just the tip of the iceberg and no leader should be under any illusions about the difficulty or achieving safe and smart city success. It is most definitely worth pursuing, but there will be other challenges that emerge, including optimising the digital infrastructure environment first, establishing cross-organisation and -department processes, dealing with political or social change, and attracting skilled people to name a few.

In all safe and smart city projects TRA recommends considering the following, *inter alia*, technology-related characteristics across the following areas:

- One-stop portals related to the strategy for stakeholders to access services online on any platform where information from disparate systems in government are integrated or accessible, including public safety services and information.
- All smart city services available in the medium of the consumer's choice whether this be digital or traditional. But with seamless cross-channel and -agency citizen or customer care and communications
- Provision of self-service kiosks or devices (with free WiFi) in easily accessible places around the city. These can also act as emergency or disaster response systems for broadcasting information or capturing feedback or alerts.
- Availability of open data repositories where data sets are automatically uploaded for citizens to use.
- Citizens able to control or at least give permission for the capture and/or use of their data.
- Providing tools that enable citizens and stakeholders to have an ongoing voice in the direction their smart city along with agency to make informed decisions.

- The use of wearable devices such as body cameras or connected protective equipment or clothing along with monitoring systems to enable a safe environments to work
- The implementation of full mobility and anywhere, anytime collaboration (including with less paper processes) so that employees can obtain healthier work/life balance while boosting productivity.
- Adotpion of emerging technologies such as AI assistants, drones (UAVs), 3D printing, VR/AR, or other tech to allow employees to be more effective with what they already do, or to achieve new goals
- Integration of the insights or output of sensor-based networks and systems with the daily processes and practices that employees undertake.

- Outcomes, not tech, focussed operations that have the citizen at the centre of all goals and which ensure multi-entity and stakeholder collaboration to achieve this end.
- An IT and business talent recruitment and retention program for top individuals and teams
- An innovation strategy that allows the smart city to continue to evolve and adapt
- Rigourous and progressive compliance, privacy and security measures, including regular health checks
- IT management approaches that support multi-supplier, multi-agency, multi-platform
- Education and change management programs for both internal and external stakeholders.

- Capacity to use a hybrid mesh of on-premises or captive data centres and public cloud computing services
- A software defined networking and SD WAN approach to intelligently manage bandwidth needs
- Sensor-based networks and systems that provide real-time information and action across traffic, water, power, logistics, buildings, public transport, food supply, critical envrionments, aged care, schools, and other critical infrastructure.
- CCTV and other security systems such as bioinformatic processing with automated notifications and policies
- A data lake, fabric, or warehouse to efficiently store data and make it accessible for analysis with big data tools
- Ability to implement and manage edge computing capabilities for IoT projects that demand high throughput and low latency

TRA Tech Research Asia

NEC \Orchestrating a brighter world

Safe and Smart City Scenarios

Just as every village, town, and city in the world has its own exceptional characteristics and personality, so too will every safe and smart city be unique. TRA offers the following two fictional examples of safe and smart city scenarios (but based on real strategies being pursued in various cities around the world today that TRA has investigated) to assist with understanding how these visions and strategies can be pursued.

#1 The SEA Capital City

City A is a capital city in Southeast Asia with a population of approximately two million people out of a total of 30 million nationwide. It is a modern city comprising well-built intracity highways, major and trunk roads within a land mass of about 200sq km in size, but could also be characterised as still in a developing phase. The majority of citizens have access to adequate health, education, and other services. City A is supported by a metro fibre ring enabling broadband infrastructure that connects both public and private infrastructure, as well as a modern wireless 4G-enabled network provided by various private operators. Technology adoption is quickly rising especially social media use via mobile devices. Yet, the city's economic success has been experienced unevenly with pockets of poverty remaining and challenges with corruption, crime, and general safety persisting along with growing troubles with transport / logistics and pollution. A rising population and migration from rural and suburban folks to the city, along with an influx of foreign labour is compounding traditional efforts to ensure safe streets and ongoing modernisation. The additional threat from a rise in global terrorism, means there is a potential for increase in threats.

The Vision and Objectives

As with peers around the globe, several City A agencies and departments were exploring smart city projects and ideas – mostly independently of each other. Because each of these projects had an impact on public safety – and vice versa – leaders at City A's law enforcement agencies thus decided to propose a holistic approach and bring everyone together for one vision. In order to establish this vision and make it inclusive, a cross-section of agencies and stakeholders formed a project oversight committee that undertook a public consultation. All groups were proactively engaged via diverse forums and mediums, and finally agreed to City A's safe and smart city vision along with the key objectives. This ensured the vision and objectives were "owned" by all. Some of the main first objectives for the implementation of a safe and smart city plan in City A were:

- To establish a multi-stakeholder working group that committed to transparent information sharing and shared responsibility for success for all associated projects and activities.
- To prioritise improved public safety as one of the first goals to achieve by establishing accurate intelligence gathering capabilities that allowed for monitoring, detecting, analysing, and acting in accordance with community expectations and privacy norms. Further, this technology-driven capability would be matched by a programme of engagement, education, and communication with the community to ensure any frustrations and legitimate concerns of all groups were addressed and mitigated before they become public safety issues. This would be pursued to ensure that any crime and violent incidents are tracked and mitigated effectively.
- To establish a central command centre equipped with the aforementioned capabilities mated to the ability to display the information in real-time, store the data in cloud-based systems, access data via secure mobile apps and connect to law enforcement to mobilise them as first responders when necessary. This centre would have multi-stakeholder participation, shared resources, and robust oversight/review mechanisms in place. It would also engage the full gamut of social groups and

communities on a regular basis to ensure an inclusive and supportive approach was established and no-one group felt "targeted" or that their rights were being trampled on.

- To ensure safety and security are included by design in all other smart city projects at the first stages of their conceptualisation.

With the aforementioned objectives decided, City A planners began first by dividing this part of the safe and smart city project into two major areas. The first to deal with all technical implementations while the second is to deal with soft issues such as people, processes, and management.

Technical design and implementation

On the technical front there were many components to modernize and optimize. In short, however, planners began identifying major types of "sensors" to be used to capture data in City A. Four major zones were identified and divided using the common north, south, east, west designation. Some of the sensors used included: high-definition, wide-angle CCTV cameras; infrared cameras; drones or UAVs, and high-definition acoustic sensors to capture audio events such as gunshots. These sensors -- IP based -- were all tied together by a secured and dedicated machine-to-machine (M2M) network (including a host of other types of sensors and actuators) with the information collected being fed back on a dedicated fibre network to the command centre. As a redundant backup or where fibre isn't available, information is relayed over the 4G wireless network (or dedicated emergency use spectrum).

In addition to this infrastructure deployment, the plans included a system for providing less-affluent parts of the community with low-cost or recycled mobile devices that are equipped with easy-to-use emergency notification and video/audio/GPS location information capture functions. In times of trouble, users can push the emergency button to send an alert to authorities with the device immediately capturing and sending data on the situation. Users can also connect to government digital services, such as easy to understand information about laws and rights, on these devices in public places via free WiFi. These devices also include apps for reporting (anonymously if desired) public safety and security issues and receiving notifications or public warnings from authorities among others.

Software and related systems are hosted via a private cloud-based infrastructure hosted in highly secure data centres to ensure capacity scalability, redundancies as well as support for mobile access. New software deployed included video capture and analysis (including facial recognition), acoustic capture and analysis, and automatic number plate recognition (ANPR) systems, all stored in a data lake with in-memory database for fast processing. All information – including that captured from social media and online sources along with existing data bases from multiple agencies – is fed to the command centre which then facilitates the analysis and visualisation of information in real time. This in turn is paired to an early warning detection system and other automated notification or decision making mechanisms. The aim of this is to enable decisions to be made in real-time and disseminated securely and easily to all stakeholders – such as police officers or first responders, along with the general public where appropriate – without increasing the burden on human resources. Furthermore, the system has been built with a view to potentially offering access to some components (e.g. some CCTV video feeds, or aggregated data sets, or results dashboards, etc) to other agencies and the general public via APIs to encourage collaboration, transparency, accountability, and innovative use of the valuable information being captured.

People and processes

In tandem with the technical design, work was undertaken to ensure that the project achieved a high level of human-centric, sustainable, inclusive, and nurturing outcomes. City A planners first identified all the major stakeholders involved in the project. This included local councillors, city hall local enforcement, local and federal police, emergency services, civil defence, major utilities and infrastructure providers, and state and federal legislators, consumer and business groups, and community leaders and representatives at all levels and locations.

Each stakeholder was engaged and consulted from the beginning and continue to be given opportunities to shape the way operations are conducted (such as through surveys, focus groups, and direct recommendations). An ongoing education and engagement programme is key ensuring the system is seen as working *on-behalf of* the entire group of stakeholders (and thus helping to reduce potential public safety threats as a result of feelings of alienation) and not as something being *targeted at* any particular on of them. This involves regular participatory events, media outreach, and open data programme, tours of the command centre (e.g. by student and community groups), sharing of lessons learnt in industry and public forums, employment opportunities and training, and dedicated strengthening of independent oversight mechanisms. In other words, truly winning the hearts and minds.

A process optimisation, mobilisation, and modernisation programme was also implemented to ensure existing processes were able to adjust to the new strategy and also so that they could adapt should changes be required in future. This entailed a significant digitisation and data sharing programme. A long-term change management and capacity building programme was also initiated to ensure the various city agencies were able to work together effectively and with as much agility as possible. This included joint training of staff and ongoing reviews of all newly established processes related to smart city collaborations. Best practices for safe and smart city project and service ideation are identified, documented, and shared openly by all agencies. Importantly, all agencies and individuals (from department heads down to coal face workers) are given shared responsibility and accountability for project success. These are just some of the steps taken to ensure the projects achieve their people and process goals.

The next steps

The ongoing success of the safe and smart city project for City A is dependent on a few key factors. First, is the openness and transparency amongst all stakeholders to ensure that territorial and jurisdictional disputes are kept to a minimum or eradicated entirely – shared responsibility and accountability are embedded across the city. This openness and transparency also applies as much to public oversight to ensure confidence that privacy and other rights are being protected.

Second, recognising that this type of project is highly collaborative by nature, City A planners must continue to be inclusive and involve the citizenry. The public safety component, after all, is meant to be *for their benefit*, not targeted at them or only implemented for institutional needs. It must continue to seek to serve everyone by being human-centred, nurturing, sustainable, and proactive in nature via meaningful engagement. Put simply, it requires the participation and input from a wide range of stakeholders, in areas including strategic governance, tactical planning, state-of-the-art technology implementation and dedicated resources in place. This helps to ensure any root causes of public safety issues are addressed early and effectively, instead of using technology to belatedly and in a top-down approach, try and fix symptoms, which often happens in public safety programmes.

Third, the project is being pursued in a staggered approach with public safety being a core first objective. You cannot do everything at once when it comes to safe and smart cities. But every project must be safe and secure. Addressing public safety early in a collaborative manner, with a secure, resilient, agile, and high performing technology environment that can adapt to future needs easily is smart. With this in place City A can now continue to refine its technology, people and processes, to ensure that it keeps up with technological updates and that there is ongoing continuity planning and deployment. It also means that all future projects have safety and security built in by design and are not merely afterthoughts.

#2 The Asia Pacific Mega City

City B is a growing metropolis in Asia Pacific with more than 5 million people. It has an advanced level of infrastructure – roads, public transport, utilities, broadband, healthcare, and education – and a high standard of living with only a few pockets of low-income suburbs. The city suffers from common problems seen in comparable locations worldwide: waste disposal, crowding, high prices for real estate, traffic congestion, an ageing population, an influx of rural population, and maintenance or upgrading of older facilities. Further, the industries on which the city found its success are now in decline and they need to revitalise the local economy to maintain standards of living and economic power.

Vision and Objectives

In collaboration with the central government, the department of trade, the national tourism body, the immigration department, law enforcement agencies, and the city mayor's office a plan for establishing a vision to make City B into a safe and smart city was set in motion. A multi-stakeholder working group consisting of representatives from each agency was set up and commenced work on a community consultation programme to inform the vision. One key component that came out of the consultation programme was to ensure a constant stream of high profile events be held in City B to attract new business and tourism, including international guests and their entourages and various security needs. The events were seen to be critical to branding and attracting new economic opportunity – they were to be the modern face of the city. It also included a new events precinct with a sports stadium, a convention centre and hotel, along with retail outlets. Thus a vision to become a safe and smart city that commences with the key objective of hosting a series of notable events was established.

Technical design and implementation

City B's events-driven safe and smart city programme required a new events precinct be designed and constructed. To achieve this the multi-stakeholder working group was formerly initiated as the oversight committee responsible for the project's success. It was given overarching authority, dedicated funding, and human resources support from all relevant agencies/departments. The executives of the committee first visited cities around the world to see first-hand how other authorities had pursued similar goals and the pros and cons of various technology solutions and processes adopted. They also spoke to global experts to capture ideas for best practice. This included a significant amount of time discussing security and safety issues along with how City B's law enforcement agencies could best collaborate with peers around the world to mitigate risks and respond to any incidents.

The conclusions drawn from this study tour were that security and safety must be built into the precinct at all levels, but at the same time that these measures shouldn't in any way define the precinct or impinge on the rights of both citizens and visitors. Indeed, the new events precinct should be: sustainable with renewable energy and a zero waste to landfill goal; community friendly and designed to be accessible and usable by all; adaptable to different types of events and able to support emerging technology or ideas; nurturing of sports, the arts; and cultural events; an enabler for business, including for start-ups; and representative of all of City B's dynamic history and population along with its aspirations for the future.

With these characteristics in mind the City B then launched a series of design competitions for the precinct including crowd-sourced entries and judging of the winners. Some of the technology solutions implemented as part of the winning design and throughout the construction included:

- An online multi-lingual, mobile optimised portal to document the entire project, provide notifications on events, promote campaigns, and offer open data sets;

- A 4K CCTV network with advanced video analytics tools that allow for facial recognition with automated notifications for first responders;
- A centralised command centre equipped with all contemporary communications and surveillance systems, along with links into other national systems (e.g. traffic management, smart girds, immigration, etc) and international databases;
- A high density mesh WiFi network-based on a redundant fibre network;
- An extensive sensor network in both indoor and outdoor spaces to sense when equipment needs maintenance, air quality levels, acoustic events, weather, water quality, and energy use;
- Power management tools and smart lighting to reduce energy consumption while making the precinct safe at night time;
- Big data analysis tools to help with crowd control and predicting behaviour;
- Wearable cameras for law enforcement operating in the precinct with real time broadcasting and recording capabilities;
- A fleet of autonomous drones that can be remotely operated for security and broadcast purposes;
- On-premises data centres but with geographically diverse redundant facilities and the use of cloud computing services to ensure high levels of performance and resiliency;
- A sand-boxed virtual and physical environment for event organisers and attendees to use for tech innovation and research throughout events;
- The development of a precinct app (to be expanded to all stadiums and event locations in the city in future) that provides visitors with personalised access to all information and services, along with the ability to enable a mobile wallet to pay for goods and services throughout the precinct. This is also complemented by support for connected bracelets and smart watches that can be used for a variety of applications and experiences. It also has support for location-based services throughout the precinct with iBeacon technology and augmented reality. These tools also allow visitors to be tracked and at the same time provide real time information to the command centre, including emergency contact; and
- Deployment of digital display information kiosks equipped with virtual assistants (AI-driven chat bots) to answer visitor questions. This virtual assistant is also tied into the precinct app and online portal.

People and Processes

City B's strategy involves welcoming a wide range of domestic and international entities and visitors on a frequent and high volume basis, and as such could foreseeably become a target for crime and terrorism. Of course, collaboration between all relevant parties that make the events a success overall is critical. The recruitment of new people and the establishment of processes for information sharing and ensuring the day-to-day operations are world-class were some of the first steps required. However, fundamental to ensuring the events precinct offers a safe environment for all was the establishing of strong relationships and protocols for the sharing of data, accessing resources/assets, and decision making between domestic agencies and international peers. One step taken to help improve cultural understanding was the establishment of a dedicated exchange programme between multiple countries for law enforcement staff. Moreover, a commitment was made to undertake frequent (but random) security and safety health checks of the virtual and physical environments, along with incident response drills related to the precinct with the participation of all domestic and international stakeholders.

Further, to ensure City B citizens' privacy rights were respected and the community supports the efforts of law enforcement agencies a long-term programme of engagement was established. This includes

education sessions with a variety of mainstream and minority social groups, tours of the precinct by students, sharing of lessons learnt by law enforcement with peers around the world and the media, along with offering employment opportunities. Further, a fully independent, transparent and robust oversight committee for public safety and security in the precinct was established to ensure domestic and international trust and support.

Next Steps

Focusing on a new events precinct as a first step in the broader smart city vision allows City B to take its lessons and best practices and apply them to almost all other types of projects. Not only does City B now have strong relationships, processes, and protocols between domestic and international stakeholders that it can leverage for other projects, it has experience with implementing a wide range of safe and smart city technology systems that have been built with adaptability in mind. Notably, all of these systems and the activities they are being used to support demand a high level of security be included from the earliest moments of ideation. This in turn contributes effectively to public safety outcomes. These systems and approaches can now also be expanded to include other parts or components of the city while maintaining or improving public safety along with strengthening the other desired characteristics of a smart city.

10 Questions for Safe and Smart City Leaders

TRA offers the following 10 questions to assist safe and smart city leaders to establish their own vision and strategy, or to give an existing one a health check. These questions are offered as a starting point and should not be used to replace proper due diligence. However, all leaders should ask these questions of their own efforts.

1. Have you established a smart city vision and strategy that includes the views, hopes, and needs of all stakeholders, including that of citizens?

2. Does this vision and strategy embrace the traits outlined above and with an emphasis on making improved public safety the core foundation?

3. Have you optimised the technology foundations on which you safe and smart city with be founded and ensured this is adaptable to future opportunities or challenges?

4. Do you have transparent and open policies and education programmes in place for dealing with the data captured as part of your strategy so that all stakeholders can benefit and turn it into actionable knowledge?

5. Have you implemented programmes for ensuring the city continues to have the required skilled individuals and teams for delivering on projects?

6. Are you truly prepared to deal with the security and privacy implications of the smart city project and the type and frequency of data it collects?

7. Is your smart city vision and strategy focused on technology or the people it intends to support?

8. Would you be able to fast-track the outcomes of your safe and smart city by leveraging the technology and experience of external partners?

9. Does your business case for a safe and smart city include non-tangible outcomes, especially as regards public safety?

10. Have you established a mechanism for ensuring that the vision and strategy are inherently part of any future planning for the city?

TRA Tech Research Asia

NEC \Orchestrating a brighter world

The Future Safe and Smart City

A smart city can only claim that mantle if it is at its core a safe city for everyone. Without safety all of the other admirable goals being pursued by smart cities will fail to be achieved at the optimal level. Public safety, of course, extends across our lives whether we are in a small town or one of the world's growing mega cities. It is, however, fundamentally diverse and requires dedicated resources and investment to get right. In TRA's view, it is important that any public safety components of a smart city strategy are pursued with the input of those directly benefiting – the people or citizens of a city – and not just via the agencies tasked with delivering on public safety mandates. It also requires robust and deep cross-agency and entity collaboration. We also encourage smart city and public safety leaders to consider the characteristics we outline in this document and try to answer the strategy questions with a frank honesty.

There are many positive opportunities to leverage existing and emerging technology to establish a smart and safe city vision and strategy. There are few people that wouldn't welcome a smarter vision for their city. It won't be easy, but delivering on the inherent and perennial hope of individuals, families and communities to live in a safe city is always worth the effort.

Methodology

Tech Research Asia undertook two online surveys with business and IT leaders in Singapore and Australia. The 250 respondents had to be in a technology decision making position within their organisation. The sample of responses captured was spread across industry type and organisation size. For more information on the methodology undertaken with these surveys, please get in contact with TRA.

In addition to the quantitative surveys undertaken, TRA analysts have also interviewed more than 30 organisations across Asia Pacific that are pursuing either a smart city strategy or an IoT project. These interviews have been conducted in person or over the phone.

This report was commissioned by NEC. For more information on NEC's Safe and Smart City offerings please visit http://www.nec.com/en/global/solutions/safety/index.html

TRA Tech Research Asia

NEC \Orchestrating a brighter world