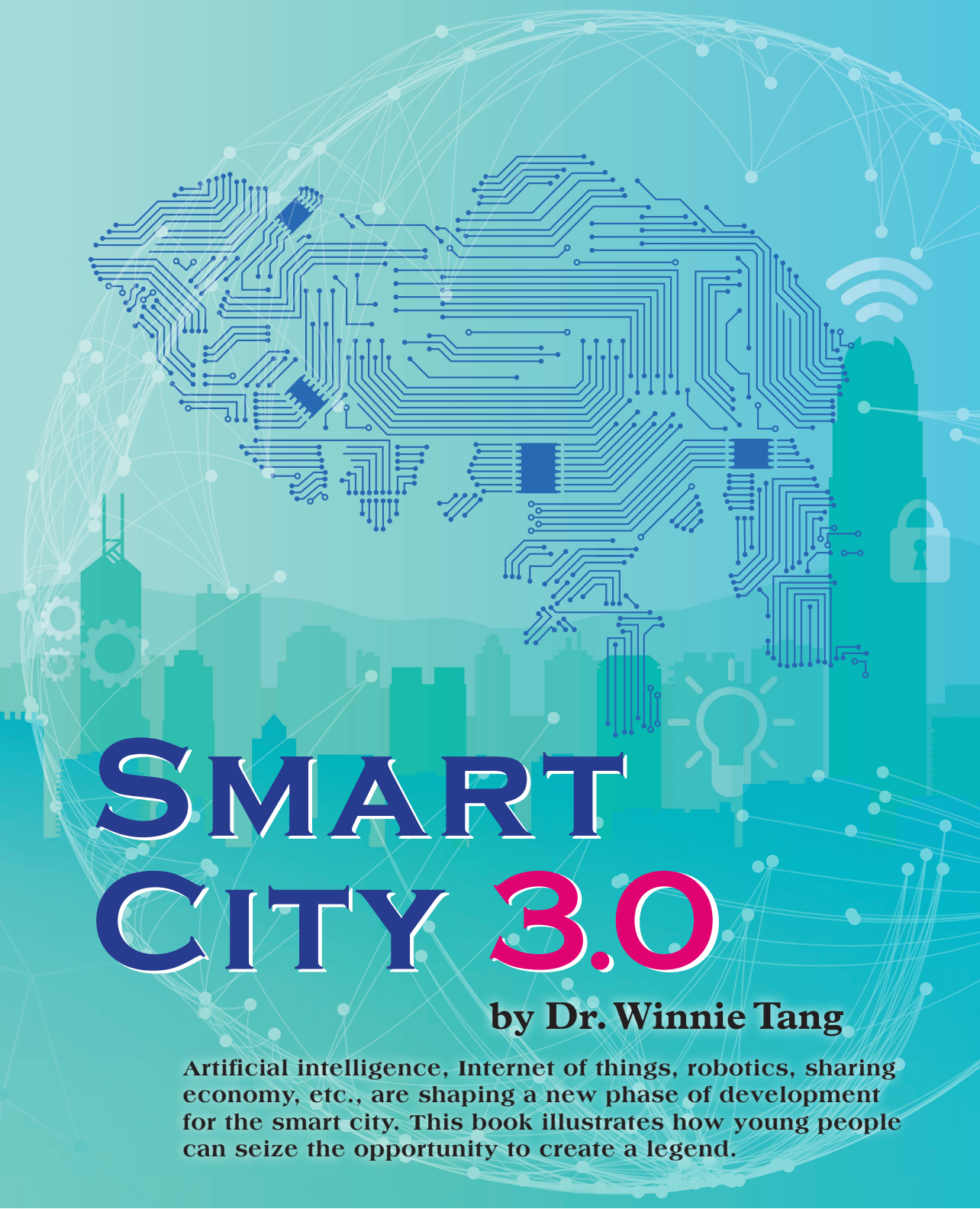

Smart City 3.0

by Dr. Winnie Tang

Artificial intelligence, Internet of things, robotics, sharing economy, etc., are shaping a new phase of development for the smart city. This book illustrates how young people can seize the opportunity to create a legend.

Definition of Smart City 3.0

According to Dr. Boyd Cohen, a smart city expert, there are three phases of a smart city:

Smart City 1.0: technology-centric. It is characterized by technology providers encouraging cities to adopt their solutions when they have not fully appreciated how they may impact the citizen's quality of life.

Smart City 2.0: technology enabled, city-led. City administrators increasingly focus on technology solutions as a means to improve the quality of life.

Smart City 3.0: citizen co-creation. One smart city project in Vienna undertaken by the local energy company Wien Energy in partnership with the citizens as investors constructed local solar plants as a contribution to the city's 2050 renewable energy objectives. Meanwhile, researchers in Jakarta have developed a real–time map of flooding by crowdsourcing flood reports from Twitter to monitor severe annual flooding of the city during the monsoon.

About the Smart City Consortium (SCC)

The Smart City Consortium (SCC) is formed by a group of professionals from different corporations and organizations, with the aim to provide opinions and suggestions to the Government for formulating related policies and standards in the development of Hong Kong as a world-class smart city. We encourage worldwide collaboration with different stakeholders to create the right ecosystem which fosters innovation and sustainable economic growth for Hong Kong.

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By Dr. Winnie Tang

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GIS enables a smarter world

Last year, we formed a partnership with the National Geographic Society of the United States to create a greener infrastructure for America. While urbanization has become the megatrend, critical resources, such as water, clean air, and landscape identity, are being jeopardized. Cities and towns are left vulnerable to the impacts of a changing planet, with people, wildlife, and the economy bearing the brunt of rampant development. This is the concern of not only the Americans but also people around the world, including those in Hong Kong.

The idea of developing green infrastructure to compensate for the grey, man-made infrastructures has spread throughout the U.S. and eventually the world. Today, this concept serves as a reference for many environmental planning efforts. Europe and Australia are using green infrastructure as a framework for smart growth. They are realizing the cultural and economic benefits of conserving natural resources and connecting people with nature.

While geographic information system (GIS) is always considered an enabler for smart city development, it also helps us shape a pathway of openness for our children and grandchildren to a smarter future.

Geospatial tools including a collection of different layers and datasets — from transportation and terrain to water and vegetation — help forward-thinking organizations, from all levels of government, nongovernmental organizations, nonprofits, and the public, institute to establish policies and procedures in guiding conservation and development efforts, and at the same time maintain constant awareness of community's aspirations, and stay connected with all of their stakeholders.

This is the essence of smart city, ie. to strike a balance between conservation and development, improving our quality of life without undermining our future with the help of information technologies and data-driven decisions. This is also the core value

of Winnie's book *Smart City 3.0*.

The book provides a comprehensive review of the concept of smart city. It embraces smart city's six essential elements, namely smart people, smart economy, smart environment, smart government, smart living and smart mobility, and how the latest information technologies have and can lift our living standard.

With all the vivid examples and stories, Winnie's latest work is a valuable reference book on the topic to young people who plan to study a master course of the subject, and to the general public fluent in either Chinese or English. By this, together, we can design, create and plan a more sustainable future and a smarter world.

Jack Dangermond

President and Founder, Esri

The past, present and future of smart city

Smart city is not new. It evolves from the early days of digital cities when we had LAN and gradually developed to intelligent cities when we had the Internet. Digital cities and intelligent cities become smart cities when we have smart phones and Wifi by which anyone can now have access to a wide variety of sensors and information through their smart phones via information and communication technologies (ICT).

With the further advancement of ICT and IoT (Internet of things), smart cities will become smarter and smarter affecting individuals, governments, firms, and the environment. It will bring convenience and better quality of life to people living in cities. No cities can afford not to be smart. Both the government and the private sector are trying to make the cities smarter for different purposes. We are now entering an era of smart cities, like sustainable cities in the 1990s and 2000s. Sustainable development is already well embedded in the development and planning of cities. The trend

is the development and planning of smart sustainable cities. It is important for us to know the present and future development of smart cities because we cannot avoid not living and interacting with it.

One of the basic backbone of smart cities is geographic information system (GIS) which provides location information for location based services. As human activities take place in location, information about the location of the place where these activities occurred is essential for smart cities to be smart. Dr. Winnie Tang has been in the field of GIS for a very long time. Her book on smart cities that covers smart people, smart economy, smart environment, smart government, smart living and smart mobility with overseas examples and best practices around the world will let more people be more aware of the concept of smart cities, what they can do for them, and how they can participate and benefit from smart cities.

I believe that this book is a must-read for anyone who is passionate about how smart cities can enhance quality of life and foster sustainable growth.

Anthony Yeh

FRTPI, FHKIP, FAIP, FRICS

Academician of the Chinese Academy of Sciences

Fellow of TWAS

Fellow of Academy of Social Sciences, U.K.

Chair Professor and Chan To-Haan Professor in Urban Planning and Design

Department of Urban Planning and Design

Faculty of Architecture

Director, GIS Research Centre

The University of Hong Kong

Founding President of Hong Kong GIS Association

Founding Secretary General and Past President of Asia GIS Association


Smart People
Smart Economy
Smart Government
Smart City
Smart Mobility
Smart Living
Smart Environment

Together,
we build a brave new world

By 2020, the world's population aged over 60 years and older will outnumber children under the age of Five. A tsunami of the ageing problem is coming.

By 2030, urban areas are projected to house 60% of people globally; the city governments will face enormous pressure by then.

In recent years, the earth's temperature broke the historic record of past 130 years; global warming is truly happening.

With the emergence of the Internet of things, artificial intelligence (AI) and robotics, it is estimated that half of the current livelihoods — from working class to professional — will disappear. By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that do not exist at present.

The smart city initiative is to deal with the various challenges facing human society and the environment using information and communication technology (ICT) as an important tool.

So what is a smart city? What is the difference between living in a smart city and our society today? Based on the Smart City Wheel, developed by Dr. Boyd Cohen in 2012, a smart city is defined by the following six attributes:

Smart People —

ICT training (including computer programming, and science, technology, engineering and mathematics) becomes a must in addition to language skills. In Europe, there are at least 13 countries, including France, Finland, Italy, and Switzerland, aiming to develop the problem solving skills of their younger generation and have geared up technology training since 2016. Starting from September 2017, China also required primary schools to have at least one hour of science class every week for grade one and two students.

Smart Government —

Establishing a common spatial data infrastructure and opening

up government information can encourage the public to brainstorm together on how to improve the quality of living, which is the core value of a smart city. The successful examples are GeoHub in Los Angeles of the United States, and Dubai Pulse in Dubai of the United Arab Emirates.

Smart Environment —

Sweden has digitised the image of the country's mountains, rivers, buildings and roads in a popular computer game Minecraft to stimulate young people's interest in urban planning; a British company proposed to use a drone loaded with germinated seeds to fire pods into the ground at a rate of planting one billion trees a year. It is ten times faster than the current method, and the cost is only 20% of planting using manual labour.

Smart Economy —

Exponential growth of the sharing economy is anticipated, with

global revenue expected to increase to US$335 billion by 2025, 22 times that of 2015. The most popular categories include tourism, car sharing, finance, human resources, music and video streaming.

At the same time, according to economic research on the AI era, undertaken by the U.S. White House, there will be four types of work created: (1) collaboration with AI, such as medical workers using AI for routine patient checks; (2) creating AI technologies and applications, such as data scientists and software developers; (3) engineers who monitor, license, or repair AI systems, such as technicians servicing AI robots; and (4) work derived from AI-driven paradigm shifts, such as lawyers creating legal framework around AI, urban planners to establish environments to accommodate autonomous vehicles (AVs).

Smart Mobility —

It is expected that by the middle of the 21st century, advanced AVs will reduce accidents by 90%. In the U.S., it would have the

potential of saving about US$190 billion annually as a result of the decrease in casualties.

Smart Living —

With AVs, drivers can save more time for work, rest or entertainment. The time saved by commuters every day might add up globally to one billion hours. It probably creates a large pool of value; potentially generating global digital-media revenues of US$6 billion per year for every additional minute people spend on the mobile Internet while in a car. At the same time, with more leisure time, human being's creativity would be unlocked.

Furthermore, linking up families and neighbours (People), caregivers and doctors (Private) as well as the policy makers within government (Public) to form a Partnership (4P) with a holistic aim of creating a smart health environment can keep citizens safe, healthy and happy with advanced information technology. Big data analysis helps predict the development of disease; telehealth can reduce

the fatigue of both patients and caregivers, and a sensor network at home can safeguard the patient.

To achieve these ambitious visions, we need to join our efforts. Founded in 2016, the Smart City Consortium (SCC) brings together professionals from different organizations and sectors to develop a world-class smart city for Hong Kong. At the same time, the SCC actively connects with global stakeholders to create a vigorous ecosystem to promote Hong Kong's innovation and development.

This book collects a series of articles which were mostly written in 2017. They were published in various media, such as *World Bank Blog, ITU Blog, South China Morning Post, ComputerWorld, Harbour Times, China Daily, Ejinsight, ecozine,* etc.

Smart City 3.0 displays in detail the upcoming scenes and challenges of smart city development, while hoping to inspire the younger and older generations on how to equip themselves, so as to encourage all of us to participate in building our brave new world.

Winnie Tang

December 2017, Hong Kong

Smart City 3.0

Chapter One: Smart People

How can we groom talent to face the rapidly changing future?
How to attract talent?
Will a smart city benefit the disadvantaged?
What is the value of creativity?

From STEM to STEAM

STEM education has been a hot topic among secondary education teachers, university professors and school principals in recent years.

One focus of the discussions is: what does STEM education mean? Some people may immediately think of the division of science and arts in the past, when biology, chemistry, physics and pure mathematics were taught as science subjects. When we review the statistics of the past ten years, it is obvious that the number of candidates enrolled in biology, chemistry and physics has dropped drastically, from about 40% in the past Hong Kong Certificate of Education Examination to only 20% in the recent examination of Hong Kong Diploma of Secondary Education. Some people think that promoting STEM education is to increase the number of students studying science.

However, besides number, shall we also consider whether the science courses could meet the needs of today's social development?

STEM stimulates thinking

Nowadays, science and technology are everywhere, the smart phone is indispensable to our lives, trees are monitored via the Internet, and even rubbish bins can be WiFi hotspots. Professor Tony F Chan, President of the Hong Kong University of Science and Technology, once raised some interesting questions: Is coal power safer than nuclear power? Is the electric car more environmental friendly than fossil-fuel car? It is only when we have understood the crux of a problem that we can avoid being a parrot.

Therefore, STEM education should not be purely functional as survival skills nor pure knowledge. It should provide us with a basis to understand the problems in an ever-changing society with

new technologies emerging every day, a knowledge to stimulate thinking and self-reflection, so that students can develop self-learning and improvement habits, this is called a “smart citizen”.

STEAM promotes creativity

While we continue to emphasize the importance of science and technology, we also need to know the STEAM Initiative raised by the Rhode Island School of Design in the United States: STEM + Art = STEAM, that is, an added element of art to STEM. The STEAM Initiative pointed out that education inclusive of art can promote imagination and design solutions to the pressing problems challenging the world, such as ageing, urban renewal, global warming, etc.

Art or humanities in a fast-paced society like Hong Kong seems to be irrelevant.

Smart city is people-oriented

However, when I recall that many “inventions” such as

> *To add an element of art to STEM can promote imagination and design solutions to the pressing problems, such as ageing, urban renewal, and global warming.*

videophone, 3D movie and fingerprint identification having first mentioned in the movie *Back to the Future* and eventually come into being, then I realised that art may have provided the visions for the inventors. The reinforced spider silk in the movie *Spider-Man* is a research project undertaken by a California-based technology company and the Michigan Biotechnology Institute in the U.S.. Even the Mac computer's beautiful font design is also a result of inspiration that Steve Jobs gained when he was attending a calligraphy design class at the university.

In fact, humans have always been striving for progress, that's why our ideal smart city is a people-oriented place that provides residents with a better quality of life. Science and technology are only the hardware, not the ultimate goal in their own right. Therefore, when we are striving in various areas of STEM, we should not overlook their application in everyday life.

*An electronic copy was originally posted on *Harbour Times* titled "Future Education: From STEM to STEAM" on 8 March 2017.

Promoting coding education in Hong Kong

Learning coding and STEM (science, technology, engineering and mathematics) have become a new trend in global education.

In 2016, Goldman Sachs laid off 600 traders and replaced them with computer programs and 200 computer engineers. People then realised the gravity of the problem with machines replacing human. Some futurists even predict that many professions, such as doctors, teachers, accountants, architects, lawyers, and pastors could one day be replaced by machines which are able to provide expert services. This made working people and parents start worrying.

In a world dominated by computers, the masters of the future will be the masters of the language used to control the computers: computer programming or coding. Training in coding could enhance logical thinking and problem-solving ability: when you start breaking down what's happening, you can start predicting what's going to happen.

Estonia becomes e-Stonia

Estonia, a small country with a population of one million, gained its freedom from the Communist Soviet Union in the 1990s, and became famous for innovation and technology. Examples include the establishment of the online communication application Skype in 2003, and a remittance service Transferwise in 2011, well-known for its low handling fee. The country's education, especially in science and mathematics, has also achieved the top international rankings in recent years.

> *Training in coding could enhance logical thinking and problem-solving ability: when you start breaking down what's happening, you can start predicting what's going to happen.*

Estonia was very poor after gaining independence but its people broadly bought into the idea that by aggressively pursuing technological advances, it could enrich the people of the nation. Even 20 years ago, all the schools had already installed an Internet network. The former president branded the country "e-Stonia". Widespread teaching of coding was encouraged and Estonia started coding education in 2012 in 20 schools as a trial. Coding courses in school started from age seven, making it the European pioneer in the area.

Coding education in European schools

At the end of 2014, the European Union published a report which analysed in details the progress and plans of the 20 member countries in coding training.

The report pointed out that 12 countries including the United Kingdom, Denmark and Italy had included coding in the formal

curriculum of primary and secondary schools, while seven other countries including Finland, France, and the Netherlands were planning to do so. Apart from training the young people logical thinking and problem solving skills, the EU countries wanted to attract students to study computer science, to help develop the information technology industry in the long run.

Hong Kong is yet to catch up

In Hong Kong, however, many obstacles have been preventing us from catching up. According to an industry source, lots of school management staff want to promote coding education but they face numerous challenges; one of which is from reluctant parents who generally do not have enough understanding of coding to appreciate its importance, especially when proficiency in a new subject like coding does not help one to go further up the academic ladder. Besides this, information technology (IT)

subjects are not in the mainstream. Most parents would encourage their children to study medicine, accounting and law, but not IT. Consequently, parents do not allocate resources for their children in IT study as much as they do in English or music.

Worldwide challenge: inadequate qualified teachers

Another challenge is that coding has been a minor subject with limited practitioners. Where can interested parties/schools find the teachers now with current rapid development in this field? The report *Shut down or restart?* released by The Royal Society of the U.K. earlier, already pointed out that, computer education was a disappointment in many U.K. schools. Students lacked interest in computer study. After learning basic knowledge, such as word processing, they left.

The 100 plus page report pointed out that the U.K. lacked teachers who had the ability and proper training to teach higher

level computer course. Also, there was no provision of continuous professional training for the teachers.

Local experts in coding education also believe that the shortage of teaching resources is a major problem in Hong Kong as well.

Private public academia co-operation

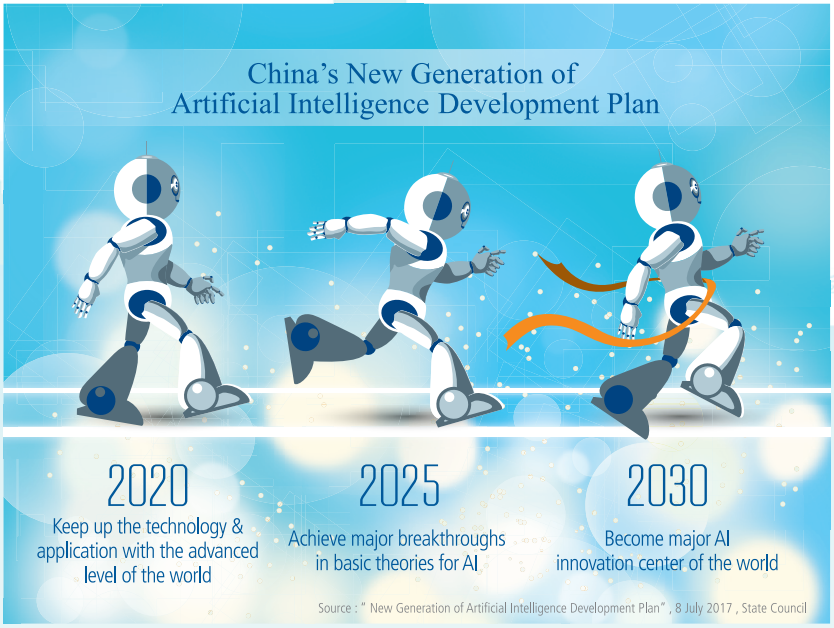
At the beginning of 2016, Finland also included coding in the primary and secondary school curriculum, but the country has to face the inadequate supply of qualified teachers and teaching resources. So what are the solutions? (1) Cooperation with universities to train teachers and develop teaching resources; (2) the Ministry of Education and Culture co-operated with private companies from 2015 to provide free computer programming course for the students.

As for Hong Kong, though we are behind other countries in coding education, there are continuous initiatives in society, like a summer camp held in the summer of 2017 co-organized by the University of Hong Kong, a well-known coding school in the United States and one in Hong Kong, the camp helped bring us the U.S. learning method.

I hope that this is a good start to arouse awareness in the subject from society, including parents and teachers. I also hope that there will be more resources allocated for promoting coding education in Hong Kong, so that our students could catch up with the global trend as soon as possible.

*An electronic copy was originally posted on *ComputerWorld* titled "Promote coding education in Hong Kong" on 28 March 2017.

Hong Kong should boost tech spending amid global AI talent contest



At the International Telecommunication Union (ITU) forum in the end of September 2017, I was invited to discuss the influence of artificial intelligence (AI) on the development of a smart city. There were also speakers from Korea and Singapore at the forum. Education and talent were two important topics discussed, because AI and smart cities both face the shortage of talent.

AI experts in high demand

University are battlefields for acquiring talent. Google successfully recruited the AI Laboratory Director from Stanford

> *With a series of measures to boost the development of innovation and technology, we can not only inject economic and social impetus to society, but also unlock the potential of young people.*

University in late 2016, the famous Chinese professor Li Feifei who studies computer vision (teaching a computer how to interpret images with meaning). At the same time, the Canadian government provided a huge sum of US$210 million (about HK$1.66 billion) to three universities in Montreal for training AI talent.

In Korea, after the defeat of the Go Master by AI in 2016, the parliament increased the budget to one trillion won (about US$883 million or HK$6.9 billion) for building the country's AI research and development (R&D) centre within five years. This budget was more than 55% of the original. Singapore began relaxing EntrePass in August 2017 to attract more overseas technology entrepreneurs. For those with a track record, they can migrate to Singapore even if their business is still in the exploratory stage. They need not have investment from a government-recognized venture capital, hold any intellectual property nor co-operate with local research institutes as previously required.

China: AI talent numbers set to rise

As for the mainland China, since September 2017, the government began to strengthen science education: primary school grade one and two must have at least one hour of study in a science subject every week, the tertiary institutes should increase the number of AI-related master and doctoral degree courses to meet the *New Generation of Artificial Intelligence Development Plan* announced by the State Council in July 2017, which set a target for China to become the global innovative AI power by 2030.

Competition for AI talent is fierce with the United States leading far ahead. According to the *Global AI Talent Report* published by LinkedIn in 2017, there are over 850,000 AI practitioners working for U.S. companies, followed by India (150,000), the United Kingdom (140,000). What about China? It ranked seventh with only 50,000 people, less than 6% of that in the U.S. Furthermore, in the AI industry of China (such as deep learning, language recognition,

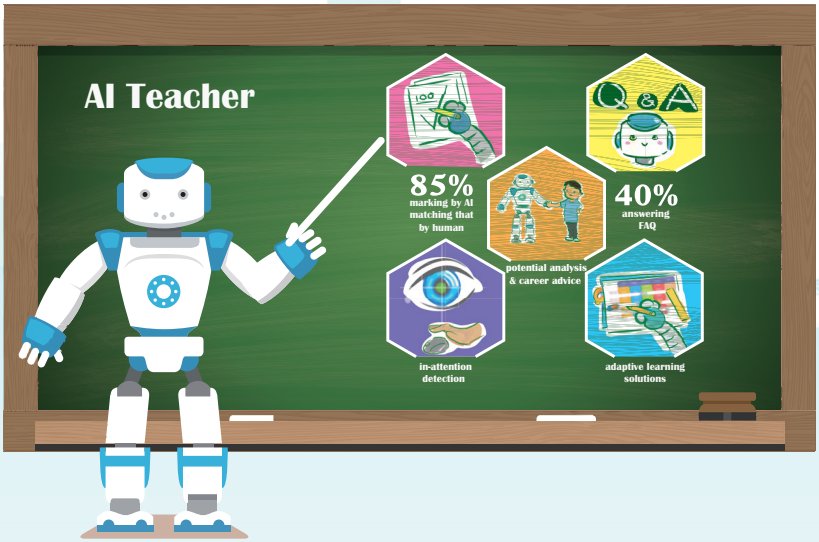
natural language processing), half of the top ten employers are U.S. companies, including IBM, Intel, Microsoft, etc.

Hong Kong: potential yet to realize

In Hong Kong, we have several world-renowned universities with world-class AI professors. In the past 20 years, however, our R&D investment accounted for less than 1% of the GDP, far below our neighbouring cities and countries. This results in slow innotech development as well as a significant brain drain. Therefore, I am delighted that our latest *Policy Address*, released on 11th October 2017, introduces a series of measures to boost the development of innovation and technology, through training, retaining and attracting talent as well as encouraging R&D. By doing so, we can not only inject economic and social impetus to society, but also unlock the potential of our young people.

*A hard copy was originally published in *South China Morning Post* titled "Smart move to invest in tech" on 23 October 2017.

Artificial intelligence transforms classroom learning



Smart cities need smart talent. However, in the Internet age today, the old-fashion teaching model in many schools cannot arouse students' interest, therefore, it is difficult to train them in a timely manner. Artificial intelligence (AI) helps to break through the current difficult situation faced by teachers and students.

Make personalized learning possible

What is the teacher's predicament? Many teachers in primary and secondary schools are already heavily occupied by routine tasks. Therefore, it is a formidable challenge for them to arouse students' interest in competition with digital device in the smartphone and Internet era.

> *AI can take up teacher's time-consuming administrative work but not replace the role of the teacher who would become a coach of students to guide them to make the best use of their strengths and face their life positively.*

How about the students? Web surfing is so much fun when compared with the boring classroom learning. When they are in high school, they are aware of the academic importance but there are just too many temptations around. When they are approaching graduation, they don't know how to connect with the outside world with their experience, interests and abilities gained from the cyberworld. Inevitably, they would feel helpless.

AI is not omnipotent, but it can perform the following tasks:

- Automate teacher's routine tasks like marking assignments — experimental results showed that using machine learning and predictive modelling, the scores marked by AI match with human grading by as much as 85%;
- Virtual teaching assistants can answer 40% of frequently asked questions by the students — In 2014, a professor from the U.S. Georgia Institute of Technology created a robot teaching assistant, which provided responses to

students' online questions for five months without being noticed by the students;

- Identify the successful formula, then apply adaptive learning solutions to deliver the right content, at the right time, in the best way to each student, according to his or her individual learning preferences and progress;
- Apply computer vision and deep learning, detect students' early disengagement signs by tracking eye movements and mouse activity, and observing their expressions to check whether they are engaged, confused, or bored; and count how many times or for how long a student takes to answer a question correctly;
- Analyze students' abilities, interests, and potential through education profile, classroom interaction, social media activities, etc., and find out the best learning method and even recommend his career path.

Teachers' true value to be released

AI can take up teacher's time-consuming administrative work but not replace the role of the teacher who would become even more important in adding value.

For example, when many students are found to commit similar mistakes in the same assignment, that is an indication of possible problem which needs teacher's attention and follow-up. Most importantly, the teachers can be a mentor or a coach to guide students to make the best use of their strengths and face their life positively.

In the meantime, UNESCO estimated that more than 24 million primary school teachers will be recruited and trained in order to achieve universal primary education by 2030, while another 44 million secondary teachers would be needed. Over 80% of them are newly recruited primary school teachers and will be replacing the retired. AI will be very useful in sharing the workload.

Man-machine synergy effect

When Lee Kai-Fu, the AI expert talked about the future with Jack Ma of Alibaba, they both pointed out the importance of realizing the strengths of human beings. Lee said, "AI should be appropriately utilized so that the man-machine synergy will be greater than 1 + 1. The key is that we must enrich our hard skills, that is, broad knowledge, and also we shall have soft skills, such as good communication skills, ability to work with others." Ma also said that only people-oriented work would not be replaceable by machine.

Communication skills and good emotional quotient are unique to human beings. Young people, let's work hard together!

*A hard copy was originally published in *South China Morning Post* titled "Smart moves in the classroom" on 29 November 2017.

Women can hold up half the sky of smart city

Smart city development relies on our joint effort; Smart People who are good at utilising, managing and developing innovative technology, are definitely required to form the backbone of a smart city. However, Hong Kong does not have enough IT talent to support such development. There is a global shortage of IT talent, female participation in particular being very low. In fact, Hong Kong women account for only 17% of the IT working population. That is why Mr. Nicholas Yang, Secretary for Innovation and Technology, recently mentioned the "serious imbalance" of men and women in the IT industry.

Bright employment in tech industry

According to the University Grants Committee, the number of

women enrolling in locally funded universities has increased by 8% over the past 20 years, from 46% in 1995/96 to 54% in 2015/16, i.e. more than half of the students were women. The number of women enrolling in medicine, business, the social sciences, humanities and education was overwhelming. However, in the two disciplines of Science and Engineering & Technology, women only accounted for moderately over 30% despite the growth of female enrolment in the last two decades.

There is not much information on women's participation in Hong Kong's IT industry. However, I have come across some updates on the United States which could shed light on the issue.

In the U.S., the IT employment prospect is very bright. According to the Department of Labour in the U.S., it is estimated that the growth of employment between 2014 and 2024, will on average be only 6.5%, while IT-related employment is 23%. In 2015 alone, the U.S. IT vacancies reached 500,000, while less than

40,000 fresh graduates possess the relevant training. Meanwhile, women in IT earn 33% more than their peers in other industries. What's more, pay difference in favour of men is common in the U.S. with 14% in STEM-related (science, technology, engineering and mathematics) jobs. While in "non-STEM" industries, the salary difference between men and women is well over 20%.

Closing gender gap

Despite the substantial vacancies and good salary, U.S. women only accounted for one fourth of the IT labour. The Ministry of Commerce also found that for women who have STEM training in universities, less than 30% of them entered related industries after graduation, but more joined the education or nursing sector. According to figures from the National Centre for Education Statistics, the proportion of women attending a degree in IT has dropped in recent years. There was a gradual increase from over 10% in the 1970s to 30% in the 1980s. However, with the popularity

of the Internet, the proportion of women enrolling has dropped to around 10%, almost the same level as 40 years ago!

Encouraging women to study IT and engage in IT-related work, can not only fill up more vacancies, but also promote competitiveness. By doing so, we could improve women's remuneration, as well as enhance their social and economic influence.

Girls can code

Susan Wojcicki, CEO of YouTube mentioned earlier about the three possible reasons for deterring women from participating in technology: (1) bored of the discipline; (2) their perceived lack of potential; (3) "they wouldn't want to be seen dead with the people who major in computer science".

These preconceived beliefs are often delusional. To correct the delusion, we need education.

> *'Soft skills' such as communication skills, empathy and team spirit are important for developing a smart city. These skills are actually the natural strengths of women, aren't they?*

Accenture, a consulting firm, and Girls Who Code, a non-profit organization initiated by female lawyers in the U.S., have recently completed a study. They interviewed more than 8,000 girls aged 12 to 18 to examine how to build and maintain their interest in IT related courses, such as coding in junior high school and even at university. They recommended encouragement, such as parent and teacher recognition, peer influence, blending classroom formal courses, such as summer camps with other activities, with an aim to increase the amount of female participation in the IT sector.

Soft skills are equally important

Back to Hong Kong, various primary and secondary schools have begun to introduce coding courses in the formal curriculum. Esri China (Hong Kong) in which I am the Chairman, also launched Asia's first e-learning program, Map in Learning, in Hong Kong in June 2016. The program allows Hong Kong's

primary and secondary schools free access to ArcGIS Online, a professional geo-information system for government, private and public enterprises. This e-learning software helps students to develop diversified potentials. Although our program is not specifically designed for the needs of female students, I could tell from their response that the software has increased their interest.

Most of the above are "hard skills." However, I believe "soft skills" such as communication skills, empathy and team spirit are also important for developing a smart city. These "soft skills" are also the requirements for leaders in the e-commerce giant, Amazon. When we look into these qualities, they are actually the natural strengths of women, aren't they? Therefore, I really hope that women could hold up half the sky of our smart city in Hong Kong!

*An electronic copy was originally posted on *Harbour Times* titled "Women hold up half the heaven of Smart City" on 1 February 2017.

Technology helps restore dignity for disabled

According to a survey conducted by the Government in 2013, the disabled population in Hong Kong is around 600,000. “Persons with disability” are defined as those: having restriction in body movement; visual impairment, hearing difficulty, speech disorder; mental illness/mood disorder; Autism; special learning difficulty, attention deficit/ hyperactivity disorder, etc. They amount to 10% of the population in Hong Kong.

Respective surveys from the European Union and the United States found that, however, there was one disabled person in every five people. The World Health Organization estimated that 15% of the world’s population had a disability (i.e. one billion) with the number continuously increasing due to ageing.

Disabled people in work boost economy

At the same time, the disabled community is generally within the low income group of society as it is difficult for them to get a job. In Hong Kong, more than 500,000 disabled people are unemployed, representing 80% of the disabled population.

Science and technology can not only help them to make a living or improve their lives, but also boost the economy as a result. According to the estimate of the U.K. disability charity Scope, if one million disabled people were employed, there would be £45 billion (about HK$450 billion) worth of economic growth, meaning a 1.7% growth in GDP. Currently, the U.K.'s population of disabled and long-term patients is 11 million, of which only six million are employed.

Market demand for assistive tech

The huge disabled population also means huge business

opportunities! The World Health Organization estimated that as the population ages, there will be more than two billion people in need of at least one piece auxiliary equipment by 2050 (i.e. one out of every five people). The older a population, the more equipment is needed.

However, only one out of ten people has the equipment today. As such, a research institution estimated that by 2019, the number of global disability or chronic disease patients will bring in business opportunities which can be valued up to US$20 billion (about HK$155.6 billion).

Tech helps restore dignity

Today, there are various auxiliary products for the disabled. For example, Dr. Amit Goffer, an Israeli inventor, has countered a car accident that paralyzed his limbs. Fortunately, his new four-wheel chair, launched in late 2016, allowed the 63-year-old

"Science and technology can not only help disabled to make a living or improve their lives, but also boost the economy as a result."

scientist to manoeuvre upright over uneven urban areas or sloped ground, as well as join conversations face to face with people standing up. For people with serious spinal cord injuries, the standing-up posture helps stave off cardiovascular, respiratory and other problems that can arise from long-term sitting or resting in bed, according to Dr. Gabi Zeilig, director of the neurological rehabilitation department at Israel's Sheba Medical Centre.

Goffer talked about the dramatic psychological effect after using the invention that it could restore "the dignity, self-esteem… to feel like part of society again, the core of society, not the fringe of society."

That's right! This is what an auxiliary technology can and should achieve, that is, not only assisting physical function, but also allowing the patients to lead a dignified life.

3D printing to lower the cost

However, these auxiliary products are often expensive. If the user is a child, there is even a need to change the equipment once every few years. Each time it costs at least tens of thousands of Hong Kong dollars; the total cost of artificial limbs in one's life could be several million.

Luckily, thanks to the developments in science and technology, and with the help of a group of dedicated people, the disabled are brought a silver lining.

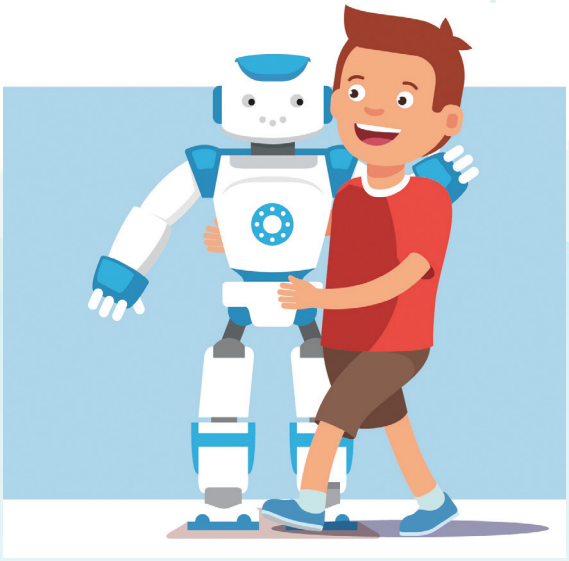
7-year-old Alex admires superheroes, he was born without a right arm; Albert is a college student who has set up a non-profit organization Limbitless Solutions to carry out 3D printing of artificial arms to help children like Alex. These arms can be tailor-made and each costs only US$350 (about HK$2,700).

Albert's move touched many people. One of them was Robert Downey Jr., the actor in the movie *Iron Man*, who handed over the 3D artificial arm to Alex. The YouTube video featuring both wearing the artificial arms together has attracted over 10 million viewings.

Recently, I read about the OECD's global student ability assessment, the performance of Hong Kong students was once again outstanding. I hope they can contribute to the solutions for disabilities and improve the well-being of mankind, while at the same time create their own bright future.

*A hard copy was originally published in *South China Morning Post* titled "Disability is no bar to dignity" on 2 May 2017.

Embracing innovation to boost our vitality



Today, embracing technology and encouraging creativity seem a norm, but is it really the case in real life?

I remember 20 years ago, when I introduced the digital map to the public and private enterprises, they all considered that a hand drawn paper map was good enough and not in need of change. It was not until very late they finally realised the power of a digital map's analytical capability, which could assist them in decision-making.

"Social media is too important to be left to the marketing department"

It is not easy to change the "status quo" mode of work which has been ongoing smoothly for some time. This is especially true for large enterprises which have tens of thousands of staff in their workforce. To make a change within a short period of time is particularly difficult for them. However, with the popularity of today's social media, such as Facebook (FB) which has daily active users of up to 1.3 billion, comparable to the population of China, the influence is self-explanatory. At the same time, the popularity of smart phones has also heightened people's expectation for quick responses. A survey showed that over 80% of adults expected to get a reply within 24 hours for their comments on social media, near 50% adults even expected a response within an hour. Facing such demand, the challenge for large enterprises is huge.

> *Whether new approaches and new technology can be successfully implemented depends on people's mind-sets.*

An article in the *Harvard Business Review* titled "Social media is too important to be left to the marketing department" quoted the transformation of Hertz, a car rental group that has 9,700 point of sales worldwide. In the past, Hertz's FB was handled by the marketing department which would forward customer enquiries and complaints received on its FB to the customer service department. The response would be uploaded to the social media in about four to seven working days.

How to delight customers

This response time was, of course, not satisfactory from customers' viewpoint. What's more, according to internal analyses, 70% of the complaints from social media were real problems with the services that needed to be solved as soon as possible. The slow response naturally led to a loss of customers and business. To retain customers, the company decided to reform itself by establishing a new cross-departmental team to provide quality

and timely social media services with the assistance of a software system to detect all-round social media activities.

I can imagine that it would not be easy to persuade the management to carry out such change, as it involved the altering of mind-sets and structural reform. Even more challenging was to persuade all the staff from bottom to top - because most staff would be concerned how the work model, workload, remuneration, bonus, promotion under the new practice would affect them. In short, whether new approaches and new technology can be successfully implemented depends on people's mind-sets.

Open-minded about tech changes

For example, an airline company once wanting to introduce ticket kiosks caused concerns to its frontline staff who worried their position would be replaced by the machine. The company had to explain to its staff that the kiosks were only capable of ticketing work; more complex work such as handling individual passenger's

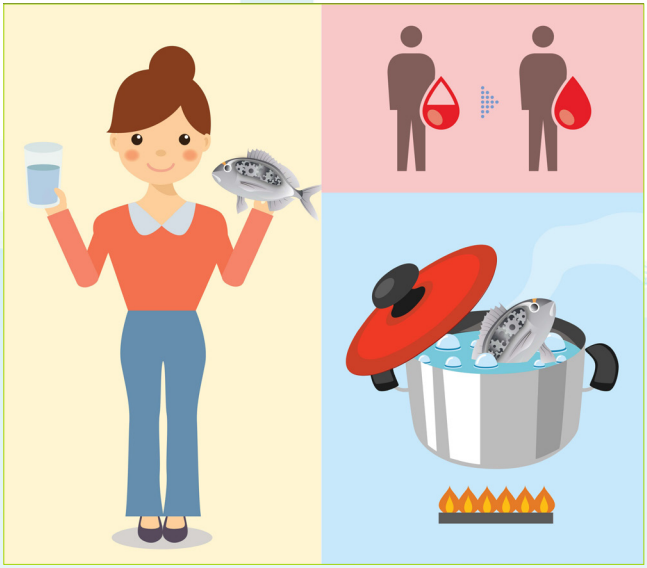
requirements would still rely on manpower. Upon clearing the doubts, employees were willing to take the initiative introducing the kiosk service to customers, finally the new technology and new products could be used.

I do not know how Hertz persuaded its employees to implement the new system, but upon adopting the new approach, the company's response rate was shortened to 75 minutes with over 1,000 customer enquiries being handled within one week.

As mentioned by Microsoft's Bill Gate in his book *Business@the Speed of Thought: Succeeding in the Digital Economy* published in 2009: "In three years every product my company makes will be obsolete. The only question is whether we'll make them obsolete or somebody else will." Innovation and change are inevitable; we have to keep our minds open to embrace them so as to maintain the vitality of the company and individuals.

*An electronic copy was originally posted on *Harbour Times* titled "Embracing innovation to boost our vitality" on 13 July 2017.

Priceless creativity



During our school days when parents' only concern was whether their kids did well at school, no one talked about creativity. To be able to become respected professionals like doctors, engineers, accountants or lawyers was the mainstream life expectation. This was particular the case in Asia. It is, however, about to change: some ten years ago, Facebook was launched while WhatsApp was nowhere to be seen. Now, almost everybody cannot do without them for both work and daily life.

Anaemia can be fatal

Today, mass media frequently mention how artificial

intelligence would one day replace human beings who would then be left jobless. In 2016, Goldman Sachs replaced 600 traders with computer programs. Who knows what will happen ten years on from now!

To survive in the future, in my opinion, you need to have creativity in addition to acquired knowledge. Creativity does not necessary mean a hi-tech or great idea. The most important thing is your recipients or clients appreciate the idea.

Nearly 3.5 billion people around the world lack sufficient nutritional iron in their diet. It can cause serious health problems including general fatigue, shortness of breath, dizziness, premature birth and even miscarriage. The problem is called anaemia.

A small smiling iron fish added in a cooking pot is a simple, low-tech yet environmentally sustainable invention and it has saved lots of Cambodian's life from the health-destroying consequences of anaemia.

Simple solution can save lives

The story started in 2008 when Christopher Charles, a health science student from Canada, worked on an undergraduate research project in Cambodia. Cambodian's daily diet is mainly rice and fish which leaves at least half of the population with iron deficiencies leading to anaemia. A change in diet with iron supplementation is a common advice. But iron pills are expensive and their side effects discourage people from taking a daily dose.

The health problem in Cambodia shocked Christopher, and led him determine to find a simple, cost-effective, accessible, and environmentally sustainable solution to the problem.

He found, through measurement, that boiling a piece of iron in water for ten minutes can provide up to 75% of the daily iron needs for a family. But how can you convince the Cambodians to accept the bizarre idea of boiling drinking water with a piece of iron?

> *"Creativity springing from caring and deliberation is priceless. This is the key no matter you are serving the society or establishing your own career."*

His first version of the invention was a plain iron bar. But villagers felt it odd to put into their cooking pot an iron bar which they used as doorstops and paperweights instead. Then the second idea of an iron plate also failed. As most Cambodians are Buddhists, he tried a pattern of the lotus flower, a resonant spiritual symbol, as the third prototype. But it didn't work out, as nobody would put a flower into their soup.

Ideas from daily life

Finally, the fish with a smile did the trick, as Cambodians consider fish as a symbol of good luck. 400 iron fish were distributed at the trial and villagers were happy to accept them and used them on a daily basis. People were taught to boil the fish for ten minutes in drinking water or soups, or stews, with a few drops of lemon juice or sauce acidic by nature.

As a result, women felt their health improving within three

months; blood tests after nine months confirmed that there has been a 50% decrease in the incidence of clinical iron deficiency anaemia and an increase of iron levels in users' blood.

Also, iron fish is cheap as well. For iron pills, each adult has to spend US$30 (about HK$230) a year, while an iron fish only costs US$5 (HK$38) and can meet the needs of the whole family for at least five years.

The iron fish has helped at least 50,000 Cambodians. Christopher's idea won him the Classy Award in 2016 for its social impact as well as the Grand Prix award for product design at France's Cannes Lions International Festival of Creativity in 2015.

Creativity springing from caring

He summed up his experience stating, that you needed to have a detailed understanding of the locals, the nutrition, the culture, the health science, etc., all in the Cambodian context. He reflected

that the failure of a lot of solutions for the developing countries might be due to their hi-tech approach, being too complicated, or simply not accepted by the locals. In his case, he moved to a rural village in Cambodia where the population was about 800 and he was the only foreigner there. Living with no electricity or modern bathroom facilities available helped him embrace the complexity of the problem.

The iron fish is made with locally available scrap iron, mainly from car parts. To ensure these are not toxic, the fish is extensively tested for safety and for its iron being readily absorbed by the body. In addition to regular testing, there are random spot tests by independent laboratories in Canada to ensure the quality.

What's more, the packaging of the iron fish uses recycled materials from the local market. So it is not only environmentally friendly but also helps create jobs.

Christopher's statement that simple innovation saves lives resonates with the smart city's principle of people orientation. This is exactly my ideal smart city with the main aim of serving the people while technology only acts as an enabler. Creativity springing from caring and deliberation is priceless indeed. I think this is the key no matter you are serving the society or establishing your own career.

*An electronic copy was originally posted on *Ecozine* titled "Priceless Creativity" on 23 May 2017.

Smart City 3.0

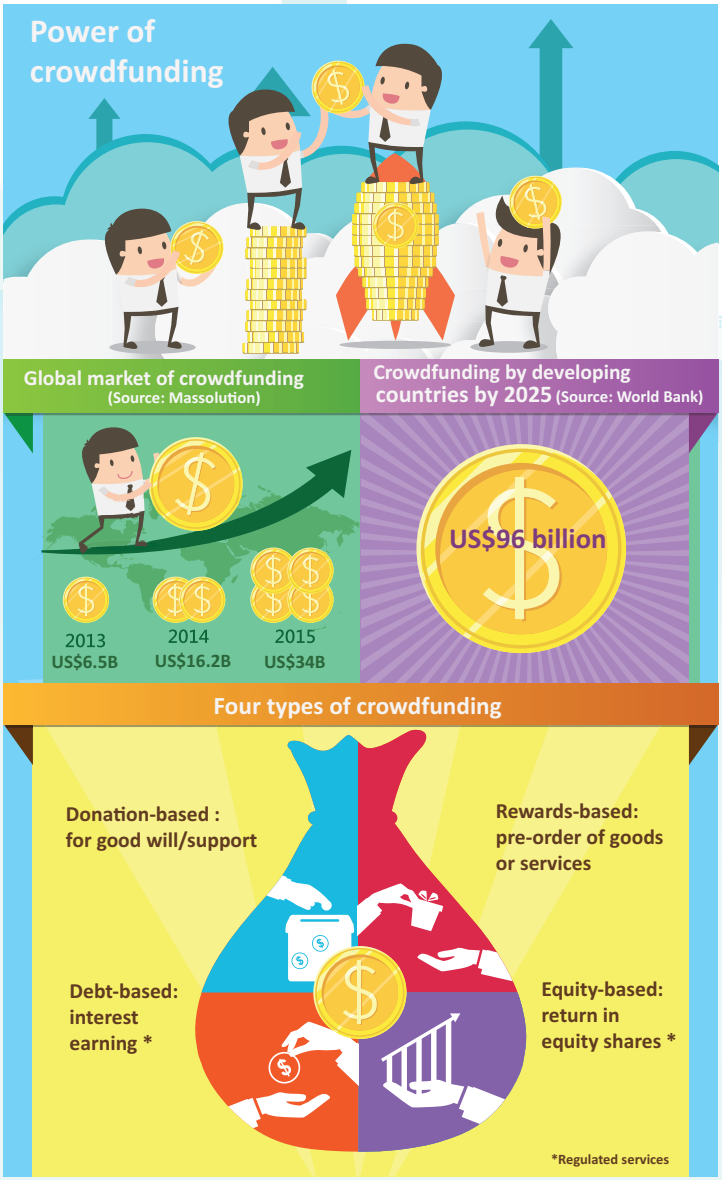
Chapter Two: Smart Economy

How do the innovative industries such as the sharing economy, crowdfunding, and FinTech create quality employment and development opportunities for the coming generations?
How can we grasp the opportunity with old jobs disappearing and new jobs upcoming?

Exert the power of crowdfunding

Crowdfunding is a product of the 2008 global financial turmoil. At that time, all enterprises, despite their sizes, were facing financial difficulties in obtaining bank loans. Therefore, raising funds from the public became an alternative. Later, there was too much cash in the market as a result from global quantitative easing, thus, crowdfunding evolved as a tool for startups: to "test the waters", to understand the market appetite for their newly created products, to raise funds with a minimal or non-existent track record and all at a low cost.

The market of crowdfunding is huge. Massolution, a research company, indicated that in 2015 the world's crowdfunding amounted to US$34 billion, an increase of more than double compared to the amount raised the year before. The World Bank also estimates that by 2025, the funds raised through crowdfunding, in developing countries alone, will amount to US$96 billion.


Power of crowdfunding
Global market of crowdfunding (Source: Massolution)
2013 US$6.5B
2014 US$16.2B
2015 US$34B
Crowdfunding by developing countries by 2025 (Source: World Bank)
US$96 billion
Four types of crowdfunding
Donation-based : for good will/support
Rewards-based: pre-order of goods or services
Debt-based: interest earning *
Equity-based: return in equity shares *
*Regulated services

> *"Our Chief Executive should strengthen communication between financial technologies and related industry sectors on the new economic model, as well as amend regulations, to cater for innovations and investor interests."*

Four types of crowdfunding

The crowdfunding platform can be divided into four types. The donation-based crowdfunding of which donors want to express good will or their support. The second type is rewards-based which allows investors to pre-order the goods or services, while debt crowdfunding is controversial in recent years because of fraud problems, especially in mainland China.

However, I believe we should actively promote the fourth type, equity crowdfunding. It is similar to rewards-based crowdfunding with diversified projects. The major difference lies in the return in equity shares — fundraisers create their projects on the platform and introduce their products, ideas, target fundraising amount as well as expected rate of return. The funds raised are generally a bigger amount.

In fact, it is similar to traditional financial investment of buying shares in the stock market. Local investors should have

considerable knowledge of such fundraising. There are also substantial number of professional investors in Hong Kong's financing market. They have rich investment experiences and they expect to own a more diversified investment portfolio.

Overseas practice

In May 2016, the United States government revised the *Jumpstart Our Business Startup* Act, first launched in 2012, to enable retail investors to participate in equity crowdfunding with projects that raised no more than US$1 million within 12 months. In the United Kingdom, the Financial Conduct Authority modified the existing securities regulatory framework, by requiring the equity crowdfunding platform to obtain regulatory approval and protect individual investors with regard to disclosure of information, such as promotion targets only limited to professional investors, or retail investors who have received investment advice. Since the

regulation came into force from 2014, the total of funds raised through equity crowdfunding has increased by more than double.

In June 2016, the Monetary Authority of Singapore announced two measures to promote equity crowdfunding, including simplifying application requirements for projects that would raise less than S$5 million (about HK$25 million) within 12 months. In February 2017, Australia's *Corporations Amendment (Crowd-sourced Funding) Bill 2016* was under a third reading, hoping to promote financial market development, while balancing innovations and investor risks.

Hong Kong lagging far behind

However, Hong Kong is still lagging far behind, and has yet to determine its direction on these emerging economic models, let alone policy co-ordination and promotion.

Recently, the Office of the Government Chief Information Officer has developed a website to solicit public views for studying

the development of a smart city. It is an encouraging action.

This is precisely the feature of smart city 3.0; that is, working together to inspire public creativity. The new economic model of equity crowdfunding is also a platform to enable the power of citizens. Therefore, I hope that our Chief Executive will be able to strengthen communication between financial technologies and related industry sectors, on the emerging economic model, as well as amend regulations, to cater for innovations and investor interests. By doing so, we could promote market development and boost Hong Kong's economy.

*An electronic copy was originally posted on *Harbour Times* titled "Exert the power of crowdfunding" on 14 February 2017.

The sharing economy is not a zero-sum game

The definition of the sharing economy is quite broad, the common understanding is the sharing of idle resources with compensation, including capital, lodging, cars and personal knowledge, skills, experience with the linking up of participating parties via the Internet. Examples like Airbnb (lodging), Uber (part-time driver), or Hong Kong's Gaifong (rent instead of purchase of household items), and Carshare (sharing of private cars).

The focus of these applications is the shared use of resources which might otherwise become idle and the provision of personal services.

Unstoppable sharing economy

Anyhow, the development of the sharing economy is unstoppable. According to an estimate of a consultant, PwC, the

global revenue of the sharing economy in 2015 was US$15 billion (HK$116 billion), it is expected to increase to US$335 (HK$2,602 billion) by 2025, a 22 fold increase in ten years. The five most popular categories include: tourism, car sharing, finance, human resources, music and video streaming.

One of the advantages of the sharing economy is to help young people to improve their financial situation. According to different surveys in the United States, most of the participants are highly educated young people. Alan Krueger, Professor of the Princeton University, has carried out an analysis on Uber. It shows that half of the Uber drivers are aged 18 to 39, 90% of them possess a degree or above in education. On the other hand, there are only 3% of full-time taxi drivers in such age group, while less than half of them have any higher education. Another study comparing participants in the sharing economy and the entire U.S. labour market also has similar findings.

Traditional economy vs. new economy

The sharing economy is a new economic model; there are many conflicting interests between the traditional and the new economy. There were news stories about protests from professional taxi drivers around the world; the protests can even lead to confrontation.

Recently, in Hong Kong, an Uber driver was charged a fine of HK$10,000 and his license was suspended for one year. The prosecution was in accordance with the Road Traffic Ordinance, which was amended in 1988 to regulate private car's "illegal car hire service". The Tourism Ordinance amended in 1997 also requires short term flat rentals of less than 28 days to apply for a license.

Measures to level playing field

Singapore often stresses embracing innovative technology

and the new economy. But with residents' complaints increasing by 60%, the country passed a new regulation in February 2017 to ban the operation of short-term lodging for less than six months, unless it has been previously approved. As for sharing vehicles, there is a new clause to add a threshold for participants and operating platforms - the new rules effective from Q1 2017 require part-time drivers to complete a ten hour driving revision session before applying for a vocational license in order to participate. If the sharing platform is found to have three or more drivers without the license, it can be penalized with suspension of operation for 12 months.

According to a study from the Hotel Association of New York City, Airbnb has gained an 8% share of the New York lodging market in 2015 and is expected to double its share by 2018.

However, are the new and old economy really zero sum games?

Synergy between old and new economy

In 2013, Avis, the car rental group, acquired Zipcar, a car sharing platform established in 2000, for US$500 million (approximately HK$3.9 billion) in order to expand its business and complement each other. Professor Krueger also pointed out that Uber generated many money-making opportunities, including benefits to all taxi drivers, including traditional taxi drivers due to an increased demand for the service.

At the same time, more than 275 jurisdictions worldwide, including Paris, New York and Ontario, etc., have reached tax agreements with Airbnb which started to collect and remit tourist taxes on behalf of the hosts from May 2017, making a fairer competition between the old and new economy. So far, Airbnb has collected and remitted more than US$240 million (about HK$1.8 billion) in tourist taxes throughout the world.

"To develop the sharing economy, we can learn from foreign experience, and provide clearer and more relaxed regulations, to allow the survival of these enterprises; injecting new impetus to the Hong Kong economy."

The way forward

While the sharing economy is progressing, there are many problems of service quality and credibility arising. The problem of how to properly protect consumers so that the new economic model continues to flourish is very important. Earlier, the British government invited a sharing economy business founder to carry out a study. Its suggestions on how the government can help enhance the trust of both service operators and consumers are of good reference to us. Some of the key ideas are:

1. Insurance : to provide guidance to the insurance industry and the sharing economy companies;
2. Verification of identity: to open up the existing identity verification system of the government, and digitise the criminal conviction record to facilitate its use by the sharing economy businesses.

Development of the sharing economy is the trend that Hong Kong should catch up on. On one hand, we can learn from foreign experience, such as taxation and other measures to balance the interests of traditional industries and the new economy. On the other hand, we should also provide clearer and more relaxed regulations, allow the survival of these enterprises; give young people a greater space for development, and also the public to enjoy more choices, while injecting new impetus to the Hong Kong economy.

*An electronic copy was originally posted on *Harbour Times* titled "Sharing Economy is not a zero sum game" on 27 June 2017.

Future jobs already here

When did you last check your smart phone? Studies show that some people check their mobile devices up to 150 times every day. That means ten times an hour which was unimaginable ten years ago.

For every job destroyed, 2.4 jobs were created

So many things have become unimaginable these days. We worry about our jobs being replaced by technologies, however, new positions are actually being created in industries that most of us cannot even imagine; furthermore, new ways to generate income arise, as suggested by McKinsey, a consultancy firm. Jobs in IT development, hardware manufacturing, mobile application creation, and IT systems management contributed one third of all newly created positions in the United States over the past 25

> *"I hope the young generation will further acquire technical skills, problem-solving skills, and make effort to address emotional concerns."*

years. A 2011 study also had a similar finding; that in the previous 15 years, 500,000 jobs were destroyed by the Internet while at the same time 1.2 million were created. In short, for every job destroyed, 2.4 jobs were created.

With Facebook becoming a daily necessity for some 5.1 million people here in Hong Kong and almost 1.3 billion people worldwide, a job opening at the Hong Kong Observatory responsible for social network communications with a monthly salary at more than $37,000 was no surprise. Some even praised the Observatory for being realistic and down to earth.

What's more, employments in mobile app and game development have become some of the most trendy careers. According to Tencent's latest result announcement, smart phone games were one of the key revenue drivers with 57% year on year growth reaching RMB12.9 billion (HK$14.6 billion). At the same time, together with sensor networks, the Internet of things, big data,

artificial intelligence, cloud computing and digital technologies, Industry 4.0 is the current trend. However, McKinsey estimated that we are just in the early stages of realizing the potential of digital technologies. The U.S., for instance, has captured 18% of the potential while Europe only 12%.

"Why are there still so many jobs?"

So, are traditional jobs approaching an end? MIT economic professor David Autor reviewed U.S. history over the last 100 years and wrote an article titled "Why are there still so many jobs? The history and future of workplace automation". He took the ATM as an example. When ATMs were introduced in the 1970s, the job of a bank teller was expected to become obsolete. While the numbers of ATM in the U.S. increased from 100,000 to 400,000 between 1995 and 2010, the number of urban bank branches rose by more than 40% and bank teller employment rose 10%

to approximately 550,000 from 1980 to 2010. Why so? When information technology enables the routine cash-handling tasks of tellers be reduced, bank personnel are enabled to become salespersons to forge relationship with customers and introduce them to additional banking services like credit cards, loans, and investment products.

Balance of technical skills and creativity

In other words, technology has helped rejuvenate "old" jobs.

Deloitte, a consultancy firm, has reviewed the expected ability of a modern workforce and concluded that "a balance of technical skills and more general purpose skills, such as problem-solving skills, creativity, social skills and emotional intelligence" as essential.

At the 45th International Exhibition of Inventions of Geneva

which is the largest scale technology competition in the world, an invention of a Hong Kong team, "Ultrasound enhanced delivery of drug into the eye via transscleral route", won a couple of awards including the Prize of The State of Geneva. The treatment is an non-invasive using low frequency, low-intensity ultrasound technology to deliver drugs for curing retinal diseases. The solution can benefit the global population. I think this is an excellent combination of technical skills, problem-solving skills, and effort to address emotional concerns from treatment which I hope the young generation will further pursue. These abilities are also key to the success of building a smart city.

On the other hand, for middle-aged people like me, lifelong learning to instil creativity and responsiveness is a must so that we can adapt and stay competitive in the ever-changing world.

*An electronic copy was originally posted on *ComputerWorld* titled "Jobs of the future have arrived" on 27 June 2017.

Artificial intelligence releases human potential

The wave of artificial intelligence (AI) has spread to Hong Kong. Hang Seng Bank plans to introduce Chatbot – a machine possessing natural language processing and a mechanical learning ability, to provide customers with credit card offers and banking services information; while the Bank of China (Hong Kong) is also researching robotic technology which is expected to answer customer questions, the Bank also plans to create a shared "big brain" to provide customers with personal services. The Chartered

Financial Analyst Institute, on the other hand, was reported to expand its scope to cover topics on AI, robot consultants and big data analysis methods in its 2019 membership qualification examination, so as to meet future market needs.

AI revolution

AI has a broad meaning. From a technical perspective, it includes: deep learning (learning from a large pool of data to assimilate human intelligence, such as AlphaGo in the chess world), robotics (responsible for pre-determined extremely cautious or dangerous tasks, e.g. surgery, dismantling bombs, surveying damaged nuclear power plants, etc.), digital personal assistants (such as Apple's Siri, Facebook's M), querying methods (finding information from a huge database speedily and accurately, e.g. IBM's Watson takes only 10 minutes to identify a rare leukaemia from 20 million medical papers; the AI-DR from the Mainland was said to

diagnose lung cancer cells in 0.1 seconds through X-ray films), and the above mentioned natural language processing, context-aware processing (e.g. when we move the mobile phone from vertical to horizontal view, the view of the screen will automatically rotate).

However, how does AI progress? In "The AI Revolution: The Road to Superintelligence", the author points out that there are three stages of development in AI:

Basic — Artificial Narrow Intelligence or Weak AI, i.e. AI specializes in a certain scope, AlphaGo can beat the world's most invincible hand in chess, but I am afraid it's unable to guide you to the nearby restaurants or to book a hotel room for you. The same logic applies to bomb disposal robot and the AI which identifies cancer cells within seconds.

Turing Test

Advanced — Artificial General Intelligence or Strong AI,

"If we can create an environment for talents to pursue their career here, we can bring out the potential of Hong Kong and AI."

i.e. the computer thinks and operates like a human being. How does a human think? I have just read a column from a gourmet connoisseur. "There are many factors affecting us in choosing a catering place, like our mood, type and taste of food, price, time, etc. The determining factors are not the same every time." See, it is really complicated and beyond the usual logical deduction by computer. Alan Turing, a British scientist who was born over 100 years ago, said: "If a computer makes you believe that 'it' is human, it is artificial intelligence."

Super Advanced — Artificial Superintelligence. Nick Bostrom, a philosopher at Oxford University, has been thinking about AI's relationship with mankind for years, he defines superintelligence as "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills."

Potential to be realized

Although we are still in the stage of Artificial Narrow Intelligence, AI application is already very extensive. By combining with big data technology, it is applied in various areas like finance (wealth management, fraud detection), medicine (diagnosis, drug development), media and advertising (face recognition advertising, tailor-made services), retail (Amazon.com), law (speedily finding information), education (virtual teachers), manufacturing, transportation, agriculture and so on.

MarketsandMarkets, a research company, estimated that AI's market value would reach US$16 billion (about HK$124 billion) by 2022, with an average compound annual growth rate of more than 60%.

However, relative to the Mainland, this estimate is very conservative — according to Jiang Guangzhi, a key member of the Beijing Municipal Commission of Economy and Information

Technology, counting Beijing alone, AI and related industries have now exceeded RMB 150 billion (about HK$170 billion).

Hong Kong can play a part

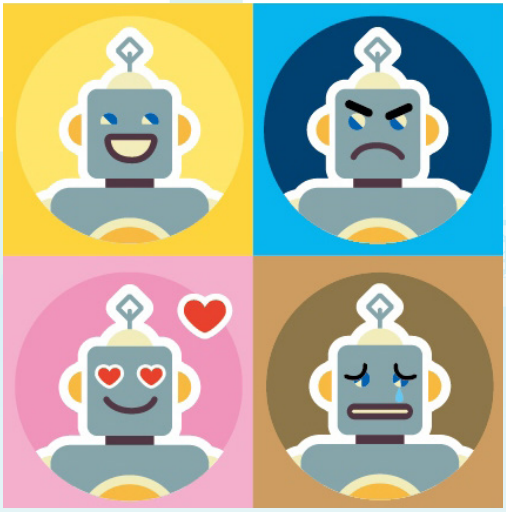
In any case, AI definitely holds a key position in the field of science and technology, it has substantial potential. However, I have just read a report: an international top AI expert and professor in HKUST said that the government and private sector were too passive in scientific research in Hong Kong, resulting in a brain drain. He has helped Huawei, a Chinese telecom and technology giant, to set up a laboratory in Hong Kong, but they found it difficult to recruit even 50 talents here.

This is really alarming. Hong Kong has world-class teachers to attract the elite to study here. However, if we do not strive to create an environment for talents to pursue their career here, I am afraid we will just repeatedly experience talent drain. Recently, the

Financial Development Board has published two research reports to promote the development and application of financial technology in Hong Kong. I hope that the Government and society could work together and speed up realizing the potential of AI in Hong Kong.

*An electronic copy was originally posted on *ITU Blog* titled "AI could advance living standards, education in particular" on 30 August 2017.

Emotionally intelligent robot



When we talk about artificial intelligence (AI), we always associate machines with no emotion even though they are clever enough to beat the world's chess champion. What if the super IQ machine comes with high EQ?

Affective computing for medical care

"Affective computing" or emotional AI is one of the most popular areas of AI in recent years, such as Affectiva from Massachusetts Institute of Technology in the United States. It has recorded more than five million faces and videos from 75 countries to "teach" the computers the expression, tone, speed of speech, other vocal qualities and body movements in expressing happiness, sadness,

> *Emotional AI can work in a wide range of areas, such as defence, education, entertainment, retail, finance, insurance, etc., with the greatest demand for medical care.*

anger or nervousness and other different emotions. People of different race, sex and age express their emotions in different ways. For example, the Japanese are more introverted, most Americans are more extroverted; thus, the researchers should be cautious to avoid mis-interpretation.

And do not forget your footprints left on social networking sites, AI may understand you more than you yourself based on your interactions with friends, reaction to things, as well as your social background, AI knows your preferences and orientation well.

These emotional AI can work in a wide range of areas, such as defence, education, entertainment, retail, finance, insurance, etc. However, it is expected that the greatest demand will be for medical care. By capturing the small changes of facial expressions, it helps medical personnel to understand children with autism or dyslexia, or to identify psychological abnormalities.

Machine can bluff

In addition to understanding people's facial expressions, AI can bluff, it can be used in negotiations.

In early 2017, AI beat four of the best professional poker player competitors. The victory was considerable and resounding as the AI led the pros by a collective US$1,766,250 in chips. Libratus, the AI, was developed by Carnegie Mellon University. Poker is an "imperfect information game" in that it is enormously complicated to figure out the ideal strategy given the various possible approaches your opponent may be taking. As such, bluffing is very important. This AI applies to a broad set of skills other than playing poker. These range from business strategy, negotiation, cybersecurity, military uses and auctions, to medical treatment planning.

Best friend or salesman?

At the same time, you may notice that Amazon announced in June 2017 it would enter the fashion industry, and launch products using their own brand. As a member of Prime Wardrobe, one can try before purchase. If you are interested in any fashion item at its member web site, it can be delivered to you free of charge for a trial of seven days. You can return the products also free of charge if you do not like it after trying it on physically. The offer is really attractive.

This service works with Echo Look, Amazon's home assistant, which can take hands-free, floor-length photos when you try on the new clothes and then send them to be appraised. The machine learning behind Echo Look follows the tastes of "trendy people", it then analyses and comments on your choice of outfit accordingly. In the future, it can even give you dress recommendations based on your mood that day, wardrobe clothing, marital status, weather,

and other technology products you are using. You may take it as a friend's recommendation or similar to that from a salesman.

As AI develops progressively, we need to intensify our efforts in creativity, which is unique to humans, in order to stay ahead. Otherwise, we will be replaced by the machine very soon. Therefore, I am delighted with the Chief Executive's latest *Policy Address* released on 11th October 2017 which introduces a series of measures to boost the development of innovation and technology through training, retaining and attracting talent as well as encouraging R&D. By doing so, we not only can inject economic and social impetus to society, but also unlock the potential of our young people.

*An electronic copy was originally posted on *Ejingisht* titled "The emotionally intelligent robot" on 26 October 2017.

Economic growth should emphasize people's well-being

At the end of September 2017, two events held in mainland China and South Korea that I participated in have enriched my knowledge and inspired me on Hong Kong's smart city development.

New financing platform

Held in Shenyang, the third China Smart City International Expo is the largest exposition in the Mainland on smart cities. A team of over 30 delegates from the Smart City Consortium (SCC) witnessed the opening ceremony of the Hong Kong Pavilion, more importantly; we attended the LinkedSmart - China - Hong Kong Business Matching Platform Signing Ceremony. The platform helps our startups to access international funding and contributes to smart city financing diversification.

I then went to Busan, South Korea, to participate in the Telecom World 2017 organized by the International Telecommunication Union (ITU). With a history of 152 years, one of the main tasks of ITU is to establish the global communications standards, including for broadband and wireless networks. The Telecom World 2017 gathered more than 5,200 industry experts from 131 countries, to exchange their experience on opportunities and challenges in creating a smart city. They also showcased the latest technological developments, such as 5G, autonomous vehicles, quantum cryptography networks and so on.

Smart city pilot program

Busan and Hong Kong are both harbour cities and Asia's tourism hot spots. Currently, Busan is actively developing as a smart city and its export of experience to other countries is forming another economic force. It is worth our reference.

According to ITU's assessment, Korea ranked first in the world's information technology infrastructure. Yunil Kim, Director General, New Growth Engine Industry Bureau of Busan Metropolitan City, mentioned the Busan U-City Project implemented from 2006 to 2014. The project aimed to integrate information technology into daily life, such as real-time bus information, Internet / mobile traffic information, tele-radiology, sensor network remote monitoring of law and order, etc.

Multi-function lamp pole

From the beginning of 2015, Busan set up four sites for testing smart city technology, namely, the financial technology valley, the information technology belt (with cloud-led smart factories), the marine information technology belt and the smart city test bed.

Haeundae, located in the south eastern part of Busan, runs a pilot scheme as a smart city. With smart devices like smart street

> *"To launch various smart city projects not only can enhance Hong Kong's quality of life and help retain talents, but also unlock the potential of our young minds."*

lights installed with lighting, dimming, sound and vibration sensors, the city can adjust the illumination, monitor air and noise pollution as well as traffic flow. The lamp pole can also detect accidents, and act as a WiFi hotspot. Haeundae's smart parking service uses sensors and camcorders to advise drivers on the availability of parking lots at different locations on a real-time basis, together with the distance of a trip, parking fee, and navigation service all via a mobile application.

To export experience of smart city service

In addition to establishing and operating smart services in the city, the pilot scheme also helped SMEs to commercialise the smart city services, promote the business of smart city startups, and establish a network to encourage co-operation from all sectors.

At the same time, Busan exported its smart city experience to other countries, such as exporting the use of big data in smart

transportation to Singapore, smart city models for countries in the Middle East and South America, a promotion platform and service interconnection experience to Spain, etc.

In 2016, the Organization for Economic Co-operation and Development redefined the term "growth" stating it should emphasise people's well-being. Although Busan's smart city blueprint requires a lot of technological hardware, its core value, to bring happiness to people, is the prime objective of improving the economy and creating employment.

Therefore, I am glad that our latest *Policy Address* released on 11th October includes a series of measures to boost the development of innovation and technology, and to launch various smart city projects in Hong Kong. By doing so, we not only can enhance our quality of life and help retain talents, but also inject economic and social impetus to society, and most importantly, unlock the potential of our young minds.

*An electronic copy was originally posted on *ComputerWorld* titled "Economic growth should emphasize on people's well-being" on 31 October 2017.

Encouraging talents to converge on Hong Kong

At present, Hong Kong's GDP is only about 2% of China's, a big difference when comparing with 20% in the 1980s and 1990s. The Mainland, our neighbour, has been progressing aggressively in recent years. How can we regain the entrepreneurial spirit and leadership of the old days? How can our young people have more upward mobility?

Hong Kong falling behind

With rapid economic development, Guangzhou's GDP has exceeded Hong Kong's over the last few years. The mayor of Guangzhou pointed out that their approach for economic growth was to undertake large scale projects promoting innovative technology. Hong Kong is a developed economy and has not had similar large scale infrastructure projects for a long time. Therefore, I have high expectations for the Lok Ma Chau Loop which has been shelved for 20 years, until recently when it was finally activated by the Government.


Greater Bay Area
Includes 9 cities & 2 regions
Zhaoqing
Guangzhou
Huizhou
Foshan
Dongguan
Shenzhen
Zhongshan
Hong Kong
Jiangmen
Zhuhai
Macau

But how can the Hong Kong-Shenzhen Innovation and Technology Park be realised in the area of 87 hectares (equivalent to 4.5 Victoria Park) and to revitalise the economy of Hong Kong? How can it attract global talents?

I have visited Japan and Malaysia; their development might be able to give us some inspiration.

Japanese experience: collaboration

Kashiwa-no-ha is one of the satellite cities around Tokyo, Japan, with a population of 400,000. Originally, it was a golf course and U.S. military land. In 2000, the government began to design and rebuild its area of 273 hectares (equivalent to 78 Taikoo Shing). Through the collaboration of the government, business, the general public and academia — with the Chiba-ken and Kashiwa Government, the University of Tokyo, Chiba University, the general public and Mitsui, the area was constructed as a people-oriented smart city.

For example, in the innovation industry, Kashiwa-no-ha has the largest co-working space in the country, called Kashiwa-no-ha Open Innovation Lab or KOIL, which is dedicated to the incubation of startups. Together with entrepreneurial expertise support, international competition targeting Asian talents; substantial scientific researches from two universities, there is all-round support to entrepreneurs.

I am particularly excited about a plant factory which is heading towards commercialisation. The factory is developed by Chiba University which uses sunlight and artificial cultivation to produce low-cost, high-yield crops. I am also impressed by the high-tech facilities such as a 3D printer in KOIL which encloses the space with a rough, unfinished, cement ceiling symbolising the startups there being under development.

"Hong Kong has advantages in the legal and the financial system, we could attract talent from abroad to regain a leading position as an innovation centre."

Malaysian experience: diversification

As for Malaysia, it has been relatively slow in economic development. But in recent years, the country has caught up to full speed and is keen to develop a smart city. The Iskandar Malaysia is adjacent to Singapore, like the Pearl River Delta being close to Hong Kong. Iskandar Malaysia has an area of 220,000 hectares, double the size of Hong Kong.

It has been developed into a special economic zone since 2006, with a highway, ports and an international airport. There are five flagship development zones. The major interested industries are low carbon green real estate, tourism (Asia's first LEGOLAND), financial and innovative technology (as Singapore's back-up). The government indicated that the district has successfully created 800,000 jobs and attracted more than MYR70 billion (about HK$ 122.5 billion) of foreign investments.

Hong Kong's own advantages

Whether it is Japan's rebuilding of an old area or Malaysia's development of a new economic zone, they all exhibited their strengths. What is the strength of Hong Kong? Mrs. Fanny Law Fan Chiu-fan, Chairperson of the Hong Kong Science and Technology Parks Corporation, pointed out that Hong Kong has started late in the development of innovation and technology, we are "competing as a non-favourite".

However, with Hong Kong's advantages in the legal and the financial system, we could attract talent from abroad. The Government should invest more both in terms of human and financial resources in developing the Lok Ma Chau Loop area. Tax benefits, for example, can be one of the measures to attract talents. As such, we could regain a leading position as an innovation centre. This is the way to activate Hong Kong's economy.

*An electronic copy was originally posted on *Harbour Times* titled "Lok Ma Chau Loop converges talents to revitalise Hong Kong's economy" on 26 April 2017.

Don't miss out on the Islamic FinTech opportunities

In May 2017, the Bank of England just finished its public consultation on a Shari'ah compliant liquidity tool for use by Islamic banks, and the deposit facility is expected to be ready by next spring. Meanwhile, in April 2017, the Financial Conduct Authority approved the first Islamic financial technology (FinTech) startup, so that it can invest in the real estate market for retail clients.

The potential of Islamic financial markets is just too enormous to be ignored. According to the Pew Research Centre, it is estimated that due to their high population growth, the number of Muslims will grow from 1.8 billion in 2010, nearly 25% of the global population, to 3 billion in 2060, accounting for 31% of the global population.

Gigantic demand for financial services

Therefore, it is anticipated that there will be a gigantic demand for financial services. However, Islamic financial services development is relatively slow today, especially in FinTech. According to Accenture, a consultancy firm, global investment in FinTech amounted to over US$50 billion (about HK$390 billion) since 2010, only 1% of which was spent in the Middle East and North Africa, the Muslim dominated areas.

This is because Islamic financial services have to comply with Shari'ah law, which opposes speculation, gambling and usury, and advocates hard work; interests are considered usury which is prohibited. In short, it is very different from the financial services we are familiar with.

In recent years, Islamic countries have focused on how to develop financial services without violating their doctrine. Wamda, an entrepreneurial promotion platform for the Middle East and North

> *"To grasp the emerging Islamic FinTech opportunities, we can consider development of Islamic cross-border trade and financing, and help Islamic countries to develop smart city infrastructure."*

African regions, pointed out that the FinTech startups in the Middle East numbered less than 20 in 2010, however, by 2015 it had increased to 105. It is expected this number will further increase to 250 by 2020.

Race to become Islamic FinTech hub

One of the prevailing businesses is cross-border remittance and payment services. According to the World Bank, the number of migrant workers in the Middle East amounted to 80% of its population, the highest proportion of migrant workers in the world, which provides much business opportunity for remittance. Many developing countries rely on nationals to work in foreign countries and remit money to support the home country economy. The World Bank estimated that the amount of remittance is huge, the global amount of remittance in 2014 amounted to US$583 billion (about HK$4,535 billion).

In addition to the remittance, other FinTech services are also under development. For example, Dubai has signed a cooperation agreement with the Singapore Monetary Authority to jointly develop a mobile payment and blockchain project in March 2017. At the same time, it introduced its first ever FinTech Sandbox in the area, allowing new products to be tested for a period of two years. Meanwhile, Cairo launched two startup projects in 2016.

According to the report from EY in 2016, the 40 largest Islamic banks have approved a budget ranging from US$15 million to US$50 million (about HK$100 to 300 million) for expansion of digital business in the next three years.

Potential of Islamic population

What is its development in Hong Kong? The Hong Kong Monetary Authority offered its third U.S. dollar Sukuk earlier 2017. Since 2013, offering and trading of Sukuk in Hong Kong enjoyed

a 100% exemption in profits tax and stamp duty to boost its sale.

To grasp the emerging Islamic digital finance opportunities, in addition to the issuance of Sukuk, we can also consider using Hong Kong's advantages in the development of Islamic cross-border trade and financing, and help Islamic countries to develop smart city infrastructure under the Belt Road initiative.

According to *Hong Kong Yearbook,* the Islamic population of Hong Kong is about 300,000. Apart from the 150,000 Indonesian domestic helpers, there are 40,000 Chinese and a lot of native Indian sub-continental people, such as Pakistanis and Indians, etc., who were born in Hong Kong. The Government may consider encouraging them to participate in the local Islamic finance industry. What's more, we can strengthen the public awareness of Islamic finance by promoting the service, and training more talent to provide support in the field.

The *2016 Top Markets Report: Financial Technology* released by the U.S. International Trade Administration has ranked Hong Kong as just being behind London and New York in Global Financial Centres based on criteria including business environment, infrastructure, human capital and reputation. We should not miss out on the huge opportunities of Islamic digital finance in the long run so that we can maintain our position as a global financial hub.

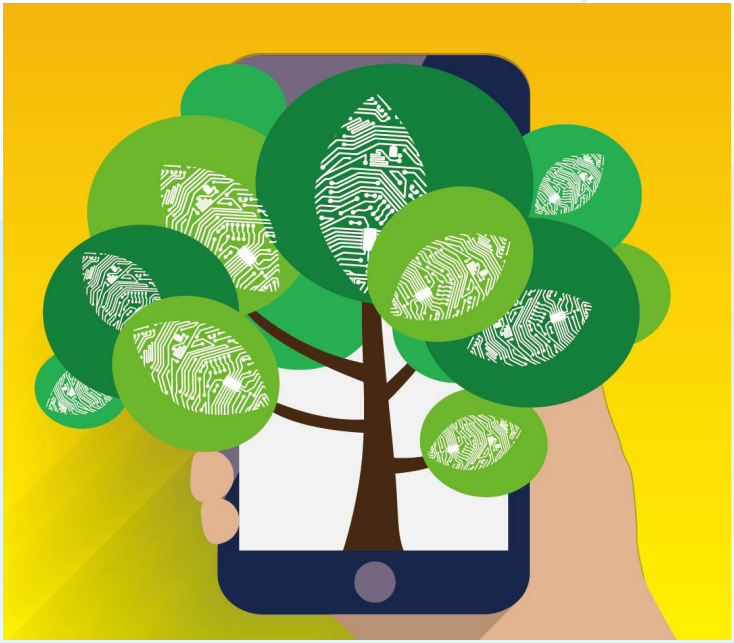
*A hard copy was originally published in *China Daily* titled "Don't miss opportunities Islamic fintech gives HK" on 31 July 2017.

Smart City 3.0

Chapter Three: Smart Environment

**Tree conservation, waste management,
the exhaustion of natural resources and green city planning
are major factors affecting the sustainable
development of the earth.
How should we balance urban development and
ecology conservation?
What is the role of information technology in these aspects?**

Training and regulation are crucial to tree management



Trees can be our shelter for cooling — a lot of research shows that in the proximity of densely built urban areas, the cooling effect of greenery is prominent with temperature being reduced by two to three degrees. However, according to a previous research from the Chinese University of Hong Kong, even though country parks occupy 40% of Hong Kong's total area, our green area per capita within the urbanised area is only two square meters, far less than Singapore's ten square meters and Tokyo's seven square meters.

Furthermore, most of the trees in the urban areas of Hong

Kong have grown in areas with shallow soil cover, making it difficult for them to have deeply rooted foundations. Therefore, fallen trees can be found everywhere after typhoons. In 2016, the Ombudsman published a survey report on the government's tree management; it made a lot of pertinent comments, in which the most important ones were regulation and skill training.

Overseas training systems

The report raised the point that there is no specific requirement to be a tree worker. These front-line inspectors are responsible for identifying problematic trees, assessing the risk of collapse and daily care of the trees. However, the government only provides them with some basic training lasting for two days. No wonder the local tree management has been criticised for being deficient from time to time.

Singapore and Japan have established tree management talent

training systems. Singapore set up a training organisation in 2007 to provide horticultural and arboriculture training for landscape workers. At the same time, each scope of work in the horticultural industry has developed their industry standards and set the skill promotion ladder for each skill level. In early 2000, Japan established local standards and qualifications systems for tree workers and arboriculturists, in accordance with the international arboriculture standards, and provided different levels of training.

Need for legislation

The Ombudsman also mentioned the need for legislation on tree management, including establishing the standards for planting, trimming and removing trees.

Singapore passed the *Parks and Trees Act* in 1975 and the Tokyo Government established the *Green Tokyo Plan* in 2006; these lay the legal foundation of tree management strategies and clearly

"I hope the Government can follow the successful experience of our neighbouring countries, to actively and systematically nurture talents with the help of information technology to create a green smart city for us."

define the responsibilities of different parties, so as to ensure the trees on government and private lands are properly managed.

GIS facilitates tree management

New technology is also applied for the purpose. Examples include Singapore's mobile application using a geographic information system (GIS) launched two years ago to facilitate front-line staff to extract information and real-time updates during inspections; 3D and mathematical models used to estimate the impact on trees under strong wind, and assess which branches need to be trimmed to minimise possible damage.

In recent years, the Mainland has also begun using new technology for tree management, especially for ancient trees. In 2017, the Department of Forestry for Zhejiang Province introduced an information management system with each old and famous tree being assigned an electronic account. When you click on a town,

the old and famous trees in that region will be shown on the map, then, you can view each tree's location (latitude and longitude), tree species, age, planting soil type, growth status, tree's photo, and the responsible unit. The workers and staff of agriculture and forestry departments in the city, county, town and village, can locate the conserved trees on a digital map to facilitate the protection and management of them.

TAP engages young people

At the same time, a local community project called the Tree Adoption Program (TAP) was recently launched by the Conservation E3 Foundation. Through an online platform, the project promotes knowledge on trees among young people.

In early 2017, the Development Bureau set up an Urban Forestry Advisory Panel to promote a comprehensive greening of the city. I hope the Government can strike a balance between

urban development needs, environmental protection and quality of living and can follow the successful experience of our neighbouring countries; to actively and systematically nurture talents with the help of information technology, thereby, creating a green smart city for all of us.

*An electronic copy was originally posted on *Ejinsight* titled "Training and regulations crucial to tree management" on 11 October 2017.

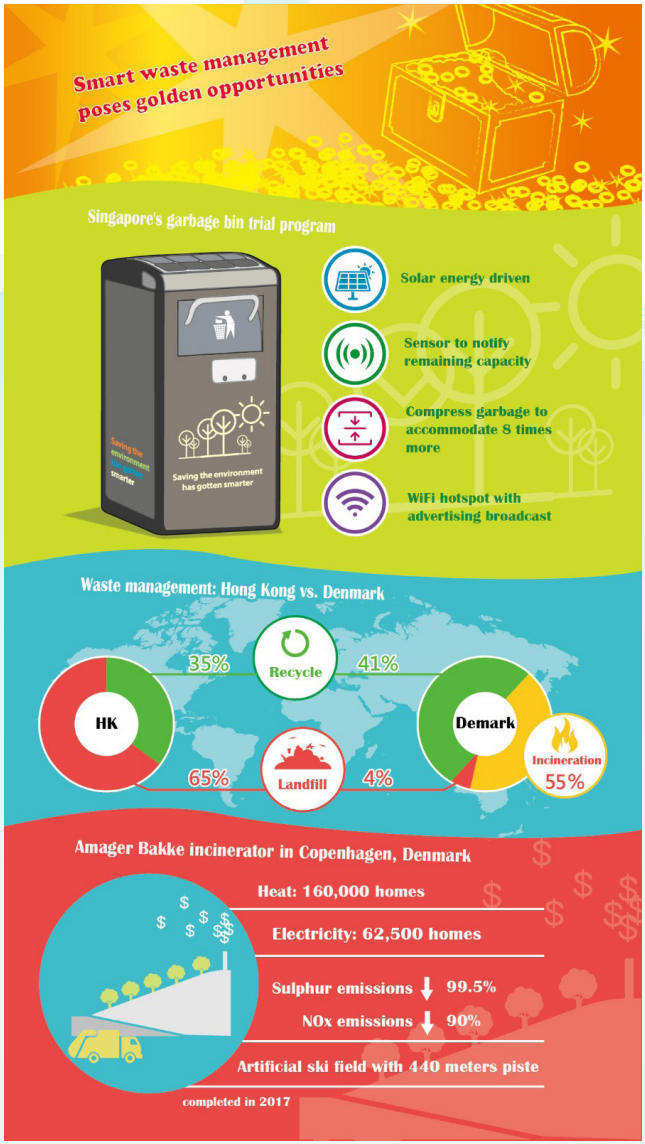
Golden business opportunity behind garbage

Many countries are aware of the urgency of the garbage problem and are coming up with numerous solutions.

Singapore's smart service trial

Singapore, for example, had a three-month garbage bin trial program. On the busy Orchard Road, the government placed a smart garbage bin which is driven by solar energy. Inside the garbage bin, there is a sensor to notify the street cleaners when the garbage bin is almost full. It also compacts the garbage so that the bin can accommodate eight times more garbage than previously. This can reduce the expense of keeping the street clean.

At the same time, it is also a WiFi hotspot which covers a radius of 30 meters. To offset part of the cost, the WiFi will broadcast advertisements every 15 minutes. However, the 125-liter, U.S. made smart product, with a basic installation, costs S$3,000 (more than HK$16,000), 20 times the cost of the current Hong Kong garbage bins in use.


Smart waste management poses golden opportunities
Singapore's garbage bin trial program
Saving the environment has gotten smarter
Solar energy driven
Sensor to notify remaining capacity
Compress garbage to accommodate 8 times more
WiFi hotspot with advertising broadcast
Waste management: Hong Kong vs. Denmark
HK
35%
Recycle
41%
Demark
65%
Landfill
4%
Incineration
55%
Amager Bakke incinerator in Copenhagen, Denmark
Heat: 160,000 homes
Electricity: 62,500 homes
Sulphur emissions ↓ 99.5%
NOx emissions ↓ 90%
Artificial ski field with 440 meters piste
completed in 2017

> *Danish example showcases a combination of ingenious technology and innovative architecture in waste management.*

Colombia, in South America, is also testing a solar smart garbage bin made by South Korea. The current issue remains how to reduce the cost of smart garbage bins.

No time to waste

Most Hong Kong people see waste management as a headache, while in the eyes of some architects and innovators, it poses great opportunities. Take incinerating waste as an example, it has been hampered by the availability of sites for locating incinerator and past proposals of sites have met great resistance from local communities. The further development of existing landfills also met great resentment from the neighbourhood. Therefore it is essential that the government has a long-term plan on land use, so as to locate these away from urban areas and yet keep the cost of transporting the waste within an acceptable level.

If landfills and waste disposal methods utilise the latest technology and are properly managed, then they can be accepted close to urban areas. As such, we can have more area for amenity use.

For inspiration, we may look to a Danish example which showcases a combination of ingenious technology and innovative architecture in waste management.

Copenhagen's amazing incinerator

In Denmark, only 4% of the waste will be dumped in landfills. More than half of the waste is incinerated, while the remaining amount will be recycled. The Amager Bakke incinerator in Copenhagen, open in March 2017, is also an artificial ski field. The 440 meters piste, with four different types of slope for skiing, has made the incinerator an architectural landmark as well as a leisure facility.

At the same time, it will produce heat for 160,000 households and electricity for 62,500 residences; it generates one fourth more electricity than the old incinerators. The plant utilizes 100% of the fuel (waste) energy content with an electrical efficiency rate of 28%, it reduces sulphur emissions by 99.5%, and minimizes NOx emissions to a tenth, compared to the former plant. The NOx-reduction is enabled due to a flue gas cleaning technology. With these, the plant can be located just five kilometres from the Copenhagen Town Hall Square!

Hong Kong is troubled by the waste disposal problem and the landfills are about to overflow. I sincerely hope that the local innovators and technology workers, especially young people, will spend more time and effort to tackle such a global issue in pursuit of a brighter future for society and for themselves!

*An electronic copy was originally posted on *Harbour Times* titled "A golden business opportunity behind garbage" on 20 November 2017.

Enhancing energy efficiency through old building renovation

Currently, Hong Kong has about 9,900 private buildings which are at least three storeys high and aged over 40 years or above, according to the Government's information. They are mainly concentrated in the old districts. In Yau Tsim Mong, Kowloon, there are 1,860 old buildings. More than 1,000 old buildings were also found in several other districts respectively, including Kowloon City, Central & Western District, Sham Shui Po and Wan Chai. According to an estimate by the Buildings Department, this kind of old buildings will increase by about 600 per year over the next ten years, posing a potential safety problem for the city.

Over 100 very hot days a year

At present, these over 40-year-old buildings account for more than 3% of the total private housing, whereas those over 20 years constitute more than 70%. These pose major safety concerns and their energy efficiency is also in doubt.

In 2016, the number of very hot days in Hong Kong was a record high, 38 days. Unless there are effective mitigation measures, the average number of very hot days in Hong Kong at the end of this century would be more than 100 days per year. The renovation and conversion of old buildings, call for not only a comprehensive review of the building's structure, but also an upgrade of its facilities to achieve energy efficiency.

There are many successful cases in foreign countries, such as in Paris, France, where the façade of buildings are decorated with greenery. What about here in Hong Kong? We have read about the

> *"The renovation and conversion of old buildings, call for not only a comprehensive review of the building's structure, but also an upgrade of its facilities to achieve energy efficiency."*

renovation of old buildings from time to time, but most of these only emphasize the appearance; seldom did they address the energy-saving aspect.

Energy-saving ideas

In fact, there are lots of services and products available to address the energy-saving needs of old buildings. At the Sustainable Built Environment Conference held recently, one of the teams comprising students from the Chinese University of Hong Kong and the Hong Kong University of Science and Technology participated in a competition to provide innovative services and design.

As a result, the team won The Best "Living" Building Award. The winning project called C3 Farming proposed planting at heights within the urban buildings to address three problems Hong Kong is currently facing, namely: climate change, food safety and an ageing population.

The team believes that the local temperature and rainfall are good enough to provide a suitable environment for plantation. They advocated vertical planting on the higher floors, which allow more sunshine, while consumer activities would be on the lower floors including supermarkets and restaurants which could directly consume the agricultural products produced above them. This combination would save transportation costs and reduce carbon emissions.

Time to review

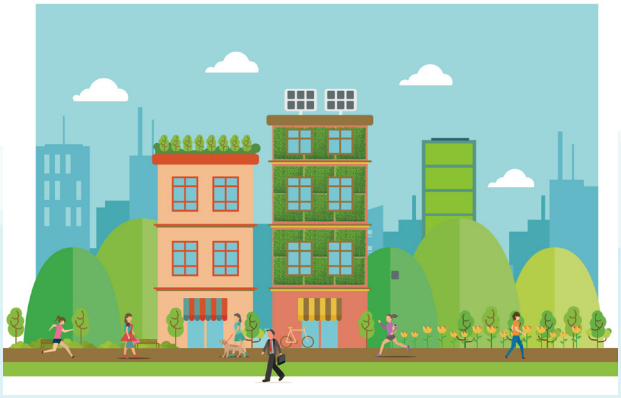
At the same time, SmartAirCon was named the Champion of the IoT Development for Smart Cities from the Hong Kong Institution of Engineers in 2016. SmartAirCon enables controlling the operation of air-conditioners and electric fans through a smart phone, and can save up to 10% of energy.

Fuel for temperature control, mainly air conditioning, accounts

for 60% of the total greenhouse gas emissions in Hong Kong. Promoting green buildings and enhancing building energy efficiency could reduce greenhouse gas emissions. In conclusion, it is time for us to review the issue of old building renovation.

*An electronic copy was originally posted on *Ejinsight* titled "Renovation of old buildings to enhance energy efficiency" on 31 July 2017.

Brainstorming our green future



Recently, I walked through the HSBC head office in Central, the spacious ground floor is highly ventilated and I could feel the cool breeze even in the summer. Every year, tens of thousands of new commercial and residential buildings are completed; how to reduce the heat island effect is a concern.

One third projects not reaching basic requirements

At present, the Government adopts the Building Environmental Assessment Method Plus (BEAM Plus). The international building standard rates buildings based on various criteria including site selection, design; use of materials, energy and water; indoor and outdoor environment and innovation, etc. Government buildings are required to achieve at least a "Gold" rating. To encourage private developers to put effort into environmental protection, a new

building registering for BEAM Plus is a prerequisite when applying for a relaxation of plot ratios.

From 2009 to October 2017, there are 1,019 new buildings registered for BEAM Plus certification, among which most are residential projects (40%), followed by commercial projects (19%). It is gratifying that within the evaluated projects, 41% are rated "Platinum" or "Gold", the highest levels (including "provisional" and "final" rating). However, "Unclassified" meaning not reaching the requirements was given to a total of 34% projects submitted, and these apparently need improvement.

Singapore's success story

Singapore's achievement in promoting green buildings is worth our reference. In 2005, its government launched a green building rating system, called Green Mark, focusing on evaluating energy saving, water conservation, environmental protection and indoor air quality, etc.

Its implementation started from an initial voluntary approach to a compulsory requirement eventually: during the introductory stage, the rating was voluntary and the government encouraged industries to apply for it. By 2008, all newly completed buildings were required to obtain the certification. To assist the applicants in complying, the Singapore Building and Construction Authority implemented the Green Mark Incentive Scheme - a cash allowance of S$20 million (over HK$100 million) for new buildings at the end of 2006. As for the renovation of old buildings, the government provided up to 50%, or a maximum of S$3 million (approximately HK$16.89 million) cash allowance in 2009.

Number of green building soared

As a result, Singapore's achievement in green buildings is reflected in the big jump from 17 buildings reaching the set standard in 2005 to over 3,000 buildings as of June 2017. At the same time,

> *"The bottom up thinking on how to determine the development of a city and community, as well as brainstorming to improve the quality of living, are really the core values of a smart city."*

the government also set a target for 80% of buildings to obtain the Green Mark by 2030.

Therefore, in the *Policy Address* released in early 2017, I am glad that our Government mentioned that it would review the existing arrangements for promoting green buildings. These include "tightening the prerequisites by requiring a development project to attain specific standards of performance in environmental protection, or even adopt performance-based and site-specific approaches to determine the maximum gross floor area concession." I hope that the relevant authority will follow the example of Singapore in speeding up the promotion of green buildings.

Bottom-up participation

The renovation of old buildings or the construction of new buildings will affect the quality of our living environment. I read a news article earlier: Sweden has mapped the country's mountains,

rivers and railways in their famous computer game Minecraft. Recently, Gothenburg, the second largest city has made the game available for free in order to stimulate young people's, as well as children's, interest in urban planning. This bottom up thinking on how to determine the development of a city and community, as well as brainstorming to improve the quality of living, are really the core values of a smart city!

*An electronic copy was originally posted on *Harbour Times* titled "Brainstorming our green future" on 6 November 2017.

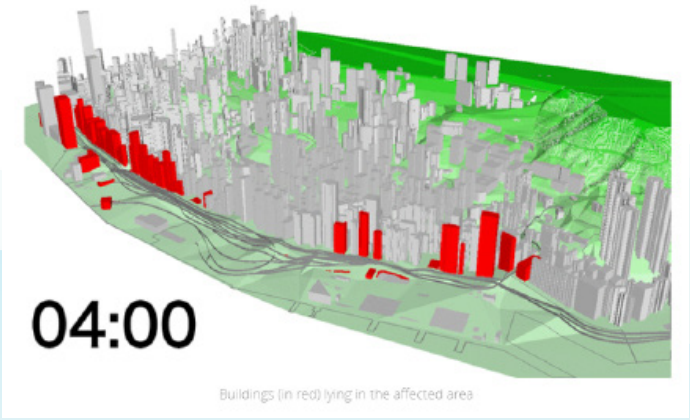
Esri Young Scholars Award: Detecting noise pollution in old districts

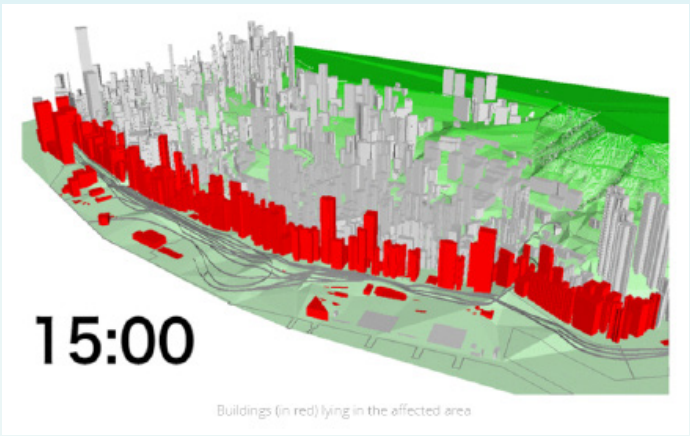
To build a people-oriented liveable city, urban planning is one of the key areas while geographic information system (GIS) application is an indispensable aspect. GIS links data and geographic distributions to allow people to grasp a given overall situation and thus help them to find suitable solutions.

Esri, a U.S. GIS software company, organizes an Esri Young Scholars Award to encourage students around the world to use GIS to study and think about different challenges facing a city. These challenges include: education, conservation, disaster relief, urban planning, business, engineering and so on.

Overseas award winning projects

The competition was first organized in 2012 with students from Canada, Germany, Spain, the Netherlands, Norway, Russia, Ghana, South Korea, China, Japan and Kuwait participating.





According to Kenneth's preliminary estimate, nearly half of the residents or 50,000 people in the West District in Hong Kong are affected by noise pollution during the peak traffic hours. The pictures show blackspots of noise pollution (in red) at different time (4am and 3pm) of a day.

Photo credit: Esri China (Hong Kong)

For example, Shun Kawakubo, a graduate student from Keio University, Japan, assessed the sustainability of municipalities in Japan, from the perspective of the environment, society and the economy; hoping that government planning will put more emphasis on building a sustainable future. While Paulina Ansaa Asante from the University of Ghana performed a site suitability analysis for a central wastewater treatment plant in the Accra Metropolitan Area. She analysed numerous variables, such as elevation, distance to surface water bodies, land cover, distance from major roads, airport facilities, and existing populated communities; then she put forward a feasible and optimal solution.

In 2016, a Finnish winner, Aapeli Leminen, worked on the lost time and costs incurred by a patient with type 2 diabetes. The World Health Organization estimated that by 2030, diabetes will become the world's No. 7 killer. Leminen's study found that the transportation cost for patients' consultations accounted for

> *Starting with GIS education, to allow everyone to learn data analysis, as well as promoting problem solving abilities, and with more care for society, we can boost the bottom up development of our smart city.*

over 20% of the total medical expense. The older the patient, the higher the expense as a taxi instead of a bus may be needed. He hopes that the study will promote the development of a local self-service medical system to relieve the fatigue of both patients and caregivers while reducing related expenses.

Hong Kong's winning project

In 2017, Hong Kong launched the competition which attracted a lot of contestants. The themes of the projects submitted varied from leisure space analysis, to mineral exploration in Tanzania, Africa, traffic routes within a campus to reduce pollution, etc. The judges consisted of local distinguished scholars and industry gurus.

Among the contestants, Kenneth Wong, a student of Urban Planning and Design from The University of Hong Kong, was named the champion of Hong Kong for his use of the case of noise

pollution in the West District. Based on the 2015 vehicle traffic data of the Transport Department, he used GIS to calculate the traffic noise decibels on each road and superimposed the noise maps of all roads to compile a noise pollution map.

According to the Environmental Protection Department's standards, noise levels over 70 decibels per hour should not persist for more than 10% of an hour, i.e. six minutes. Kenneth's study shows that about 40%, i.e. 600 of the studied buildings are affected by noise pollution for over an hour each day and, furthermore, 68 buildings in the area, close to main roads, are subject to excessive noise pollution. According to his preliminary estimate, during the peak traffic hours, nearly half of the residents or 50,000 people in the West District are affected by noise pollution.

He further pointed out that the traffic noise pollution was not unique to the Western District, other poorly planned old districts such as Tai Kok Tsui and To Kwa Wan also had similar problems.

He suggested the relevant department to install noise cancelling barriers on the main roads, as well as subsidise the residents cost to install double-glazed windows, which would minimize the noise pollution impact.

Map in Learning promotes problem solving skills

The study is very practical. The proposal shows humanistic care; it aroused people's attention to the long-term problems of living with noise pollution. In fact, many proposals in the past show young people's concern with society.

Dr. Kenneth Tang, the tutor of the Hong Kong winner, is glad that the Esri Young Scholars Award promoted GIS through a benign competition in view of Hong Kong being slow in GIS education since the course is only available at university.

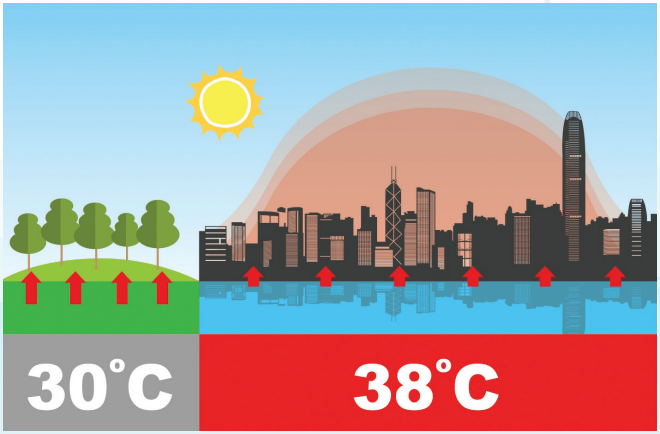
That is why Esri China (Hong Kong) launched Asia's first e-learning project, Map in Learning program in 2016, to enable our

primary and secondary students to have free access to ArcGIS Online, a corporate cloud GIS software previously only used by governments and businesses. It strengthens the analytical ability of students, helps them develop potential in multiple areas. So far there are over 140 secondary and primary schools which have participated in the program, while over 240 teachers have attended the training workshop.

Starting with education, to allow everyone to learn data analysis, as well as promoting problem solving abilities, and with more care for society, I believe that we can boost the development of our smart city, from the bottom up with participation from all of the sectors of society.

*An electronic copy was originally posted on *Ejinsight* titled "How to detect severe noise pollution in old districts" on 14 August 2017.

IT alleviates climate change



I am sure you still remember the frost in Tai Mo Shan that trapped many hikers in January 2016. We need to reduce carbon emissions to address climate change in the coming decades.

Climate change is a big topic, how can students contribute to it? What role can information technology (IT) play?

Free e-learning program for students

In June 2016, Esri, a U.S. software development company, launched Asia's first electronic learning project Map in Learning program in Hong Kong. The project allows primary and secondary schools free access to ArcGIS Online software. This geographic information system (GIS) helps the students to organize, compare and analyse different data, so as to develop diversified potential solutions.

Aiming to enhance life-long learning of primary and secondary students in coping with climate change, while integrating creative thinking with technology to contribute to reducing climate change in real life, the Education Bureau announced in October 2016 a strategic partnership with Esri China (Hong Kong) Limited and Hong Kong Education City. This partnership will organize an Inter-school Cross-curricular Project Competition on Climate Change 2016-17 with 17 organizations comprising government departments, local universities, major school councils as well as non-government organizations serving as support groups. The competition is a signature event of the Education Bureau for 2016/17.

IT can greatly facilitate students' understanding of climate change in two main aspects: first, it allows people to collect a lot of information in a flash. Second, it enables our understanding of these topics.

GIS facilitates understanding of issues

Although there are loads of information resulting from an Internet search of "climate change", we may not grasp the topic. It is also difficult to identify where to start. However, learning will be more interesting and vivid when we use interactive approaches and methods such as images, videos, games, and e-learning software.

There are many technologies which can be applied to learning, such as mobile applications, video games, and virtual reality (VR), augmented reality (AR), as well as GIS. The 2016 popular mobile game "Pokemon Go" is a good example, it uses a simplified version of a digital map. I believe many students have gained much knowledge about the names of local places or streets by playing the game.

To understand the impact of climate change, including various phenomena, causes and impact on human beings, you can use

"Through the use of digital maps and related GIS technology, students can enhance their conceptual thinking, allow them to connect with the real world, thus, moving a step toward coping with climate change."

ArcGIS Online, the latest digital map technology, which contains tools like cloud computing, big data, real time data and a Story Map.

The data can be presented on a computer or mobile phone through images, videos and maps; it is then easier for students to comprehend the changes and facilitate their investigative study. If students can further express their creativity, they could design a mobile game like Pokemon Go to drive people to walk around the territory to capture the "Big Waster". This will surely make learning more interesting, and also easier for students to remember the information.

Connect students to real world

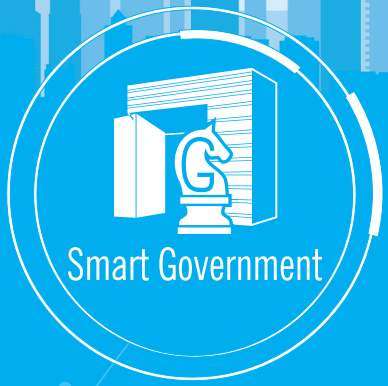
At the same time, students can begin to understand the topic of climate change in their everyday lives. For example, they can compare the environmental benefits of various modes of public

transport, understand the slope management work, inspect the air quality of urban areas, search the waste recycling facilities and explore the beautiful trees worthy of appreciation, etc. They can use digital maps in accomplishing all of them.

As the Chairman of Esri China (Hong Kong) Limited, I am very excited about the students' participation in the competition. I hope that through the use of digital maps and related GIS technology, students will be able to conduct thematic studies from micro and meso to macro levels. This could enhance their conceptual thinking, allow them to connect with the real world and broaden their horizons, thus, moving a step toward coping with climate change.

*An electronic copy was originally posted on *Friends of UNESCO HK e-Newsletter* titled "IT in fight against climate change" in January 2017.

Smart City 3.0



Chapter Four: Smart Government

**The government makes full use of information technology,
open data and increases governance transparency,
thus, facilitating communication between
the government and the public, which stimulates civic innovation.
Together the city will be better equipped
to deal with various problems.
There are many successful cases worthy of reference.**

Small data leading to big change

At the beginning of 2017, I returned to my alma mater — the University of Hong Kong, and once again set foot on a platform to teach how to build a smart city using information technology. In the last lecture of the master degree program at the end of April, the students had to choose a smart city for discussion and compare it with Hong Kong, to make recommendations for the development of our city.

I had invited five renowned guests to be the expert judges, including Prof. Tong Fuk-Kay, Chief Executive Officer, Hong Kong Applied Science and Technology Research Institute (ASTRI); Mr. Chan Siu Bun, Chief Land Surveyor, Lands Department; Mr. Sin Chun-kai, former Legislative Councillor (Information Technology);

Mr. Wong Tak Choi, Deputy Head of Energizing Kowloon East Office and Miss Joyce Tang, Project Manager of Energizing Kowloon East Office. In the three-hour lecture, the judges raised questions and provided feedback to the students; it was a very challenging experience.

City operation improvements driven by data

Different groups of students cited different smart city examples, such as Barcelona, Helsinki, London, as well as Singapore, and Songdo in South Korea. These cities have different advantages, but most of them have open data which is the biggest area lacking development in Hong Kong!

By "data", I'm referring to spatial data or geospatial data, information about the geographic location of features (such as cars, buildings or mountains), that can be mapped. It can be accessed, visualised, manipulated and analysed through the use of computer

software. We should pay attention to the content, format and real time availability of the data while using these public data.

Stephen Goldsmith, a professor of governance and director of the Innovations in Government Program at the Harvard Kennedy School, having served as an advisor for different governments on the use of data in smart cities, pointed out that many city governments were undergoing unprecedented major changes in using data to improve operations, while big changes were already under way in leading smart cities. "In terms of city governance, we are at one of the most consequential periods in the last century," he told *The Wall Street Journal* recently.

Forecasting the future

In mid-April 2017, the Smart City Consortium organized the Internet Economy Summit, one of the prominent speakers, Lilian Coral, Chief Data Officer of Los Angeles GeoHub, spoke on *How*

to gather and utilize open data. Therefore, I was surprised that my students missed out Los Angeles as an example of a smart city.

Ms Coral said that her major responsibility was to answer what was happening at the moment and to forecast what would be happening in the future, just like Amazon.com which can predict the next book that you will buy.

GeoHub, a website of the City of Los Angeles, contains various real-time geographic information from multiple government departments, such as traffic blackspots, temporary road closures, accidents, etc., so that government departments, public and private organizations, mobile app developers and the public can access the latest information. At the same time, the public is encouraged to build mobile apps to facilitate information updates.

API a must

For example, the Clean Streets Index set up by CleanStat

allows the public to rate (from 1-3) the cleanliness of each street in Los Angeles based on four factors: litter, weeds, bulky discarded items and illegal dumping. Different colours in the map show the cleanliness for public monitoring as well as the government's strategic resources deployment. As a result, the street cleanliness has been greatly improved - in Q4 2016, nearly 90% of the streets scored the highest marks of cleanliness, while streets which were rated as "not clean" and "somewhat clean" decreased by 80%. As for Street Wize, it allows users to track the on-going and upcoming road works, so as to avoid traffic congestion.

Lilian pointed out that through open data, they hoped to boost the creativity of Angelenos to relieve the problems bought by an economic downturn and climate change. The key was collaboration by different government departments and civil organizations. In short, interoperability is crucial.

To promote multi-party collaboration, it was important to

> *The government services should be 'digital by default', that is, releasing data and making them available for download as APIs. Specifications for recording data and guidelines are also needed for collecting and processing data so as to ensure data privacy.*

have multiple formats for data download. In other words, the application programming interface (API) should be all embracing, so that the data can be downloaded as in the format of KML, SHP or spreadsheet.

Another critical success factor was flexibility which was not always the strength of governments. She took an example of data flow design where the initial plan required each individual government department to input its data into the GeoHub, but later they found that it would be more effective to connect the system in different departments and have data directly extracted from the source. By doing so, it also facilitated the exchange of information among departments.

Public monitoring of government performance

Apart from encouraging the sharing of data among government departments, and examining public usage to understand the issues

of concern, decision-making and legislation were based on the data information.

In addition, Mayor's Dashboard was introduced showing updates of a collection of public concern items in Los Angeles, including unemployment rate, new jobs, average days for street pothole repair, public service hotline response time, crime rate, reserve fund balance, etc. Those areas with improvement are in green, otherwise they are in red, all information is open to the public. By opening data to everyone, the city's Mayor, Eric Garcetti hoped to "make city operations more efficient, stimulate partnerships between the city and the community, and give residents a greater controlling stake in government."

As a result, Los Angeles ranked the highest in open data application in the United States.

Digital by default

The Smart City Consortium in its earlier proposal for future development submitted to the government, proposed that government services should be "digital by default", that is, releasing data and making them available for download as APIs. At the same time, the government should set up specifications for recording public data and guidelines for collecting and processing data so as to ensure data privacy. It is also necessary for the government to review relevant legislation and formulate an implementation timetable. A high-level government body (perhaps, a Chief Data Officer like Ms Coral) is therefore required to coordinate these major tasks.

Lilian also spent two weeks in Singapore earlier 2017 to share her experience on open data strategies with the Singapore government and to explore how to effectively integrate the participation of citizens in achieving the best results of government

and the public usage of data. Though the Singapore government has set up a dedicated Data.gov.sg, which is No.1 in open data in Asia, the country continues to work hard to introduce new technologies, approaches and open data in particular, as well as learning from foreign experiences.

I hope that our government will also speed up and actively resolve the problem of open data so as to promote the healthy development of a smart city in Hong Kong.

*An electronic copy was originally posted on *ComputerWorld* titled "Small data brings big changes to smart cities" on 25 May 2017.

Transform data into governance wisdom

Mrs. Carrie Lam will be delivering her first policy address soon. The public have long expected that the new CE would use her maiden policy address to tackle major problems. One of which is to help inject new impetus into Hong Kong's economy, and provide our young people with more opportunity for upward mobility. I think a smart city which emphasizes bottom-up participation, utilizing information and communication technology to improve our quality of employment and life is certainly the way forward.

Data transparency encourages creativity

How can a smart city achieve these goals? Governance with transparency, which encourages public participation and creativity,

is the key factor for success I learned from Los Angeles, in the US.

Lilian Coral, L.A.'s Chief Data Officer (CDO), came to Hong Kong earlier 2017 to share the best practices of L.A. As the CDO, her major responsibility is to bring in tens of government departments to provide data, so that government departments, public organizations and her office can collaborate with each other to boost efficiency and eliminate information bottleneck.

The sharing of data with the public is essential to encourage creativity. As a result, people in the city were bubbling with ideas and startups were launching various application platforms, as Mayor of L.A. Eric Garcetti described after the launch of L.A.'s open data platform GeoHub.

The way forward

In June 2017, the *Hong Kong Smart City Blueprint Consultancy Study* released by the government recommended establishing a

> *"The focus of an open data policy was to translate the data into wisdom; through the free use of the data and associated derivative work. In doing so, we could enhance the city's innovation and governance vitality."*

high-level officer to co-ordinate various bureaus in ensuring the smooth implementation of smart city policies.

It's really assuring to hear such news. In fact, in October 2016, the Smart City Consortium (SCC) has submitted an interim report to the government on the future development of a smart city. It pointed out that the government must set up a high-level dedicated department which is very important in that it has to persuade all government establishments to adopt "digital by default" (that is, open data with an application programming interface). The department has also to establish public data specifications, determine guidelines on data collection and processing, to protect personal privacy. At the same time, it should review the relevant legislation and formulate the implementation timetable. It is an extremely demanding task.

L.A. by establishing a strategic position of CDO is a good example the government should follow.

Mayor's Dashboard enables public monitoring

When talking about L.A., I must also mention the well-known Mayor's Dashboard which was boldly presented by Mr. Garcetti in 2013. The dashboard not only helps managing the city, but it also allows the public to monitor the government's performance.

It lists the data related to people's livelihood and divides them into the following four areas:

1. Prosperity — subdivided into three categories, economic development (such as number of new jobs, film and TV series shooting days); economic opportunities (family rent burden, poverty — proportion of elderly and children, homeless); veterans (employment ratio and by industry).
2. Liveability — three areas: urban services and sustainable development (such as the ratio of girls to boys and youth participation in sports, days expired before potholes in the streets are repaired); water and electricity (such as

household daily water consumption, solar power supply); and traffic matters (eg. traffic accidents, bus timeliness).

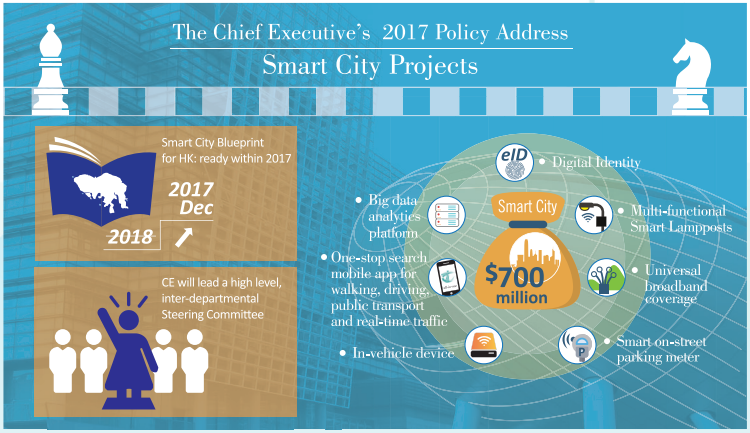
3. Public security — real-time crime information, including the type of case (violence, theft, drunkenness), and the distribution of cases on a map; the response time of police, firefighters and hotlines, as well as ambulance arrival time, etc.

4. Efficiency — government efficiency, such as the number of civil servants, visitors to the L.A. City website, city reserves, and the non-emergency 3-1-1 hotline performance.

Ms Coral said, "The focus of an open data policy is to translate the data into wisdom; through the free use of the data and associated derivative work. In doing so, we can enhance the city's innovation and governance vitality." This is also my expectation of the smart city in Hong Kong and the new SAR leadership team.

*A hard copy was originally published in *South China Morning Post* titled "HK needs a data revolution at the very top" on 22 November 2016.

Smart City: Better quality of life, more business opportunities



It is gratifying that the *Policy Address* released in October 2017 actively fosters innovation and technology development with specific and practical proposals; ranging from nurturing startups to attracting talent, opening government data, increasing public and private sector research resources and revising outdated regulations.

Business opportunity

According to an estimate from the research company, International Data Corporation, the annual market demand for smart city technology in the Asian market alone will reach US$1 trillion before 2025. Another research organization, Navigant Research, also predicted that by 2026, the global investment in smart transport, including smart traffic management through the

Internet of things, more sophisticated traveller information services and transportation mode recommendations, will be as high as US$17.5 billion when compared with US$6.6 billion in 2017. There is an increase of nearly three times.

The figures are huge because smart city service hardware does not come cheap. For example, a smart WiFi rubbish bin installed on the Orchard Road in Singapore costs over HK$16,000 for a basic configuration, 20 times the cost of the rubbish bin currently used in Hong Kong. It is driven by solar energy, a sensor inside the garbage bin will notify the street cleaners when the garbage bin is almost full. It also compacts the garbage so that the bin can accommodate eight times more garbage than previously while it also acts as a WiFi hotspot. If you want other features, such as temperature and humidity sensors, noise and air pollution detectors, as well as traffic monitoring; it definitely costs much more.

Budgeting for the change

The Government is keen to implement the pilot scheme of Multi-Functional Smart Lampposts, which have been installed in Busan, South Korea and New York City in the US. Features of the smart lamppost available on the market include: illumination adjustment, sound and vibration sensors, air and noise pollution detection, as well as traffic flow monitoring. It can also detect accidents, act as a WiFi hotspot and a re-charging station for electric vehicles; and be equipped with an emergency call facility, etc.

It is obvious that a budget of HK$700 million for smart city infrastructure here in Hong Kong is not sufficient when compared with that of the neighbouring cities. In Taipei, a budget of NT$5 billion (about HK$1.2 billion) has been allocated. Even for a smaller city like Macau, a budget of $500 million for a number of smart city services has been confirmed. To ensure our smart city program a

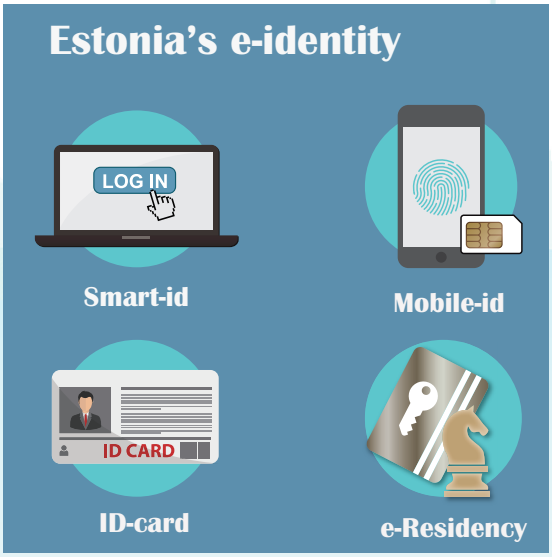
> *"Implementation of smart services would benefit peoples' livelihoods and also enable Hong Kong to have a share in the huge related market."*

success, we need to secure a firm financial commitment, otherwise the effectiveness of the pilot scheme would be compromised.

Implementation of these smart services in Hong Kong would benefit peoples' livelihoods and also enable Hong Kong to have a share in the huge related market. Therefore, we should speed up our smart city pathway.

*An electronic copy was originally posted on *Ejinsight* titled "Smart city: Better quality of life, more business opportunities" on 18 October 2017.

Learning from overseas experience in electronic identity



The Government mentioned in its *Policy Address* about developing as a smart city, with implementation of electronic identity (e-ID) as one of the priorities. E-ID is the backbone of a smart city. An officially recognized e-ID can facilitate the public to carry out various online activities; it also facilitates government's promotion of electronic government services. What is the status of e-ID implementation in the rest of the world? Are there any foreign experiences that we could learn?

Estonia: four types of e-identity

The world's pioneer in eID is Estonia, a small European

country. It has allowed its citizens to use e-identify for online voting with legal status since 2005. However, a security flaw in the chip of its ID card was found recently which makes it possible to steal the identities of half of its population, ie. 760,000 individuals. As such, Estonia's government has required its citizens, residents and e-residents to update their digital ID cards with new certificates by March 2018 to help protect against a potential security vulnerability.

Its electronic identity uses blockchain technology, all changes are encrypted and leave a record that cannot be altered. Its electronic identity is available in four formats: ID-card, mobile-id, smart-id, e-Residency.

ID-card:

This plastic card looks similar to our Hong Kong identity card, but has a broader usage. The mandatory national card also provides digital access to all of Estonia's secure e-services. Once inserted

to a card reader, it is a legal travel document for Estonian citizens travelling within the EU; a national health insurance card and proof of identification when logging into bank accounts; allowing you to check medical records, submit tax claims, i-Vote and to use e-Prescriptions, etc. At present, the e-ID is widely accepted, 67% of Estonian people use it regularly.

Mobile-id:

A special SIM card provided by a mobile service provider, with an embedded personal key, and after authentication enables signing without the need of a card reader. If you want to log in to your bank account, you only need to enter a password on your mobile phone.

Smart-id:

After verifying one's identity online, the users can access financial services, such as banking services via a smartphone

without a SIM card or a tablet, as long as there is WiFi service.

e-Residency:

This may be the most creative electronic identity created by Estonia. It is for foreigners' business applications; they can set up a company in Estonia without the need to be physically in Estonia. E-residents then have access to the EU business environment and can use public e-services through their digital identity. Currently, 20,000 people from 138 different nationalities have applied for e-Residency.

The spread of eID

It is noteworthy that Estonia's successful experience has been exported to other countries — a database system developed by Estonia for exchange of information, and accessible by the public, is now used in Finland, Azerbaijan, Namibia and the Faroe Islands,

> *If the future e-ID can be integrated with the Know Your Customer platforms of financial organizations, it can be opened to outsiders, further strengthening Hong Kong's status as a worldwide financial centre.*

an autonomous country within the Kingdom of Denmark. When Japan first launched its national electronic identity, My Number, in early 2016, they also sought Estonia's experience.

Anna Piperal, Managing Director of e-Estonia, who is responsible for promoting digitization to the Estonian people, said Estonian people feel proud of the electronic identity service as they could control and organize their personal matters, which made everyday activities much easier.

Singapore: biometric elements for encryption

Singapore has positioned itself as a smart nation and is adopting more advanced digital identity technology. Its new national digital identity (NDI) is a mobile application that uses encryption to verify identity online; it can be used to sign documents and carry out various online transactions. The goal of the project is to use the mobile application for access to public and private services,

such as medical and banking services, removing the hassle of remembering different usernames and passwords in different organizations. It is currently undergoing a six-month test and is expected to be implemented within three years, replacing the SingPass, launched in 2003.

Compared to SingPass, the mobile digital identity uses public key infrastructure (PKI) for encryption, which is more convenient and secure than the current one-off password via SMS. The new system will also include biometric elements for data protection and support the application programming interface (API) to facilitate participation by private companies.

Australia: extensive public consultation

Britain launched a system called Verify in May 2016, so that citizens can choose from several methods to prove their identities to public and private entities, such as post offices or banks. Once

their identity is verified, a citizen can use at least 15 government services, at gov.uk, related to their personal tax account, pension, and vehicle licensing. The Japanese e-identity, My Number, was launched in early 2016, the public response to this 12-digit smart ID card was lukewarm; only one third of the population (10 million applications) applied for the new ID card at the initial stage. There were system glitches at the beginning and the scope of application was quite limited (disaster relief, social welfare, taxation; and later extended to library cards and shopping point cards, etc.); there were also privacy concerns.

Australia's e-identity, Govpass, which is undergoing a testing phase, has been under extensive consultation lasting for 12 months, covering privacy and security issues. The consultation, known as Trusted Digital Identity Framework (TDIF), just ended in late October 2017. Its goal was to seek national consensus and to

give assurance, which is also the spirit of smart city 3.0, on their work in upcoming digital identity for building a national standard.

Hong Kong: integrate with Know Your Customer platform?

Hong Kong should learn from overseas experiences to enable the smooth introduction of e-ID. In the meantime, the banking sector has been discussing how to improve the process of KYC (know your customer) over recent years. At present, a bank needs to verify a customer's identity, background, source of funds and usage of account for every new account opening. If it is an enterprise, the customer needs to provide information regarding the beneficial holders, equity structure, etc., it is time-consuming and inconvenient. If the future e-ID can be implemented together with the KYC platforms of all financial organizations, such an integrated platform can facilitate users. It can also be opened

to outsiders, paving the way for the Bay Area development and further strengthening Hong Kong's status as a worldwide financial centre.

*A hard copy was originally published in *China Daily* titled "HK should look to overseas experience when creating eID" on 11 November 2017.

Smart city earns you one extra hour every day

Previously, there was an international assessment called City Initiatives for Technology, Innovation and Entrepreneurship (CITIE), which reviewed the progress in adopting technological innovation across 40 cities, the criteria were consistent with that of Smart City.

The assessment divides the progress of city development into four stages: “Front Runners”, “Challengers”, “Builders” and “Experimenters”. Among the Asian cities being reviewed, Singapore is the only one ranked as a “Front Runner”, as expected.

As early as 2014, Singapore initiated a national policy of advancing to be a “Smart Nation”. The country has been promoting a top down national policy vigorously implemented, it also intended to export the relevant experiences and technologies to others. International Data Corporation, a market research

> *"The successful construction of a smart city should be driven by governments with support from the general public. Besides, the attitude of the government and the public should be changed - the public should become a participant in the smart city development."*

company, estimated that by 2025, the annual demand for Smart City technologies will reach US$1 trillion in Asia alone.

Hong Kong's data not fully open

What about Hong Kong? We were ranked within the third stage, of "Builders", same as Tokyo and Sydney.

Although different assessments have different criteria, and there may be subjective elements in the assessments, the findings are useful to serve as a reference. For example, among the nine assessment criteria, Hong Kong scored weakly in "making full use of data to improve services and promote innovation", such a "low score" is not very surprising.

In recent years, the Government and many public and private organizations have been working on information sharing with the public, they did their own work individually but there is no integrated platform; they also did not cater to the needs of the

users, particularly mobile app developers.

For example, the bus company's "Estimated Time of Arrival" service is very useful to passengers. However, such service is only limited to buses, not all modes of transportation in Hong Kong. People also criticized that the download format is not in API, which is used by app developers, users have to process the data before use. My colleagues have been doing the conversion for some time. When we sponsor primary and secondary students with free usage of a GIS software, for the students to use local government data in their studies, we have to convert the data format regularly, it is very labour intensive and time consuming.

Helsinki leading the way

When we talk about open data and smart city development, Helsinki, Finland is a representative model. Even Boyd Cohen, the smart city expert and Joe Pine, MIT visiting scholar both gave

acclaim to the city. Open data is a key focus of the city's development strategy; Helsinki currently opens over 1,200 datasets to the public and organizations. The city encourages cooperation among different developers, and organizes various activities each year, such as the hackathon, which gathers professionals and IT workers (game developers, programmers, interface/user experience designers) in the area of architectural design, engineering, construction, and geographic information systems, to study construction-related topics.

Helsinki is acclaimed for its experimental smart city district "Kalasatama". Kalasatama means "feast", it was originally a harbour in an industrial area. The district is now equipped with various environmental design elements; it encourages innovative service, its goal is "to let everyone earn one extra hour every day", to save time for the benefit of the public.

Testing ground for startups

The district has a program to provide small grants, ranging from about €1,000 - 8,000 (about HK$9,200 to HK$73,600), to promising startups. For example, Auntie Solutions, one of the experimental services, aims to prevent serious mental health incidences through easy access tools that help to tackle the most common life crises. Auntie experiments with different service packages for gaining an understanding on user experience and the effectiveness of different digital channels. As such, startups can test the new services on real users and companies, and get user feedback to improve their operation.

Boyd Cohen pointed out that the successful construction of a smart city should be driven by governments, via the establishment of eGovernment and the Internet of things, etc., in addition to support from the general public. Besides this, the attitude of the government, and the public, should be changed; the public is no

longer merely an audience member or customer, but a participant in the smart city development, to improve their living.

*An electronic copy was originally posted on *Harbour Times* titled "Getting Ahead in Hong Kong: Speak up for a Smart City!" on 20 September 2016.

Opening up spatial data can boost creativity

In the Information and Technology industry, there is a saying: "80% of data is geographic". For example, the photos taken by our smart phones and posted on social networks are marked with "location". When a country is building its smart city, the success or

failure of the smart city cannot be separated from the management and usage of data. In short, the availability of geospatial data becomes a critical factor for success.

A data exchange platform

I am glad to learn from media reports that the Office of the Government Chief Information Officer and the Lands Department will launch an inter-departmental Geographic Information Platform at the end of 2017; including the location data of a wide range of facilities, such as clinics, cultural and recreational venues as well as electric vehicle recharge terminals, etc. The public can download the required information and develop applications (apps) through the application programming interface (API). This can be considered as the Hong Kong Government's continual support to the development of the smart city.

The *Policy Address* released in 2017 on innovation and

> *"To maximize the benefits made possible by CSDI, we should address the local needs as well as lobby different organizations to open up their geospatial data for the development of various smart apps and services."*

technology mentioned that the Development Bureau is promoting the establishment of Common Spatial Data Infrastructure (CSDI), including the appointment of a consultant to conduct a study so as to formulate a development strategy and roadmap. CSDI is a more professional, comprehensive, large-scale digital infrastructure, which is also an important foundation for a smart city. It can support various apps and services.

According to the Development Bureau's description of CSDI, government departments, as well as public and private organizations can consolidate and exchange various data, such as road networks, plots, land use, underground pipelines, urban planning requirements, real-time traffic conditions, and the local weather condition. The platform will facilitate not only government departments and public organizations but also citizens to develop broader functional apps, based on spatial data.

Promoting app development is one of the main objectives of delivering geospatial data. Their success will help to bring together creative ideas and improve the efficiency and quality of city operations and decision making. However, it requires proper strategy support.

Los Angeles experience

The Los Angeles GeoHub is the best example. It uses the latest technology and operation concepts to share geospatial data; their successful experience is worth our reference. Lilian Coral, Chief Data Officer of Los Angeles City, came to Hong Kong earlier to share her experience. Her team has lobbied more than 60 government departments to share spatial data, which is open to the public for developing innovative digital maps and apps beneficial to peoples' living.

GeoHub spawned various apps, such as Clean Streets Index (showing street cleanliness), Street Wize (displaying current and upcoming road works), Vision Zero Los Angeles (showing traffic accident black spots), etc. These apps have established a good reputation and are widely used by the public, creating a sense of accomplishment for the developers. As a result, more and more organizations are willing to open data and even participate in the design of apps. There are over 600 kinds of datasets on the platform now.

Taiwan: public-private collaboration

At the beginning of 2017, I attended the 15th World Conference of the Global Spatial Data Infrastructure Association (GSDI) in Taipei. The conference focused on Taiwan's smart disaster prevention and management strategy. Experts and academics from around the world discussed how to increase Taiwan's ability to fight natural

disasters, such as earthquakes, typhoons and floods through the use of an SDI-based disaster alarm, disaster relief and post-disaster rehabilitation apps. At the conference, the Taiwan government and local disaster prevention sectors indicated that they would follow up on these recommendations to strengthen the integration of local stakeholders and the industrial community's relief effort and to promote the development of related products and technologies. Looking at the positive atmosphere at the conference, I anticipate that a number of well-established manage disaster apps and services based on geospatial data will be found in the near future.

I believe the strategy of developing CSDI in Hong Kong should be related to the characteristics and needs of the local market, such as the public's special interest in the property market and the provision of services to the ageing population. Besides, like Los Angeles, it should lobby and attract different organizations and departments to open up their geospatial data and collaborate to

promote the development of various smart apps and services. All these will contribute to maximize the benefits made possible by CSDI.

*An electronic copy was originally posted on *ComputerWorld* titled "Opening up spatial data to boost creativity" on 25 July 2017.

Women can play a major role in smart city development

The serious imbalance of men and women working in the IT industry is a worldwide phenomenon. In the United States, for example, the proportion of women in the IT industry is 25%.

It is 16% in the United Kingdom, 30% in Singapore, and 17% in Hong Kong — although half of Hong Kong women are in the workforce.

The Esri User Conference in the US gathered over 16,000 IT professionals in the geographic information systems (GIS) field from all over the world in 2016. While Los Angeles is the No. 1 city in the US when it comes to open data, it is surprising that the post of chief data officer in the city comes from a minority group in the

IT field, i.e., a woman. Her name is Lilian Coral and she is in charge of GeoHub, the city's award-winning public platform for open data.

Smart Dubai: aim to build the happiest city

It is even more incredible in 2017. Everyone applauded and held their breath when Esri president, Jack Dangermond introduced Dr. Aisha Bin Bishr, a lady, being the head honcho at Smart Dubai.

The United Arab Emirates is one of the world's richest countries and Dubai is its largest and most populous city. It is one and a half times larger than Hong Kong, with a population of only two million. It is also the economic and financial centre of the Middle East. It ranks among the top 20 global financial and technology centres and No. 1 in the Middle East.

What is the vision of Smart Dubai? It aims not to be the world's most prosperous city but the happiest. It wants to see all residents,

including tourists, businessmen, workers, and civil servants, working and living happily in the city.

Through the all-round city information platform, Dubai Pulse, the public can access information on public projects and events, such as the status, estimated expenditure and completion time of construction work in various city locations.

The government, developers and the public can exchange ideas on developing various projects; the government can also listen to the public's views through the social network and provide a timely response.

Challenge: engage public, private and government

Smart Dubai was launched almost 20 years ago. In 1999, the government announced its IT strategy, and launched the Internet city and e-government in the following year. By 2013, the Dubai

> *"Alibaba's Jack Ma said the future would be dominated by women, because in the future, 'people-oriented work would focus on experiences not replaceable by artificial intelligence'. I expect women to play a more active role and show their strengths in smart city development."*

Smart Government was established, and a smart city office started operating two years thereafter.

Dr. Bin Bishr pointed out that the biggest challenge in building Smart Dubai was how to engage the public and private organizations, as well as enhance communication between government departments and private organizations.

Ms Coral, from Los Angeles, had gone through the same process. She said communication and interpersonal skills, were among the strengths of women that could greatly facilitate the coordination process.

Addressing privacy concerns

In addition to facilitating public and private innovations, Dr. Bin Bishr also sees data as the "new oil", a form of resource. She intends to begin a process of data commercialisation in the third quarter of 2017. The commercialised data will be divided into three

categories: raw data, data that has been consolidated by analysts, and government-only data.

The data covers traffic of pedestrian and vehicles, anonymous mobile phone data, etc. Dr. Bin Bishr is also actively exploring the business opportunity of data analysis.

Her plan has led to concerns over personal privacy. However, Dr. Bin Bishr has been aware of such concerns. So, in addition to the comprehensive privacy regulations, there is a newly added clause requiring the government to seek the people's permission whenever it is collecting their data.

People-oriented work not replaceable

She estimated that the revenue from data commercialisation would reach US$2.9 billion per year by 2021, generating an average of more than US$1,000 per year for each Dubai citizen. Of course,

this is trivial when compared with an income per capita of more than US$40,000, but it has a long-term significance in diversifying the city's economy.

Recently, Alibaba executive chairman Jack Ma said the future would be dominated by women, because in the future, "people-oriented work would focus on experiences not replaceable by artificial intelligence". Women are strong in considering for others, attending to details and good at communication.

Hong Kong's new chief executive is also a woman. I expect women to play a more active role and show their strengths in smart city development.

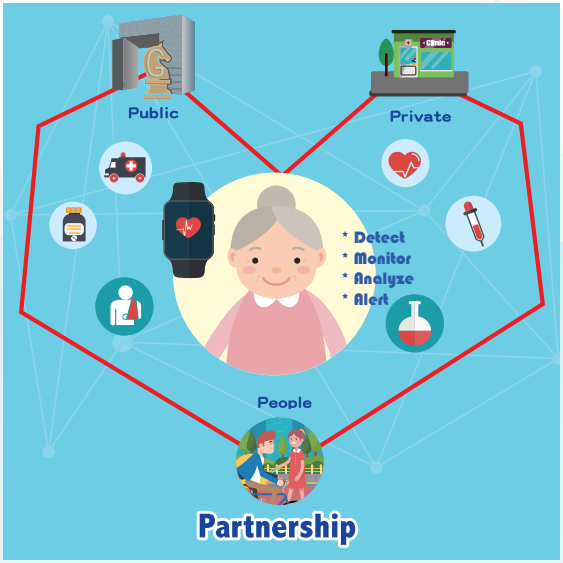
*An electronic copy was originally posted on *Ejinsight* titled "Women could play a bigger role in smart city development" on 7 August 2017.

Smart City 3.0

Chapter Five: Smart Living

The risks and opportunities brought about by the tsunami of the ageing population, cybersecurity in the Internet age, the changes of lifestyle brought by the Internet of things, etc. have pushed technology forward. This not only enhances the quality of living and death but also brings in many employment opportunities.

HOW to engage Private-Public-People-Partnerships



The World Bank Smart Cities Conference, held in Yokohama, Japan in late 2016, where experts from various cities shared their insights on the latest progress in developing their own smart city, was very inspiring.

The audience were amazed by the successful transformation of Yokohama, which means “harbour of the future”, from an old town to a modern green city. The focal point is a central seaside urban area, called Minato Mirai 21 District, which was once a large shipyard until the 1980s; when development began to turn it into a new city centre. Its major accomplishments include the integration of history, culture and art, as well as the utilisation of renewable

energy and a greener city centre. Its citizens, who defined the city direction through massive surveys, were the driving force behind it. I think it sets a good example for the Energizing Kowloon East Office, Hong Kong's test-bed for smart city development.

Pressure from urbanisation

India, currently, is heading for urbanisation in an urgent manner to accommodate 750 million people within the next few decades. The government has, therefore, pledged to build 100 new smart cities to refurbish 500 old ones. But which cities to develop, how to conserve the natural resources for the future generations, what needs to be done to provide a better living environment and more job opportunities are things that need more thinking among India's people as well as global experts.

Like India, many countries have a common concern with data transparency, which is crucial for citizen engagement. Countries

in Africa are moving ahead on the issue; the African Development Bank just took a step forward to increase openness to help visualise global development aid. That's why the audience appreciated the importance of application programming interfaces (APIs) when I raised it at the Conference. APIs allow users to download data in various formats which fit their needs. This is actually the critical success factor of the Los Angeles city portal GeoHub, launched in 2016. Since then, value-added applications have been flourishing.

Public-private-people-partnership

Back to Hong Kong, the Census Department announced that we had 1.12 million people aged over 65, 15% of whom were over 85 in 2015. The increase of the ageing population is steep as baby boomers reach their retirement age. By 2040, one in every three persons will be over 65 and I shall be one of them.

The main objective of a smart city is to improve the quality of

> *'A Smart City means a Competitive City.' If the government can take the lead to promote collaboration with various players in the cities, not only can we address the demands brought by an ageing population, but our city can also enhance efficiency and stay competitive.*

life, whilst enhancing the competitiveness of the city, even when ageing is a global issue, especially in developed countries. The promised benefits from increasing expectations will have to be provided by a decreasing working force. But how can innovative eco-systems and citizen engagement help to address the issue?

I found the answer to the above issue at the Conference. It was enlightening to see an advocacy of public-private-people-partnership (4P), which I conceived as a practical and perfect approach towards the ageing issue while enhancing competitiveness at the same time, not just for Hong Kong but also other cities.

Efforts to meet public expectation

Nowadays, with the popularity of the Internet, smart phones and social networks, public participation in decision making and comments from interested citizen have become increasingly common. To better realise the changing public aspirations and

demands for policy formulation and infrastructure planning, many policy makers have started to engage private organisations and the general public to help improve the development process. A Partnership among the Public (the government), Private (organisations and corporations) and its People (the citizens) is formed. It embraces the bottom-up participative initiatives which make citizen engagement clearly visible for policy making and infrastructure planning. As a result, the city can moderate the risk of unforeseen oppositions, allocate clear responsibilities and rights, and create opportunities for public inputs.

Successful examples of a 4P effort can be found in Vancouver, which successfully engaged over 30,000 citizens in a program, Vancouver Greenest City 2020 Action Plan. In another example, researchers in Jakarta have developed a real-time map of flooding, by crowd sourcing flood reports from Twitter to monitor severe flooding during the rainy season. Meanwhile the Helsinki authority,

accelerates new concepts into service innovations and new businesses by allowing startups to test creative service ideas on real users and companies. These successful smart city initiatives illustrate the growing potential of collaboration among citizens, corporations and the governments.

A holistic approach to address ageing problem

In Hong Kong, currently, there is a queue of 32,000 elderly citizens waiting for nursing homes. Equally worrying is that there are over 18,000 new cases of senior citizens diagnosed with dementia each year. Our present senior care and healthcare systems have been under an escalating amount of pressure. Ageing with dignity is a mere fantasy for most elderly in this metropolis.

In order to facilitate healthy ageing in Hong Kong, I believe linking up families and neighbours (People), caregivers and doctors (Private) as well as policy implementation by the government

(Public) with a holistic and proactive smart health environment can keep our citizens safe, healthy and happy at home.

A recent advisory paper on smart cities by the Smart City Consortium (SCC) suggests that the smart health environments, with the 4P in place, can be constructed using the following three approaches.

Proactive, predictive and preventive approach

The first approach is Proactive Smart Health Monitoring using a smart Internet of things (IoTs) network to monitor an individual's real-time health with a link to the individual's family, doctor, clinic and hospital to provide comprehensive health management.

The second approach is Predictive Smart Health Analysis, by which digital healthcare professionals detect the on-set of acute diseases and provide real-time advice for personalized medical treatment.

It works with the latest yet most important approach: The Preventative Smart Health Community Network through which the sharing of electronic health records and tele-medical consultations are now feasible for patients with chronic illness. When required under emergency situations, the nearest neighbour or healthcare practitioners would receive alerts to locate the person in need.

"A Smart City means a Competitive City"

The above approach requires the collective support of the government (e-health record sharing policy, emergency units), medical and healthcare professionals, community organizations and the general public. It takes proactive measures to tackle ageing and healthcare issues, instead of the traditional reactive medical care. As a result, it would help to alleviate pressure on frontline healthcare workers, reduce the burden of medical expenditure, and enhance the competitiveness of the city.

What's more, apart from conventional caretakers and medical practitioners, the new service creates a number of job opportunities for talents from various fields, from: sensor network planning, biometric data monitoring, social behavioural model building, big data analysis and acute diseases predictive model building, etc.

"A Smart City (SC) means a Competitive City (CC)", I think what Mr. Kurt Tong, the US Consul General for Hong Kong and Macau recently said is very true. If the government can take the lead to promote cohesive collaboration with various players in the cities, not only can we address the demands brought by an ageing population, but our city can also enhance efficiency and stay competitive in the years to come.

*An electronic copy was originally posted on *World Bank Blogs* titled "How can Hong Kong stay smart and competitive? By driving change through a 'Public-Private-People Partnership' approach" on 14 December 2016.

Be the master of your mortality

In 2017, a family tragedy occurred in Yiu Tung Estate, Shau Kei Wan. An 80-year-old man could not tolerate his wife's suffering from a stroke and he strangled her. The media cited information from the Social Welfare Department, which indicated that the female deceased had been allocated a subsidised place in a day care centre, but she had declined. If e-health was available, would it be different?

Where to spend the last days of life?

A study had been carried out by *The Economist* and The Kaiser Family Foundation, an American think tank, aiming to find out where people want to spend their last days of life. The survey interviewed over 4,000 people from Japan, the United States, Brazil and Italy. Though with different backgrounds and cultures, more than half of the respondents wanted to spend their last days at home.

What about Hong Kong? The media quoted 70-year-old Dr. Yeoh Eng-kiong, former Secretary for Health, Welfare and Food: "When I pass away, I want to be at home …you know how crowded a hospital is…" We all share the same view.

However, to pass away at home in Hong Kong actually poses a lot of problems. Prof. Joseph Lee Kok-long, member of the Legislative Council representing the health service sector, pointed out that less than 3% of patients participated in the Home End-of-Life Care Program in which the original idea was to enable elderly patients suffering from chronic diseases to choose to stay at home so they could enjoy a more peaceful time during the last days of their lives. The main reason for this low adoption is that many people "worried about handling death themselves" if death occurred outside a hospital. In addition, people may worry that the spirit of the dead would become attached to their home, turning the property into a "haunted house" and thus affects the price of the property.

The last days pose heavy burden

On the other hand, with an ageing population, chronic diseases such as dementia are becoming increasingly common in Hong Kong – according to government information, Hong Kong's major causes of death, such as cerebrovascular disease and chronic lower respiratory disease, have been declining from 2001 to 2016, whereas dementia increased from 2.6 per 100,000 people to almost five times today. The dementia could cause issues for 10 to 15 years, and would therefore pose a heavy burden to the caregivers.

In the United States, the proportion of deaths at home is as high as one fourth; largely due to the huge cost of hospitalization. According to Medicare, the U.S. government's health insurance program, Americans spent a quarter of their total income on medical expenses in their last year. At the same time, local research also pointed out that the annual opportunity cost of the U.S. home

caregivers was as high as US$522 billion (about HK$ 4 trillion). One reason for this high figure is that a lot of people quit their work to take care of the patient at home. The second reason is that taking care of a patient often extends over day and night. In Hong Kong, according to a survey by the Department of Social Science of the University of Hong Kong and the Hong Kong Council of Social Service, within the last six months before passing away, the elderly, on average, are admitted to hospital three times for a total of 28 days. You can imagine how hectic the caregivers' schedule must be. As such, they are prone to suffering from Caregiver Syndrome.

A study by the Stanford University found that caregivers suffer from great mental stress, irritability, guilt and so on; they are more likely to have depression and suffer from illness. As a result, they may even die earlier than the patient – 4% of dementia caregivers in such a case.

> *What IT can do - telehealth can reduce the burden and fatigue of both patients and caregivers, big data analysis helps predict the development of disease; a sensor network at home can safeguard the patient.*

Information technology can help

In the 2015 Quality of Death Index published by *The Economist*, Hong Kong ranked 22nd among 80 countries and communities in the world. It is not proportional to our high income per capita – which is four times higher than the global average. While Taiwan ranked 6th globally, and 1st in Asia in the Index, Hong Kong needs to catch up, no matter whether in regulations, hospice care, advance directives, life and death education, etc.

On the other hand, Information Technology may help – telehealth can reduce the burden and fatigue of both patients and caregivers, big data analysis helps predict the development of disease; a sensor network at home can safeguard the patient. For example, if no motion is detected in the bathroom or kitchen for say half an hour, a signal would be sent out to alert the relevant parties. Moreover, a Partnership among the Public (the government), the Private (corporations and civic associations) and the People

(friends and relatives) or "4P" could be formed to help improve the living quality of patients and caregivers.

When facing our own mortality, everyone is a novice, so we need to take extra care. We came to this world surrounded by love, we want to pass away with dignity and peace. This is the essence of a people-oriented smart city.

*A hard copy was originally published in *China Daily HK* titled "Be the master of your own mortality during final days" on 7 July 2017.

When a loved one is dying, advance directives matter

Recently, Chiung Yao, the Taiwanese popular romance novelist, had a melodramatic dispute with her stepchildren over putting her husband on life support.

The "tug war of love" as Yao put it occurred after her husband suffered from severe dementia and a serious stroke. The doctor diagnosed that without intubation, the husband would naturally die in two to three months. Her husband also indicated in his will earlier that "When I am dying, please do not send me to the intensive care unit. I do not want any tube and medical equipment to maintain my life... I don't need tracheostomy, electric shock, intubation,

nasogastric tube, urinary catheter... let me pass away peacefully." However, his children insisted that their father only had dementia, he was not terminally ill and could not make proper judgement, therefore intubation was needed...

In the 2015 Quality of Death Index published by *The Economist*, Taiwan ranked first in Asia, its Ministry of Education began to include the education of life and death, as well as an ethical life in 2000, though there had been chaos in the execution. What is the situation in Hong Kong?

Time to implement advance directives?

Early in 2006, The Law Reform Commission of Hong Kong submitted a report named *Substitute Decision-making and Advance Directives in Relation to Medical Treatment* for consultation. "Advance directive" (AD), refers to advance decision-making by an individual himself, as to the health care or medical treatment he

> *If we can decide on an effective advance directive when we are still healthy, we can avoid a 'tug war of love' between healthcare personnel and family members.*

wishes to receive at a later stage when he is no longer capable of making such decisions. AD is based on the principle of self-determination by patients, which spares medical staff and family members from making difficult medical decisions, in particular the decision to withhold or withdraw life-sustaining treatment.

The Commission recommended that the concept of AD should be promoted in a non-legislative manner for public awareness before considering legislation. In 2012, Dr. York Chow Yat-Ngok, the former Secretary for Food and Health, said in the Legislative Council, "Some people still regard it a taboo to discuss the issue of terminal care and death, and the public at large are not fully familiar with the concept of advance directives. As such, we agree that it is not the appropriate time to implement advance directives at this stage through any form of legislation."

Without legislation on AD, healthcare workers may fear that they would bear the legal responsibility in not saving life according

to instruction. Dr. Chow also mentioned that the Ethics Committee of the Medical Council of Hong Kong had difficulties when formulating the AD guidelines, like determining the validity of AD. The Medical Council believes that a legal framework should be developed for AD to protect patients and healthcare workers.

No tug-of-war between medical staff and love ones

Time flies, it is now 11 years since the last consultation by the Commission, is it the right time for Hong Kong to move forward?

The Electronic Health Record Sharing System has been officially launched for more than a year and is now being made more comprehensive. If we can decide on an effective AD when we are still healthy, and register it into the system for the healthcare personnel and family members to follow, we can avoid a "tug war

of love" among family members when we are dying, it also allows the living and the deceased to have peace of mind.

*An electronic copy was originally posted on *Ejinsight* titled "When a loved one is dying, advance directives matter" on 14 July 2017.

Promoting IoT is key to smart city development

Gartner, a market research company, predicted that by 2017, there will be 8.4 billion objects in the world that are connected to the Internet of things (IoT). By 2020, the number will increase more than double to 20.4 billion. Objects connected to the IoT in Greater China, United States and Western Europe account for nearly 70% of the world's total. The fields of application include: automobiles, televisions, digital set-top boxes in the consumer market, as well as smart meters and security surveillance cameras for commercial use.

Data-based model to ensure smooth city operation

The Government appointed PwC to write a *Report of Consultancy Study on Smart City Blueprint for Hong Kong* (the *"Report"*) which was released on 30 June 2017. The Report has substantial coverage on various topics related to data, including big data, geospatial data; characteristics, management and use of open data, privacy protection and security and governance framework, etc. The smooth operation of a smart city depends on the data-based operation model. Therefore, the *Report* pointed out, in particular, that the IoT is one of the sources of big data and is an important foundation for Hong Kong's development as a smart city.

The IoT can simply be defined as a digital network consisting of automated sensing devices; their main function is to retrieve data from the surroundings automatically and send them back to the central system for further processing and analysis. Examples

of the IoT applications include the detection of farmland pH levels and road traffic conditions. The smart city services and applications are "smart" because they enable resources to be used effectively, through adjustments according to environmental data extracted from IoT.

Hong Kong's IoT examples

In fact, Hong Kong has been deploying the IoT for a period of time in a number of areas. The *Report* cited a variety of public infrastructure that have applied the relevant technologies as follows:

- The Water Supplies Department is actively installing sensors in the water supply network to detect water pressure, so as to build the Water Intelligent Network enhancing maintenance efficiency and reducing water wastage due to leakage;

"IoT data should be open to the public with API through CSDI for facilitating the development of innovative applications."

- The Drainage Services Department uses an ultrasonic sensor to detect the water level of a manhole for programming the sequence of maintenance;
- The Transport Department installs sensors at busy road junctions to monitor traffic conditions;
- The Customs Department uses electronic locks (E-lock) and a global positioning system (GPS) to monitor the clearance of goods in and out of the Mainland;
- The Civil Engineering and Development Department monitors the possibility of landslide on slopes through sensors installed in retaining walls.

IoT data should be shared at CSDI

However, we need to do a lot of preparation for Hong Kong to harvest the value of the IoT. These include:

1. Launch 5G as early as possible — some of the IoT applications must provide an immediate response when there is an environmental change, such as a low latency network for unmanned automobiles to avoid accidents on the road. China is planning to work with other countries to develop a global unified 5G international standard; the first version is expected to be completed by June 2018. At the same time, there is news reporting that 5G devices, developed by other countries, would be available within 1-2 years. With the current timeframe of launching 5G in Hong Kong by 2020, I hope that we could push forward our launch date.

2. Protection of privacy and protection against hackers — the IoT applications will inevitably involve personal privacy issues. Which organizations and people can access, use and how to use the data will be a major social concern.

At the same time, the IoT security mechanism is prone to hacker attacks. The *Report* proposed the establishment of a cross-departmental high-level Smart City Steering Committee, which I expect will handle privacy and the IoT security issues as a matter of high priority.

3. Open data — the IoT produces a lot of data which can be open to the public for promoting innovation. Currently, the Government's Data.gov.hk and the common spatial data infrastructure (CSDI) being constructed are the platforms for distributing the IoT data in future. Meanwhile, we have to ensure that the data is provided in an open format and application programming interface (API) which can be available to others for facilitating the development of innovative applications.

With the IoT as an example, the *Report* is just the beginning of constructing Hong Kong as a smart city. I hope the Government

can continue to pursue unremittingly despite various difficulties. Through this, all sectors could communicate and collaborate closely. Together we shall turn the smart city vision into a reality, step by step.

*An electronic copy was originally posted on *Harbour Times* titled "Promoting IoT is key to smart city development" on 2 August 2017.

New approach to cybersecurity

The recent raging cyberattacks by WannaCry, a ransomware and cryptoworm, have drawn the world's attention to network security.

According to Kaspersky Lab, a network security software company, online attacks detected in the first quarter of 2017 had doubled to more than 400 million when compared with the same period in 2016. At the same time, over 200,000 mobile phones had been affected by ransomware Trojans which is ten times the first quarter of 2016!

Antivirus is dead?

Unfortunately, antivirus software may not be able to protect your computer and mobile phone completely from attack — the

management of Symantec, the developer of Norton, once the best antivirus solution, announced the "death" of antivirus software, as it is difficult to keep the virus away.

Cybellum, an Israeli network security company, recently announced that they found a virus that specialized in attacking antivirus software and named it DoubleAgent. Instead of hiding and running away from the antivirus, attackers now directly assault, hijack and gain control over the antivirus security agent, turning it into a malicious agent. As the antivirus is considered a trusted entity, any malicious operation done by it would be considered legitimate, giving the attacker the ability to bypass all the security products in the organisation. In other words, it is impossible for us to defend against network attack programs and ransomware.

Tackle new problems with old thinking

Michael Daniel, the White House cybersecurity coordinator

in the Obama administration, said that cybersecurity was a big challenge, one of the reasons was that we handled new problems with old thinking. His recent article in the *Harvard Business Review* indicated that there were three reasons for the severe network security problem:

- It is not a mere technical problem although there is a technical aspect, such as how to write a totally bug-free program;
- The cyberspace is different from the physical world; the rules of the game have to be redefined. At light-speed, "concepts like distance, borders, and proximity all operate differently in the cyberspace, which has profound implications for security." In the physical world, a person is likely to be on site when committing a crime, while in the Internet world, threats can literally come from anywhere and by anybody.

Moreover, the borders in cyberspace do not follow the same lines as we have imposed on the physical world; instead they are marked by routers, firewalls, and gateways; it is not bounded within any particular country. In other words, crime on the Internet is the same as crime in international waters, it usually relates to more than one jurisdiction, and is thus complicated to arrest the criminal, not to say punish them – how do we hold individuals and organizations accountable for mischief done in international areas?

Who is responsible for chasing after culprits?

- The law, practice and rule of the Internet world have not been fully developed yet – the Internet started to be popular only 20 years ago, the regulations are not complete, including responsibility of user protection. To quote the recent WannaCry incident, the sufferers ranged from

"Education is the best way to solve cybersecurity problem. The Government should speed up coding training and STEM education in primary and secondary schools."

government departments, public and private organisations to individuals, but the copyright owners of the computer software being attacked belong to the software developers, so who is responsible for chasing after the culprit?

In addition, we need to consider the following: What is the right division of responsibility between governments and the private sector in terms of defence? Are there any protective measures provided by the companies which are handling our data? Are there any standards to follow in the industry? How should regulators approach cybersecurity in their industries? What can governments, private enterprises and individuals do and what can they not do?

In short, as long as we continue to try mapping physical-world models onto the cyberspace, they will always fall short in some fashion.

As Mr. Daniel suggests, the government cannot and should not be held responsible for the protection of all the online activities of every private organisation. Doing so would hinder business operations. He believes that, like disaster response management, small scale online activities should be the responsibility of private organizations, while the government should intervene in large scale ones.

How can we protect ourselves?

Network security experts point out that risk is inevitable, since we have to use the Internet as a channel in our business operations. What we need is be proactive in developing a defence mechanism to improve our ability to fend off the attacks.

Therefore, to manage and mitigate the risk, public and private organisations, as well as governmental departments should foster cyber resilience by strengthening their "immune systems". The

recently published *2017 Global Information Security Manpower Research*, which interviewed 19,000 industry professionals from 170 countries, pointed out that global IT security personnel are in serious short supply. The workforce gap by 2022 will reach 1.8 million, an increase of 20% when compared to the survey two years ago.

Education is the best antivirus

There is no immediate solution to the cybersecurity problem as raised by Daniel and the talent shortage issue. I, however, believe that education is the best way to stimulate new thinking and solve the problems. Therefore, it is a matter of urgency to train the younger generation in computer programming and network security awareness, as well as to promote STEM (science, technology, engineering and mathematics) in primary and secondary schools. The Government should speed up accordingly as there is no

shortcut for talent training.

There is opportunity in every danger. I hope millennials can grasp the opportunity to strengthen our network security and at the same time attain their business objectives.

*A hard copy was originally published in *South China Morning Post* titled "Education is the best antivirus as cyber risks grow" on 24 July 2017.

Co-operation amongst government, industry, academia and research sectors

In recent years, we often hear news discussing autonomous vehicles, virtual reality (VR) and how a smart city improves quality of life with information technology. But what exactly are these in real life?

The new Climate Change and My Smart City Experience Centre, opened in the Zero Carbon Building, Kowloon Bay in mid 2017, enables people to experience these new technologies. There are four thematic centres, "Climate Change", "Smart City & Sustainable Built Environment", "Smart Living" and "Health & Well-being".

Local inventions

I am pleased and proud to see that many exhibits are the result

of local research and development; they are also the evidence of the co-operation amongst the government, industry, academia and research sectors. Some of them are the result of our Smart City Consortium members.

The opening ceremony at the Zero Carbon Building in June 2017 was crowded. I did not have the chance to experience each exhibit, However, I saw enough to just name a few of the brand-new technologies here:

Diabetic Eye Screening:

It is estimated that there are at least 700,000 diabetics in Hong Kong, of which 40% have diabetic eye disease which can eventually lead to blindness. Unfortunately, there are no obvious symptoms at the early stage. Visiona MedTech, a graduated 'incubatee' at Science Park, has combined intensive learning and artificial intelligence to develop diabetic retinopathy screening technology, so that by taking pictures of

the retina and uploading to the central system, people will be told whether they are likely to have diabetic eyes, and its level of seriousness. It is fast and convenient, and most importantly, non-invasive. From the long waiting queue for testing on that day, we can conclude that there is a substantial demand for such technology.

Stroke rehabilitation:

In recent years, Hong Kong's new patients suffering from strokes are coming from younger and younger generation. Stroke may lead to impairment of hand capability. The "Hand of Hope" developed by the Polytechnic University and Rehab Robotics was awarded the Honorary Award in the International Exhibition of Inventions in Geneva. Through detecting the patient's own electromyography signals, the "hand" helps the patient to train their hand-brain co-ordination, so as to "rebuild the connecting nerves", and wake up other dormant brain

> *"The co-operation amongst the government, industry, academia and research sectors is able to bring about the improvement of quality of life."*

cells to take over hand activity function from the damaged cells. It has been adopted by a number of public hospitals and rehabilitation centres in Hong Kong and has been certified by the European Union. It has also been exported to more than 20 countries and regions, such as Germany.

Smart cane:

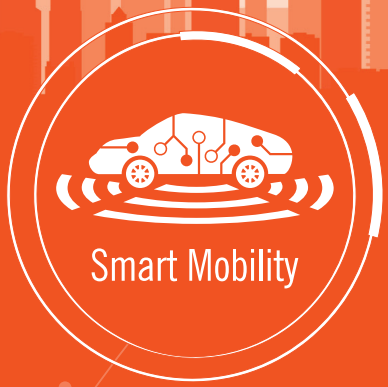
Another local product is a radio frequency identification (RFID) cane navigation system for the visually impaired. It was awarded the Gold Award in the International Exhibition of Inventions in Geneva in 2016. This is an invention from the Hong Kong R&D Centre for Logistics and Supply Chain Management Enabling Technologies. A REID reader is embedded at the tip of the blind cane used by the visually impaired. By reading the signals reflected from REID tags installed inside the tactile paving, it can provide voice instructions via a smartphone to lead the way.

Other exhibits like a mobile phone application which works with a headphone for the hearing impaired; and an eight-seater autonomous electric vehicle imported from the United States are on display. A Japanese-made mechanical armour, commonly known as "construction site Iron Man" was introduced which workers can use to reduce waist pressure by 15 kg when lifting heavy weights; a training program on construction site safety via VR technology; and a cute robot called Zero Carbon Boy which can interact with visitors are all of interest.

I look forward to more innovations for the people in need to improve the well-being of mankind.

*An electronic copy was originally posted on *Ecozine* titled "Smart City Technologies" on 28 June 2017.

Smart City 3.0



Chapter Six: Smart Mobility

What kind of changes will the unmanned era bring us?
How can we benefit from the flying car?
When faced with the increasingly serious air pollution, some cities have come up with alternative ways of travel which are worth our consideration.

Smart city should be People-oriented

The Hong Kong Government launched a consultative study on the *Smart City Blueprint* in late 2016. The objective of such a study is to establish the direction and standard for the city's future development, including information and communication technology infrastructure and public-private partnership, etc. The Smart City Consortium (SCC), a non-governmental and non-profit organisation, hoped to provide a solid reference for formulating the relevant Government's policy, therefore we carried out a five-week consultation in August, to consolidate public views and industry opinions on smart city development. As a result, we submitted an interim report to the Government in October 2016.

During the consultation process, we were pleased to see that many people and organisations had great visions for the future, they have made a number of substantial recommendations. The interim report combines both overseas experiences and local ideas for the Government's consideration. Most importantly, the report sends out a coherent message of a people-oriented and a sustainable future. Although technology is the key, we shall not forget the original intention of building a smart city to serve the people.

Sweden's success story

What is the principle of people-orientation? Over the past few decades, Hong Kong people have been striving with the Lion Rock Spirit, we are used to believing in "development is an unyielding principle" which has always created prosperity with the scarce resources available. Today, the affluent society is stagnant due

to lack of competitiveness, our young people are agitated at the crossroads. At this point of time, Sweden's Vision Zero which was launched nearly 20 years ago, gives us a timely guideline.

According to the World Health Organization, traffic accidents ranked the ninth highest cause of death in the world, killing more than one million lives a year. However, cars are a necessity in modern society. In Sweden, the number of private cars has increased from an average of 200 to 300 thousand a year in the past ten years, to a total of 4.7 million in 2016. However, there was no increase in casualties despite the increase in vehicles. The number of Swedish cars has doubled since 1970, similar to that of the United States while the number of deaths from traffic accident per 100,000 inhabitants is as follows: 11.4 in the United States, 5.5 in the European Union, and 2.6 in Sweden.

Sweden has such an impressive record mainly due to the Vision Zero policy passed by their Congress in 1997. The policy

> *Today, Hong Kong as an affluent society is stagnant due to lack of competitiveness, our young people are agitated at the crossroads. At this point of time, Sweden's people-oriented Vision Zero launched nearly 20 years ago, gives us a timely guideline.*

aimed at eliminating casualties in traffic accidents. The idea is very simple: (i) life is more important than anything; (ii) people may make mistakes, but the traffic system should not.

People-oriented spirit

Therefore, Sweden, when in the planning of roads, safety overrides speed and convenience. For example, there is a more stringent speed limit in urban areas, more pedestrian zones established, use of a railing to separate the bicycle path and the road; there is strict law enforcement in regard to driving after drinking alcohol. As of 2013, drink-driving related deaths were less than 0.25%. This contrasts with Hong Kong where the figure was 0.48% in 2015.

Sweden is continuing its goal of zero traffic casualties. Moving forward, the next step is to reduce human negligence, such as installing built-in alcohol breath test equipment in vehicles to warn

drivers before driving and developing unmanned vehicles.

With so much introduction for Vision Zero, I want to show you that, with the people-oriented principle in mind, there's no boundary to smart city's development.

We are convinced that Vision Zero is not only applicable to transportation, it is also ultimately a goal for our smart city development.

*An electronic copy was originally posted on *ComputerWorld* titled "Lessons learned from Sweden's Vision Zero smart city principle" on 8 November 2016.

Give smart transport a green light

When you are driving in a rush (perhaps to an important meeting or a child's graduation ceremony) and every traffic light is red, you will get more and more frustrated when there seems more and more red lights ahead... According to a report released by the Texas A&M Transportation Institute (TTI) of the United States in 2015, Americans could spend 48 minutes, on average, for an original 20-minute drive due to traffic congestion. Looking back 35 years, in 1982, the delay on the roads was 18 hours in a year, it more than doubled to 42 hours by 2014.

TTI estimated that the US in a year consumed 3.1 billion gallons of gasoline more and lost 6.9 billion hours due to traffic congestion, resulting in traffic costs of up to US$160 billion (about HK$1,245 billion), the loss on average per person is US$750

> *"Implementation of smart city services in Hong Kong would benefit people's livelihood, and also allow Hong Kong to have a share in the huge market. Therefore, we should speed up our smart city development plan."*

(HK$5,800). Furthermore, from 2013 to 2014, 95 out of America's 100 largest metro areas saw increased congestion. In the previous year only 61 did so, the problem of traffic congestion is getting more and more serious.

AI to smooth traffic flow

Due to a lack of real-time information, many people, enterprises and even governments cannot fully utilise or effectively use public facilities. In recent years, the US Department of Transportation (DOT) introduced smart traffic lights, or the adaptive signal control technology, to collect real-time traffic data through roadside sensors, so as to adjust the traffic lights. The DOT pointed out that with such implementation, travel time could be reduced by more than 10%, saving gasoline while the air quality could be improved as well.

TOMTOM, the Dutch traffic navigation service provider announced the global traffic congested city rankings in 2017,

Hangzhou ranked 16th in the world, 7th in China (Hong Kong's world ranking was 44th). Alibaba's AliCloud, launched the Hangzhou City Brain, in collaboration with the Hangzhou government to alleviate traffic congestion. Through big data, cloud computing, artificial intelligence (AI) and image recognition technology, and 50,000 video cameras at the roadside for real-time control of traffic lights, such as extending the green light when the system detects a vehicle approaching, driving time is reduced by as much as 11%. Other places like Macau also introduced similar technology in August 2017.

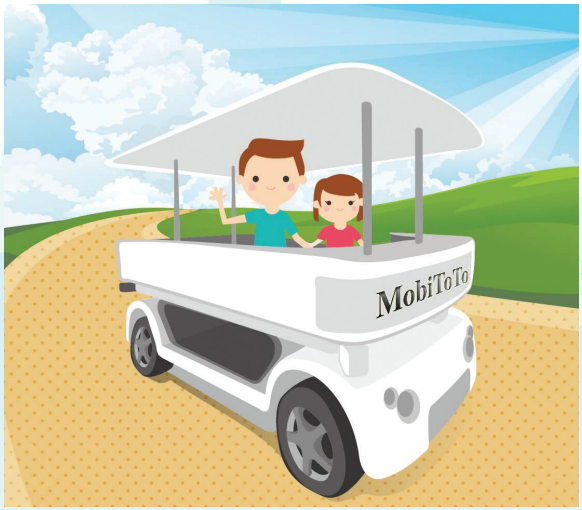
Apart from smart traffic lights, many places have successfully implemented smart city technologies, such as smart parking, digital tourism, smart grid and geo-technology, with impressive results. A recent consultancy report commissioned by the Government also recommended such measures to improve people's livelihood.

Huge business opportunity

At the same time, according to the estimate of the research company, International Data Corporation, the annual market demand for smart city technology in the Asian market alone will reach US$1 trillion before 2025; while another research organisation, Navigant Research, also predicted that by 2026, the global investment in smart transport, including smart traffic management through the Internet of things, more sophisticated traveller information services and transportation mode recommendations, will be as high as US$17.5 billion, compared with US$6.6 billion in 2017, an increase of nearly three times. Implementation of these smart services in Hong Kong would benefit people's livelihood, and also allow Hong Kong to have a share in the huge market. Therefore, we should speed up our smart city development plan.

*A hard copy was originally published in *South China Morning Post* titled "Give traffic tech a green light" on 9 October 2017.

Marching towards the automated driving era



Today, all the world's major automobile manufacturers, such as: BMW, Mercedes-Benz, Volvo, Audi, Honda, Toyota, and even the digital giants, including: Apple, Baidu, Microsoft, Samsung, etc., have indicated their intention to launch autonomous vehicles (AVs).

However, their definitions of "automation" are different. The SAE International Association defines six levels of automated driving, according to the level of human participation: the highest three levels of full automation are without human monitoring, such as the level of High Automation, claiming that the driver can sleep while travelling.

We have heard of AVs for a long time, when can we have it? It is said that Tencent will first market a small quantity of AVs by the end 2018 or early 2019. Many automobile manufacturers also claimed that they would launch these vehicles (including models without a steering wheel or pedals) before 2021.

Autonomous driving has a long way to go

Beginning in April 2017, Waymo, the Google self-driving spinoff, publicly invited hundreds of residents in Phoenix, United States, to try unmanned vehicles. They can drive in an area equivalent to double San Francisco, that is, one and a half times as big as Hong Kong Island. Over the past eight years, Waymo has accumulated more than three million kilometres of driving records on public roads. However, according to *Car Advice*, an online platform for editorial reviews of new cars, the data as at the end of 2016 showed that on average, Waymo cars need human intervention in every 8,000 kilometres of driving in order to prevent an incident.

The figure is higher than the average accident statistics in the US. According to the US Department of Transportation, the traffic accidents in 2015 killed 35,000 people and over 2 million people were injured. The figures seem astonishing, but do not forget the average annual mileage of Americans is 300 billion, the accident rate is 1.12 deaths and 76 injured per 100 million miles. Therefore, Waymo's safety record is not promising in comparison.

AV for consumers after mid 2020s

McKinsey, a consulting company, previously interviewed over 30 European, American and Asian experts to come up with a more realistic timetable:

From now to the mid-2020s - AVs would not be available to consumers. Priority will be given to industrial fleets, such as mining and agriculture, driving within a relatively well-defined environment; then to the driving of trucks on highways; and then to the commercial fleets that deliver mails.

> *McKinsey anticipated that the time saved in commuting with autonomous vehicles would be as much as one billion hours per day across the world. More free time helps to unlock our creativity.*

It is estimated that by the mid to late 2020s, AVs will be introduced to the consumer market. It will take several more years for the AVs to become popular. This estimation is similar to the customer survey published in 2017 by Gartner, another consulting firm, which interviewed 1,500 Americans and Germans. More than half of them expressed concern on the safety of AVs. With limited demand at the early phase, the price of each AV can be as high as US$100,000 (HK$780,000) initially. Also, the road authorities could take years to develop relevant regulations. These factors make us believe that automated driving could only be used by the public by 2025 or after with various promotions offered by the automobile manufacturers.

More free time to unlock creativity

Although it will take a decade or more for this mode of driving to go mainstream, we could imagine that the AVs will have a significant impact to our everyday life. One of which may be the increase of leisure and entertainment time.

McKinsey anticipated that the time saved in commuting with AVs would be as much as one billion hours per day across the world, enough to build two Great Pyramids of Giza! The value of this extra time is surprising, for example, it is estimated that every extra single minute of leisure time per person a day, could bring over US$6 billion revenue for the world's digital media. At the same time, more free time also helps to unlock our creativity.

In addition, air quality would be improved as the AVs will be automatically optimized, and carbon dioxide emissions are expected to be reduced by upto 60%.

Softer car to protect pedestrians

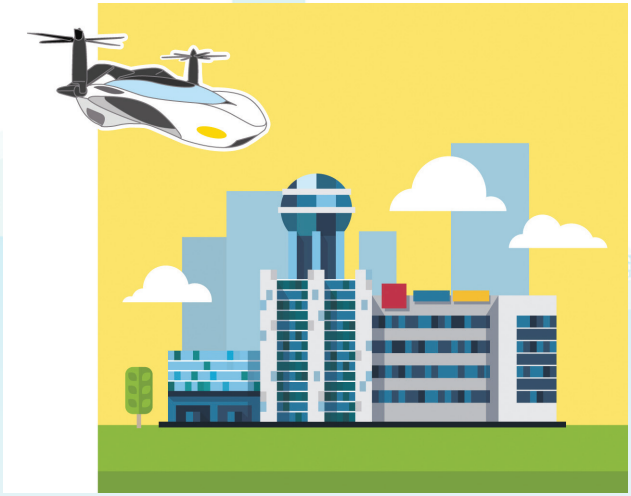
The most important benefit is that accidents will be substantially reduced to 10% of the existing figure. In the US, a single fatal traffic accident could cause one deceased, eight hospitalized, and 100 treated and released from emergency rooms. In 2012, traffic accidents cost the country US$212 billion. With a decrease in accidents, the US could save around US$190 billion a year.

Google previously applied for the patent of an automatic adjustment for the vehicle's impact characteristic - in a crash, if a hard object like a car is detected at the instance of impact, the vehicle's body will become stiff; if it is a human, the vehicle's body will "loosen up" to ease the impact of the crash.

Later, we may sigh with relief for having less misery from traffic accidents.

*An electronic copy was originally posted on *Ejinsight* titled "Autonomous driving era: We may have to wait a bit longer" on 31 October 2017.

The future mode of mobility is about to come true



Traffic congestion and air pollution are two of the major problems in almost all cities. They have inspired scientific and technological innovation. For example, the flying car is considered a possible solution.

Flying car: Japanese, German, Gulf version

The Olympic Games Tokyo 2020 will be applying various future technologies, the most fascinating one is a flying car. A Japanese company is developing a one-seater jet. It is light, easy to operate without the need of a driving license, and enables one to avoid traffic congestion during the Olympic Games. The price of this flying car is ¥5 million (HK$350,000), it can be used in the air

and on land, with three tires for ground traveling, and propellers for flying. It can fly at 10 to 20 meters high, the highest speed on the ground and in the air is 150 km per hour.

Apart from Japan, in Munich four young persons founded an aviation startup in 2015 to develop a flying car. The electric flying taxi weighs only 25 kg, can take-off and land vertically, top speed of up to 300 km per hour and is claimed to generate noise quieter than a motorcycle. In 2017, after a successful test of a prototype with two seats, the company proceeded to develop a five-seater jet. Tencent and the founders of Twitter are among its new investors. It is expected that this pilotless flight can be launched officially by 2025.

Dubai is also developing flying cars. At the Gulf Information Technology Exhibition in September 2017, a flying taxi was exhibited. The local regulatory body believes that by 2022, technology and regulations will be mature enough to enable the

> *"I hope that the Policy Address will be able to encourage young people and industries to adopt innovative technologies, so that we can jointly improve the environment and promote the economy."*

new invention to be launched in the market. Each flying car will be priced well over US$200,000 (about HK$2 million). It is surely a luxury item.

Hydrogen as a clean fuel

Meanwhile, energy supply and air pollution are both global problems. Hydrogen is the most abundant element in the universe and readily available in the form of water on earth. It is easy to be isolated in a form that can be used, and hydrogen as a fuel provides clean energy. However, the current method of extracting hydrogen from water is energy consuming and therefore not cost effective.

Elon Musk from Tesla described the idea of using hydrogen as a fuel "incredibly dumb". However, there is now a turning point: at the end of September 2017, US scientists reported a new photocatalyst process which can store solar energy in hybrid

nanomaterials in the journal *Energy and Environmental Science*. They presented a method by which can extract hydrogen from seawater at low cost, thereby increasing the feasibility of hydrogen as a fuel.

In fact, many countries are also developing hydrogen as a fuel, the Japanese government is one of them. The Tokyo Metropolitan Government will invest ¥40 billion (about HK$2.7 billion) to build hydrogen refuelling stations and the related infrastructure - hydrogen refuelling stations are costly, about ¥500 million (about HK$34 million) each, five times the cost of a petrol station. This is because hydrogen is inflammable and must be stored in the form of liquid under high-pressure. Thus, the installation, handling and storage of hydrogen, and the pipeline for conveying it are expensive.

However, the Japanese government is determined to invest in the new energy to reduce environmental pollution; this can also

drive the economy. These hydrogen refuelling stations will be increased from eight currently, to 35 by 2020. That means, there will be one refuelling station for every 15-minute drive in Tokyo, and the number of hydrogen fuelled vehicles is expected to increase to 6,000.

At the same time, the Japanese government expects that the country's demand for hydrogen and other fuels will reach ¥1 trillion (about HK$70 billion) by 2030, and increase to ¥8 trillion by 2050. Meanwhile, many countries are also committed to the R&D of the new fuel. Norway has the opportunity to surpass Australia to secure this huge market. The country is currently offering a cubic meter of hydrogen fuel at ¥24 (HK$1.7), much more competitive than the nearly ¥30 (HK$2) offered by Australia.

China plans to replace diesel

The Ministry of Industry and Information Technology in

mainland China issued a draft proposal at the end of September 2017, advocating vehicles to use new energy starting from 2019 and gradually replace the traditional diesel to reduce air pollution. This has a great impact on many car manufacturers. For example, among the 1.25 million Honda cars sold in China in 2016, none of them were electric or hybrid cars.

Will hydrogen fuel become a major energy for vehicles in the future? Will flying cars be seen everywhere? Let us wait and see. I hope that the *Policy Address* will be able to encourage young people and industries to adopt innovative technologies, so that we can jointly improve the environment and promote the economy.

*Two electronic copies were originally posted on *Ejinsight* titled "The future of mobility: Flying cars the answer to traffic woes" on 8 November 2017, and "Coming soon: Hydrogen as a clean but cheap fuel" on 14 November 2017 respectively.

Promoting walkability in urban areas

Fitch International, a credit rating agency, pointed out that on average each car spends 96% of its usable life parking. When the cost of maintenance, depreciation, insurance and other running costs are added together, cars are the most underused asset consumers own.

According to the World Health Organization, seven million people die prematurely each year due to air pollution, that is, one eighth of all deaths being caused by air pollution. It is acknowledged that car emission accounts for 25% of the pollutants concentrated mostly in urbanised areas.

Although the electric car and hybrid car have been here for a couple of decades, they only account for less than 2% of new car

sales in many parts of the world. It is anticipated that these cars might represent half of the vehicles in the United States only after 2035.

Cities that plan to go car-free

At the same time, there are ideas of changing the city to one full of pedestrian areas or cycling tracks.

The pioneer of such an idea is the city council of Copenhagen, Denmark. Early in the 1960s, the city had designated pedestrian zones. Today, the capital has over 200 miles of cycling track, and the car ownership rate is the lowest among European countries. The latest plan was to build 28 cycling thoroughfares to connect surrounding towns. The first one was opened in 2014, while over 11 thoroughfares will be completed by 2018. At the same time, the city has targeted to reach zero carbon emissions by 2025.

In 2014, Paris began to restrict the use of roads to alternate days according to even or odd car registration numbers, and achieved a reduction in air pollution by 30% immediately. This encouraging result has led to other measures to reduce emissions being introduced which included prohibiting all cars manufactured before 1997 to enter the city on weekdays starting from mid-2016; car-free day; and to multiply the number of cycling tracks by 2020.

In London, the mayor planned to ban diesel vehicles by 2020, some areas of the city charge diesel vehicles ten pounds (about HK$100) for entrance during peak hours now. In Oslo, Norway, it planned to permanently ban private cars in the capital by 2019 and to replace them with public transport. The measure will be extended to other cities nationwide six years thereafter.

In the Mainland, there is a pioneering project of building a green satellite city for 80,000 inhabitants in a suburb of Chengdu. The project is handled by a Chicago-based architectural design

> *"I hope that Hong Kong can strike a balance between cost effectiveness, comfort, practicability and a sense of beauty. By doing so, living in our city would be more comfortable and the spirit of a smart city can be realised."*

firm. When completed in 2020, the city will consist of residential buildings, shopping malls, office towers and hotels, etc. The city design adheres to green concepts with a car-free zone, it only takes 15 minutes to walk from city centre to the suburbs.

Street connectivity linked to city prosperity

The United Nations pointed out that a well-planned city should have 30% to 35% of land available for streets and public areas. At the end of 2016, Civic Exchange, a local think tank had assessed Hong Kong's current state of pedestrian environment in different areas based on population density, traffic flow, hilly topography and connectivity to nearby destinations. A "walkable" city is defined as urban areas that have adequate provision to encourage people to commute by walking rather than by cars. Public and expert opinions were consolidated in the assessment.

Central is one of the chosen places for auditing. It is found that its "walkability" is medium. Although it is accessible from all sides, the walking experience is not quite interesting. While Choi Hung Estate, another place reviewed, is highly rated. Its walking trail has good linkage, clear signage, and close connection to the MTR. There are also chairs for rest, as well as greenery and local stores along the way. It also imposes a speed control of vehicles within the area fostering a sense of safety. This is an example of a well-designed community that most people are looking forward to.

I hope that Hong Kong can strike a balance between cost effectiveness, comfort, practicability and a sense of beauty. By doing so, living in our city would be more comfortable and the spirit of a smart city can be realised.

*A hard copy was originally published in *South China Morning Post* titled "Steps to make HK walkable" on 6 November 2017.

Epilogue

We are going through the 4th industrial revolution.

The 1st industrial revolution began in the mid-18th century with steam power when railway and textile machinery were invented.

The 2nd industrial revolution emerged in the late 19th century with electricity gaining popularity, rapid industrial development, and large-scale production emerging.

The 3rd industrial revolution was in the last century, the 1980s, with computers and the Internet emerging which brought about the Internet age.

A revolutionary leap

I had the chance to witness and experience the change from paper maps to digital maps, utilising a geographic information system (GIS), a change that was not gradual but a revolutionary leap. Today, paper maps still exist, but most have become collectables,

like watches considered as accessories rather than time keepers nowadays.

What will the 4th industrial revolution look like? Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, once described it as a "tsunami" that would have all-round impacts on humanity. It is driven by advances in artificial intelligence (AI), robotics, autonomous vehicles, 3D printing, nanotechnology and other areas of science. The enormous change brought about by these technologies will destroy employment and wipe out much of the middle class.

Challenges ahead

"Think beyond automation" is the first-ever advice given to governments and business leaders in *The Global Talent Competitiveness Index 2017: Talent and Technology* from INSEAD (or European Institute of Business Administration).

The over 350-page report analysed the technology challenges faced by 118 countries, whether they are ready at all levels, like nurturing and attracting talent through education and labour policies, collaborating with different sectors and technological progress. The report makes a number of recommendations.

The report also forecasted that many of the existing skills will become outdated. Governments and enterprises need to enhance people's skills and carry out re-training. The process of adaptation will not be smooth.

Creativity unique to human

I believe that human beings have the unique characteristics that enable their continual existence.

I remember the event of Ke Jie, the World Go champion, being fully defeated by AlphaGo, an AI software in 2017. Pro. Yang Qiang, an AI expert from HKUST said that South Korea's Lee Sedol

might be the only person in the world who had ever defeated the AI. Mr. Lee himself expressed his view after watching the game between Ke Jie and AlphaGo that there was no way for a human being to defeat AI or to succeed through conventional approaches. We needed to invent unprecedented and creative ways. Actually, innovative moves won Lee Sedol one game in the match held in 2016.

Kai-fu Lee, an AI expert and Jack Ma from Alibaba talked about the future earlier, Lee said, "When making full use of AI, the synergy of man and machine will be greater than 1+1. The key is that humans need to enrich their hard skills, that is, to have comprehensive knowledge and also good communication skills, and team spirit". Ma also said that only people-oriented work will not be replaceable by machines.

Creativity, communication skills and excellent emotional quotient are uniquely human. To the middle aged and the millennial generation, let us work harder together!

Bilingual Glossary

Book Title

	Smart City	智慧城市

Chapter One: Smart People

From STEM to STEAM	science, technology, engineering & mathematics (or STEM) education	科學、科技、工程和數學教育（簡稱STEM）
	STEM + Art = science, technology, engineering, art & mathematics (or STEAM) education	科學、科技、工程、藝術和數學教育（簡稱STEAM）
	virtual reality (or VR)	虛擬實境（簡稱VR）
	augmented reality (or AR)	擴增實境（簡稱AR）
	geographic information system (or GIS)	地理資訊系統（簡稱GIS)
Promoting coding education in Hong Kong	coding or computer programming	電腦程式編寫（簡稱「編程」）
	word processing	文書處理
Artificial intelligence transforms classroom learning	artificial intelligence（or AI）	人工智能（簡稱AI）

Hong Kong should boost tech spending amid global AI talent contest	McKinsey Global Institute (or MGI)	麥肯錫全球研究所（簡稱MGI）
	Association for the Advancement of Artificial Intelligence（or AAAI）	美國人工智能協會（簡稱AAAI）
	International Joint Conference on Artificial Intelligence（or IJCAI）	國際人工智能聯合會議（簡稱IJCAI）
Women can hold up half the sky of smart city	soft skill	軟技巧
	hard skill	硬技能
	programmer	程式編寫員
	Map in Learning Program	Map in Learning計劃

Chapter Two: Smart Economy

Exert the power of crowdfunding	crowdfunding	眾籌
	equity crowdfunding	股權式眾籌
	Jumpstart Our Business Startup Act (or *JOBS* Act)	《JOBS》法案
The sharing economy is not a zero-sum game	sharing economy	共享經濟
Future jobs already here	sensor network	感應器網絡
	Internet of things (or IoT)	物聯網（簡稱IoT）
	big data	大數據
Artificial intelligence releases human potential	chatbot	聊天機械人
	deep learning	深度學習
	querying method	查詢方式
	context-aware processing	情境感知處理
	Artificial Narrow Intelligence (or ANI)	狹義人工智能（簡稱ANI）
	Artificial General Intelligence (or AGI)	廣義人工智能（簡稱AGI）
	Artificial Superintelligence	超級人工智能

Emotionally intelligent robot	affective computing	情感運算
	Texas hold'em	德州撲克
	imperfect information game	不完全訊息博奕
	combinatorial auction	大型組合拍賣
	machine learning	機器學習
Encouraging talents to converge on Hong Kong	Kashiwa-no-ha	柏葉
	Kashiwa-no-ha Open Innovation Lab (or KOIL)	柏葉開放創新研究所（簡稱KOIL)
	Iskandar Malaysia	依斯干達經濟特區
Don't miss out on the Islamic FinTech opportunities	financial technology (or FinTech)	金融科技（簡稱FinTech）
	Shariah-compliant	伊斯蘭教義
	Pew Research Center	皮尤研究中心
	EY（formerly Ernest & Young）	安永會計師事務所
	International Trade Administration (or ITA)	（美國）國際貿易局（簡稱ITA）
	Financial Conduct Authority (or FCA)	（英國）金融服務監管局 (簡稱FCA）

Chapter Three: Smart Environment

Training and regulation are crucial to tree management	*Parks and Trees Act*	《公園及樹木法令》
	Green Tokyo Plan	《東京綠化計劃書》
	Tree Adoption Program (or TAP)	樹e護計劃（簡稱TAP）
Enhancing energy efficiency through old building renovation	SmartAirCon	智能空調控制裝置
Brainstorming our green future	BEAM Plus	綠建環評
	Green Mark	綠色建築標誌
	Green Mark Incentive Scheme	綠色建築津貼計劃
Esri Young Scholars Award: Detecting noise pollution in old districts	Esri Young Scholar Award	Esri 青年學人大獎

Chapter Four: Smart Government

Small data leading to big change	Hong Kong Applied Science And Technology Research Institute Company Limited (or ASTRI)	香港應用科技研究院（簡稱應科院）
	Chief Data Officer (or CDO)	首席數據官（簡稱CDO）
	interoperability	協同工作能力
	Mayor's Dashboard	市長的儀表板
	application programming interface (or API)	應用編程介面（簡稱API）
	digital by default	開放數據並附API成指定動作
Smart city: Better quality of life, move business opportunities	eID	數碼個人身份
Learning from overseas experience in electronic identity	blockchain	區塊鏈
	mobile-id	手機身份
	smart-id	智能身份
	e-residency	電子居留權
	national digital identity (or NDI)	國家數碼身份（簡稱NDI）
	public key infrastructure (or PKI)	公共鑰匙基建（簡稱PKI）

Chapter Four: Smart Government

Learning from overseas experience in electronic identity	short message service (or SMS)	短訊
	Trusted Digital Identity Framework (or TDIF)	「可信賴數碼身份框架」（簡稱TDIF）
	Know Your Customer (or KYC)	認識你的客戶（簡稱KYC）
	Smart Nation	智慧國家
Smart city earns you one extra hour every day	City Initiatives for Technology, Innovation and Entrepreneurship (or CITIE)	科技、創新及企業家精神的城市倡議（簡稱CITIE）
	dataset	數據集
	hackathon	編程馬拉松
	Kalasatama	芬蘭赫爾辛基一小區
Opening up spatial data can boost creativity	Office of the Government Chief Information Officer (or OGCIO)	政府資訊科技總監辦公室（簡稱OGCIO)
	common spatial data infrastructure (or CSDI)	空間數據共享平台（簡稱CSDI）
	Global Spatial Data Infrastructure (or GSDI)	全球性空間資料基礎建設（簡稱GSDI）
Women can play a major role in smart city development	Smart Dubai	智慧杜拜
	Dubai Pulse	杜拜脈搏

Chapter Five: Smart Living

How to engage Private-Public-People-Partnerships	Public Private People Partnership (or 4P)	官商民合夥（政府、私營機構和市民結成夥伴，簡稱4P）
Be the master of your mortality	Caregiver Syndrome	照顧者綜合症
When a loved one is dying, advance directives matter	advance directive (or AD)	預設醫療指示（簡稱AD）
Promoting IoT is key to smart city development	Global Positioning System (or GPS)	全球定位系統（簡稱GPS）
	E-lock	電子鎖
	low latency	低延遲
	Data.gov.hk	一線通
New approach to cybersecurity	ransomware	勒索軟件
	malware	惡意軟件
	DoubleAgent	雙重間諜
	gateways	網關
Co-operation amongst government, industry, academia and research sectors	radio frequency identification (or RFID)	無線射頻識別（簡稱RFID）

Chapter Six: Smart Mobility

Smart city should be people-oriented	Smart City Consortium (or SCC)	智慧城市聯盟（簡稱SCC）
	Vision Zero	願景：交通零傷亡
Give smart transport a green light	Texas A&M Transportation Institute (or TTI)	美國德州運輸研究所（簡稱TTI）
	adaptive signal control technology	可調校交通燈信號技術
Marching towards the automated driving era	SAE International	國際汽車工程師協會
Promoting walkability in urban areas	walkability	好行度
	Fitch Group	惠譽國際

Epilogue

	Institut Européen d'Administration des Affaires（or INSEAD）	歐洲工商管理學院（簡稱INSEAD）
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About Dr. Winnie Tang:

Dr. Winnie Tang JP is an Honorary Professor in the Department of Computer Science at the University of Hong Kong (HKU). She is one of the locally-bred IT entrepreneurs of Hong Kong. In the 1990s, Dr. Tang founded Esri China (Hong Kong) Limited to develop and promote Geographic Information System (GIS) software and solutions. She is also the Founder and Honorary President of Smart City Consortium.

Over the years, Dr. Tang has been actively advocating the use of technology and sharing her views regarding the ICT industry, eHealth, environmental conservation, entrepreneurship and smart city through her services in government and non-government organizations in Hong Kong. She has published nine Chinese and English books and over 400 research papers, newspaper articles and journals, mainly published in the local Chinese media, such as *Hong Kong Economic Journal, Hong Kong Economic Times, Recruit* as well as the English media, such as *South China Morning Post, Harbour Times, ComputerWorld, Ejinsight,* etc.

In recognition of Dr. Tang's outstanding contributions to society, she was recognised as one of the Distinguished Alumni by the Faculty of Science of HKU in 2009. In the same year, she was also appointed as Justice of the Peace (JP) by the Chief Executive of the Hong Kong SAR Government. In 2006, Dr. Tang was recognised as one of the Ten Outstanding Young Persons by the Junior Chamber International Hong Kong (JCIHK). In 2004, Dr. Tang received the Young Achiever of the Year in the Women of Influence award presented by the American Chamber of Commerce.

- By 2020, the tsunami of the ageing problem will arrive – the world's population aged over 60 will outnumber children under five;
- By 2030, city governments around the world will face enormous pressure – urban areas are projected to house 60% of people globally;
- Now, global warming is truly happening – the temperature in recent years frequently breaks the hundred year record;
- By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that do not yet exist at present.

The smart city initiative aims to deal with all kinds of large and small challenges with information technology playing an important role. Today, the concept of smart city development has swept around the world, we must gather all parties' effort to achieve the smart city vision.

This book describes the applications and potential of future technologies, how the technologies can change our lives, and the challenges and solutions from six perspectives, namely smart people, smart economy, smart environment, smart government, smart living and smart mobility.

Dr. Winnie Tang has over 20 years of experience in the IT industry and has been actively involved in social affairs. In order to promote the smart city, she founded the Smart City Consortium (SCC) in 2016, bringing together professionals from different sectors. Through this book, she explores the implications of new technologies to our smart city development, hoping to connect kindred spirits, especially young people, to build Hong Kong as a world-class smart city. This is exactly the core value of smart city 3.0, where public participation is the essence.

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