



GLOBAL SMART SOLUTION REPORT 2019

City Challenges and Innovations

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Foreword



• Gino van Begin

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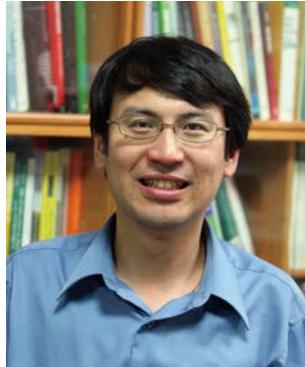
In a rapidly changing world cities are exploring solutions to respond to citizens' needs and address urban development challenges in a smart way. Digital technologies integrated with urban management systems and infrastructure represent a great opportunity for cities to use resources efficiently, deliver a higher quality of life and ultimately become more 'smart and sustainable'.

For ICLEI, a Smart City is about much more than technology. It involves a cooperative process that integrates networking, engagement and innovation among governments, citizens, businesses and non-government organizations. With the overarching goal of creating sustainable cities, ICLEI supports local governments to look at the bigger picture of 'smartness', taking into account overall urban governance and to ensure an approach that is people-focused, inclusive and transparent.

The 2019 Global Solution Report is a selection of Smart City projects from all over the world, working towards core values of urban livability and sustainability. From the Asia-Pacific region to Europe, the 12 selected cities demonstrate a variety of innovative solutions in energy, transport and infrastructure. They share their enlightening strategies on how they engage citizens and different stakeholders that truly enable the realization of the projects.

Making such experience-based stories and best practices openly available is crucial to support fellow cities facing similar challenges and searching for practical guidance. ICLEI offices work together with local government and stakeholders from various sectors to share and adopt smart solutions. It is our mission to help cities navigate the digital transition by building strategies and developing leadership capacities in line with the SDGs.

As the definition of smart city continues to evolve, ICLEI endeavors to spread a sustainability-centered model of smart cities by employing a systematic approach. This report provides a valuable reference for policy makers and city officials to identify smart solutions, set action plans and map indicators. With the aim of facilitating the 'smart' transition to a sustainable city, we hope you will find the case studies in this publication informative with tangible ideas, replicable across the world.



● **Tze-Luen Alan Lin**

President of International
Climate Development Institute

When the Paris Agreement was adopted by UN parties in December 2015, it reflected the worldwide consensus that climate change is an urgent issue and has caused severe threat in many parts of the world. Among various human living environments, cities are the ones that face the highest risk. Based on a variety of evidence, human activities are changing the climate in ways that increase the risk to cities, and cities and their citizens have already begun to experience the effects of climate change. This highlights the importance of building up urban sustainability in cities on the front lines of climate change.

As one of the leading institutes concerning the right of development vis-à-vis climate change, ICDI is dedicated to the facilitation of urban sustainability in cities. Together with international organizations and local governments, our core focus is on helping cities establish cooperative networks around the world, and to support capacity building within local communities through innovative and people-oriented approaches. For this purpose, it gives me great pleasure to present the “Global Smart Solution Report 2019: City Challenges and Innovations”.

“Global Smart Solution Report 2019: City Challenges and Innovations” is an insightful review of policies, implementation and progress illustrated in case studies, and an overview of practical solutions which cities around the world have applied to achieve their goals of inclusive, safe, resilient and sustainable human settlements. The report highlights the diverse challenges that cities have faced, and the innovative actions which help cities address these challenges and further develop their own capacity through the utilization of ICT and IoT technology.

What also sets this report apart is its attempt to build linkages between the city cases and Sustainable Development Goals (SDGs). This is vital as it is widely recognized that the interlinked challenges of climate change and sustainable development must be urgently addressed to deliver a stable and secure world to future generations. To promote awareness among stakeholders and further inspire action, this annual publication will show how cities achieve urban sustainability with innovative solutions.

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Ashley is a junior studying Economics and Earth Systems at Stanford University. She is originally from Sugar Land, Texas. She loves asking big questions about the world and has an interest in global inequality and justice, sustainability issues, and thinking about how her own power and privilege contribute to this. Her time working for ICDI gave her exposure to many issues, including disaster resilience, smart cities, and international policy. She was able to take a rare and complicated worldview to produce impactful policy and project-based work. She also has experience working for the Social Entrepreneurship Corps in Nicaragua and is involved in many public service and social entrepreneurship initiatives at Stanford.



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Kaohsiung Capacity Center

ICLEI - Local Governments for Sustainability is the leading global network of more than 1,700 cities, towns and regions committed to building a sustainable future. By helping the ICLEI Network become sustainable, ICLEI impacts over 25% of the global urban population.

As the only ICLEI-recognized capacity center in East Asia, **ICLEI Kaohsiung Capacity Center** provides training, professional expertise and a variety of information exchanges to help cities in this region move towards sustainable development through action plans, regulations, policies, public environmental education, and international symposiums.



International Climate Development Institute

International Climate Development Institute (ICDI) is a non-profit organization which concerns the right of development under climate change. By providing its professional knowledge and skills to climate governance, this think tank engages in planning and implementing national climate policy with the PPP approach; supporting local communities and vulnerable groups in capacity building to achieve climate-resilient and sustainable lives.



Smart City Summit & Expo (SCSE) is jointly organized by Taipei Computer Association, Taipei City Government, and industry partners with the aim of presenting one-stop IoT solutions tailored to market needs. Through the networking of high-profile innovators and city leaders, this 4-year international exchange platform has initiated numerous cases of collaboration across industries and countries, addressing urban issues including transportation, mobility, healthcare, education, security, the environment, and building.

• List of Acronyms and Abbreviations

AR: Augmented reality	LGU: Local government units (Philippines)
CCTV: Closed-circuit television	MMDA: Metropolitan Manila Development Authority
CO2: Carbon dioxide	MVP: Minimum viable product
CO2e: Carbon dioxide equivalent	OECD: Organization for Economic Co-operation and Development
COP: Conference of the Parties by the UNFCCC	PM2.5: Particulate matter less than 2.5 micrometers in diameter
EPA: Environmental Protection Agency	PM10: Particulate matter less than 10 micrometers in diameter
EST: Environmentally sustainable transport	PPP: Public-private partnership
EV: Electric vehicle	PV: Photovoltaic
GHG: Greenhouse gas	UNFCCC: United Nations Framework Convention on Climate Change
GIS: Geographic information systems	USGS: United States Geological Survey
GPS: Global positioning system	SCSE: Taipei Smart City Summit & Expo
ICDI: International Climate Development Institute	SDG: United Nations Sustainable Development Goal
ICLEI: : International Council for Local Environmental Initiatives (Local Governments for Sustainability)	SOP: Standard operating procedures
ICT: Information and communications technology	TCA: Taiwan Computer Association
IEC: Information, education, and communication	TSI: The Southern Initiative
IoT: Internet of Things	UAV: Unmanned aerial vehicle
IPCC: Intergovernmental Panel on Climate Change	UHI: Urban heat island
ITS: Intelligent traffic system	UN: United Nations
KEPB: Kaohsiung Environmental Protection Bureau	WWTP: Wastewater treatment plant
KRTC: Kaohsiung Rapid Transit Corporation	
LCD: Liquid crystal display	
LED: Light-emitting diode	

Executive Summary

This is the Global Smart Solution Report for City Challenges and Innovations. The three co-launchers of the report embrace diverse, yet closely related perspectives on urban development. ICDI is concerned with the right of human development under climate change, while ICLEI KCC focuses on building a sustainable environment for urban populations. SCSE, as the leading summit and exhibition of the ICT industry in Taiwan, is dedicated to facilitating city adaptation via advanced technology. Together, we envision building people-oriented systems with ICT and IoT technology, which help cities around the world achieve urban sustainability under climate change.

This report presents a variety of cases demonstrating how cities in different regions cope with urban sustainability challenges with innovative solutions. As priority areas, sectors, and hazards differ from city to city, the temporal and spatial scale at which solutions can be applied will therefore vary significantly according to contextual factors. Through the launching of this report, we hope to provide a platform for cities to exchange experiences and facilitate cooperation to achieve urban sustainability.

Cities, Climate Change and Urban Sustainability

Cities, which are home to more than half of the world's population, face increasing environmental pressures and infrastructure needs. The global climate science research community has concluded that human activities are changing the Earth's climate in ways that increase risks to cities. According to a report released at the IPCC Cities and Climate Change Science Conference in Edmonton, Canada, cities around the world emit 70 percent of the world's carbon dioxide, and the number will likely increase when consumption emissions are included. This kind of human-caused climate change presents critical risks to cities beyond the familiar risks caused by natural variations in climate.

As cities grow in size and warming trends continue, the type and severity of challenges cities face change dramatically. Cities become warmer than their surrounding areas due to human activity, a phenomenon called the urban heat island effect. This phenomenon, combined with the warming climate, exacerbates air pollution in cities. Traffic congestion slows down travel and speeds up carbon emissions. Waste management infrastructure

faces difficulties keeping up with increased residential density. Furthermore, climate extremes such as heat waves, droughts, coastal flooding, and heavy downpours are expected to increase in frequency due to changing climate conditions.

It is therefore essential to consider what cities can do to enhance quality of life and social equity. In September 2015, the United Nations endorsed the new Sustainable Development Goal 11, which is to “make cities and human settlements inclusive, safe, resilient and sustainable.” As underlined in the Summary for City Leaders of the Urban Climate Change Network ARC3.2, this new sustainability goal cannot be met without explicitly recognizing climate change as the key component. Likewise, an effective response to climate change cannot proceed without understanding the larger context of sustainability.

This leads to our perspective on the definition of ‘Urban Sustainability.’ Various factors such as public health, efficient governance, economic vitality, and class equality all contribute to the long-term resilience of cities. This report tries to focus case studies centering environmental sustainability under the impact of climate change. However, with the understanding that cities function as complex, interdependent and integrated social-ecological systems, solution descriptions must remain attentive to economic, social, and cultural considerations which intersect with environmental impact.

‘Smart’ Solutions

In addition to the focus on environmental sustainability, the cases in this report also outline the application of ‘Smart’ solutions. As the ‘Smart City’ trend increases and gains popularity, city leaders have thought of smart city development primarily as injecting sensor data and high-tech command centers into infrastructure. Following this vision of focusing on physical, infrastructural elements, city governments have employed a technoscientific and predominantly top-down, managerial approach.

However, it is now becoming clear that that smart city strategies start with people, not technology. Instead of installing digital interfaces in traditional infrastructure or streamlining city operations, ‘Smartness’ is more about using technology and data purposefully to make better decisions and deliv-

er a better quality of life. Also, while good management is central to smart cities, companies and residents also play a critical role in shaping cities' performance. Therefore, in this report, 'Smart Solutions' are seen as a set of tools to reach the broader goal of improving urban sustainability, responding to public demand and involving the public in planning processes.

City Cases

A large proportion of this report provides a review of 20 geographically and thematically diverse city cases, which serve as examples of innovative practice in achieving urban sustainability. As mentioned previously, the purpose of this section is to propose a well-assorted array of urban solutions which exhibit a proactive stance towards challenges under climate change and actively encourage cities to communicate, discuss, and facilitate further cooperation.

Classified into three subsidiaries under 'Smart City', the cases of Stockholm, Kaohsiung, Auckland, Pasig, Taoyuan, Darkhan, Yokohama, and Tainan will offer a review of context-based strategies that are well-aligned with the multi-sectoral, multi-hazard, and multi-stakeholder understanding of urban sustainability put forward throughout the text. Prior to the official publication, the cases of Stockholm, Kaohsiung, Auckland, Pasig, Tainan, and Yokohama were selected as showcases in this brief version due to the more holistic and inclusive solutions provided. The brief version of the report will be introduced in the United Nations Climate Change Conference 2018, and the official report will be launched at the Smart City Summit & Expo 2019.

To bring more discussion and interaction into the report, seven experts from diverse fields with a common vision to promote urban sustainability were invited to form an expert panel. Each submitted case was reviewed by the expert panel on a rolling basis and received insightful comments. In addition, echoing the importance of the 2030 Agenda for Sustainable Development, the cases are linked to the 17 Sustainable Development Goals based on the challenges faced and the solutions adopted. The following provides the full list of the 17 goals.



Goal 1:
End poverty in all its forms everywhere



Goal 7:
Ensure access to affordable, reliable, sustainable and modern energy



Goal 13:
Take urgent action to combat climate change and its impacts



Goal 2:
Zero Hunger



Goal 2:
Promote inclusive and sustainable economic growth, employment



Goal 14:
Conserve and sustainably use the oceans, seas and marine resources



Goal 3:
Ensure healthy lives and promote well-being for all at all ages



Goal 9:
Build resilient infrastructure, promote sustainable industrialization and foster innovation



Goal 15:
Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss



Goal 4:
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all



Goal 10:
Reduce inequality within and among countries



Goal 16:
Promote just, peaceful and inclusive societies



Goal 5:
Goal 5: Achieve gender equality and empower all women and girls



Goal 11:
Make cities inclusive, safe, resilient and sustainable



Goal 17:
Revitalize the global partnership for sustainable development



Goal 6:
Ensure access to water and sanitation for all



Goal 12:
Ensure sustainable consumption and production patterns

1-1

City Challenges and Innovations-Background Information of the report

1-2

What is ‘Smart Urban Sustainability’ ?

1

Introduction

1-1 City Challenges and Innovations-Background Information of the report

Through rapid urbanization, cities have become crucial zones for human sustainability. More than half the world's population today lives in cities, and it is expected that another 2.5 billion people will join them by 2050. The trend of rapid urbanization can make the world's society and economy increasingly vulnerable to the impact of climate change. As highlighted in the New Urban Agenda adopted at the United Nations Conference on Housing and Sustainable Development in Quito, Ecuador in October 2016, "urban centers worldwide, especially in developing countries, often have characteristics that make them and their inhabitants especially vulnerable to the adverse impacts of climate change and other natural and man-made hazards."

Despite these increasing vulnerabilities and risks, this trend of rapid urbanization pushes forward the importance of the role of cities in human development. Also highlighted in the New Urban Agenda, "Given cities' demographic trends and their central role in the global economy in the mitigation and adaptation efforts related to climate change and in the use of resources and ecosystems, the way they are planned, financed, developed, built, governed, and managed has a direct impact on sustainability and resilience well beyond the urban boundaries".

During COP23, global and regional leaders issued the Bonn-Fiji Commitment, signifying the strong commitment and intention of local and regional leaders working in partnership with all levels of government to achieve the objectives of the Paris Agreement. Under this framework, numerous initiatives at the city and regional levels are already under way to address the challenges of mitigation and adaptation in areas of human settlement. To put these commitments and initiatives into practice and live up to sustainable development goals, it is essential to connect policy, science and business communities to explore "smart" solutions and facilitate real breakthroughs in tackling urban challenges.

Building on the momentum of the Taipei Smart City Summit & Expo 2018 (SCSE), ICIDI, ICLEI-KCC and TCA together launched the publication initiative — "2019 Global Smart Solution Report: City Challenges and Innovations" to showcase selected smart city achievements around the world.



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Introduction

1-1 City Challenges and Innovations-Background Information of the report

Through this publication, we hope to connect cities from different regions with similar urban challenges, and create a platform for these cities to exchange their experiences in addressing these challenges. Finally, we hope to facilitate a cooperative network among cities.



Introduction

1-1 City Challenges and Innovations-Background Information of the report



© Taipei Computer Association

Introduction

1-2 What is ‘Smart Urban Sustainability’ ?

1-2 What is ‘Smart Urban Sustainability’ ?

This report will outline smart solutions to urban sustainability challenges around the world. But what makes a city or solution “smart,” and what constitutes “sustainability”? A consistent evaluation framework requires arriving at an agreed definition of these often nebulous terms, a difficult task in itself. This section aims to explain the definitions and rationale utilized in the context of this report.

The “smart city” trend has gained rapid popularity in recent years, with wide-ranging definitions. In *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* by Anthony Townsend, a smart city is a “place where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems. Meanwhile, Antoine Picon in his book *Smart Cities: A Spatialised Intelligence* describes a smart city as “a city whose digital tools allow the optimization of its functioning and sustainability, as well as of its inhabitants’ quality of life and... relationships.” The common denominator of these various definitions is a city that integrates information and communications technology (ICT) into its infrastructure, operations, and decision-making processes.

However, after a decade of trial and error, municipal leaders are also realizing that smart city strategies start with people, not technology. “Smartness” is not just installing digital interfaces in traditional infrastructure or streamlining city operations. It is about using technology and data purposefully to make better decisions and deliver a better quality of life. Therefore, this report builds on a definition of smart solutions that incorporates ICT into a city’s infrastructure and institutions with the broader goal of improving urban sustainability. Such solutions must respond to public demand and involve the public in planning processes.

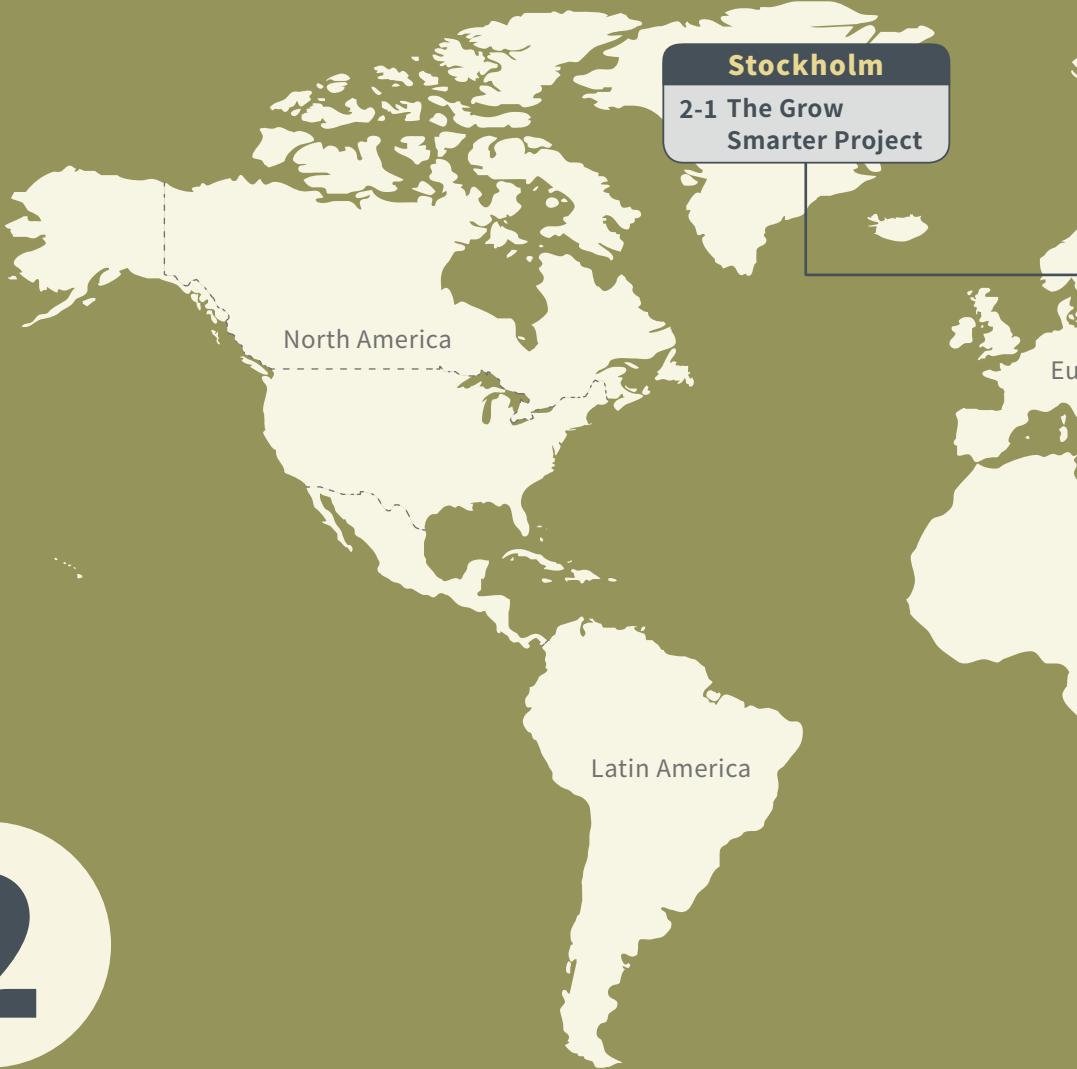
It naturally follows to clarify the concept of “urban sustainability” that this paper refers to. One popular model defined by Brendan Gleeson and Nicholas Low in 2005 is the “three-pillar” model of sustainability, in which sustainable development “is about the achievement on a global scale of three principles: economic development, social justice and ecological re-

Introduction

1-2 What is ‘Smart Urban Sustainability’ ?

sponsibility.” The United Nations Sustainable Development Goals are even broader, outlining 17 categories from “Zero Hunger” to “Climate Action.” Evidently, various factors such as public health, economic vitality, and class equality all contribute to the long-term wellbeing of a community.

This report will focus on case studies centering environmental sustainability under the impact of climate change. Specifically, this report will adopt John Morelli’s definition in the Journal of Environmental Sustainability: that environmental sustainability entails “meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them.” In the interest of collecting a focused set of case studies, this definition is certainly narrower than those proposed by Gleeson and Low or the UN SDGs. However, the solution descriptions remain attentive to economic, social, and cultural considerations as they intersect with environmental impact.



2

City Solutions



I

Integrated Solutions: Building Green Community

2-1 The Grow Smarter Project

 Stockholm City

2-2 Future City and the Next-Generation Community

 City of Yokohama

2-3 Green City in Transformation

 Kaohsiung City

The Grow Smarter Project

— Stockholm City



© GrowSmarter website

City Profile



Area: 188 km² (73 sq mi)
Population: 1,515,017

Common Sustainability Challenges in European Cities

European cities face common sustainability challenges regarding housing, mobility, and infrastructure. As rapid urbanization is an inevitable trend, cities need to become smarter to respond to citizen needs and to reduce their environmental footprint. As the population grows, urban mobility must address issues such as increased congestion and air pollution. There is a burning need to shift transportation habits from private cars to public transport, cycling or walking. There is also a need for smarter logistics as the flow of goods increases due to online shopping. Changing demographic structures are another issue, requiring not only more housing, but adjustments to existing housing to meet the needs of the increasing numbers of elderly people and single families. Construction during urban development

City Solutions

2-1 The Grow Smarter Project

Contributor:

Gustaf Landhl, Head of Dept.
Stockholm City & GrowSmarter
Coordinator

is also an important factor to consider, as the process usually requires massive resources and energy to tear down and rebuild infrastructure and housing. As a result, it's essential to consider how to most effectively renew infrastructure and housing with the smallest environmental impact.

Linking SDGs



Grow Smarter

Coordinated by the city of Stockholm, the GrowSmarter project brings together cities and industry to integrate and demonstrate "12 smart city solutions" in energy, infrastructure and transport, and to provide other cities with valuable insights on how they work in practice as well as opportunities for replication.

GrowSmarter's vision is to "transform cities for a smart, sustainable Europe" through smart technology. The goal is to ultimately reduce Europe's ecological footprint while continuing to modernize its cities. An important value in the GrowSmarter project is sustainability, which entails not only concern for the environment, but also economic and social factors too. Regarding environmental impact, GrowSmarter is committed to reducing energy usage and greenhouse gas emissions. In addition, this project improves the lives of people by providing more jobs, a greater selection of transportation, and a more efficient waste disposal system. At the same time, GrowSmarter contributes to a sustainable economy with increased cost efficiency while fostering economic growth



Grow-Smarter logo@GrowSmarter
Official Website

Overarching Smart Solutions

The GrowSmarter project demonstrates twelve smart solutions to be implemented in the three "Lighthouse" cities of Stockholm, Cologne and Barcelona. These solutions are split into three overarching themes. The figure and the table below categorize and briefly summarize each of the twelve solutions.

I. Low Energy District



Smart building shell refurbishment



Smart building logistics



Smart energy-saving tenants



Smart local electricity management

Smart building shell refurbishment

Problem

One-third of Europe's housing was constructed between 1950-1970

Solution

Refurbish old housing with smart building technology to reduce their energy usage by up to 75%

Smart building logistics

Problem

The transport of construction materials accounts for a high percentage of emissions

Solution

Implement a centralized logistics depot for more efficient transport; introduce eco-friendly transport vehicles

Smart energy saving tenants

Problem

Residents struggle to measure their energy usage and waste habits

Solution

Provide real-time information regarding energy usage and waste levels through smart technology; charge waste disposal, energy bills, etc. based on the amount each household pollutes, which encourages residents to be more environmentally conscious.

Smart local electricity management

Problem

National grids aren't responsive and are too dependent on changing weather conditions

Solution

Promote local energy production and storage investments such as vehicle to grid for EV and better control of electricity demand

II. Integrated Infrastructure



Smart street lighting



Waste heat recovery



Smart waste collection



Big data management

City Solutions

2-1 The Grow Smarter Project

Smart street lighting		Waste heat recovery	
Problem	Solution	Problem	Solution
Traditional lamp posts consume too much energy.	Implement LED lights with smart motion sensors that only light up when needed; serve a dual purpose as EV charging centers and communication hubs.	Heating systems consume energy excessively.	Develop a circular energy system in which waste heat is reused to heat apartments.
Smart waste collection		Smart building logistics	
Problem	Solution	Problem	Solution
Waste trucks contribute to congestion and are neither eco-friendly nor efficient.	Implement automated waste collection services using color-coded waste bags and smart technology to vacuum waste bags through underground collection portals.	No central data infrastructure exists to monitor cities' environmental status.	Develop an open data platform that monitors and analyzes patterns for city activities.
III. Sustainable Urban Mobility			
	Sustainable delivery		Smart traffic management
	Alternative fuel driven vehicles		Smart mobility solutions
Sustainable Delivery		Smart traffic management	
Problem	Solution	Problem	Solution
The increasing popularity of online shopping results in more delivery trucks on the road	Create a smart integrated delivery system directly to delivery rooms in apartment building that reduces traffic, uses clean delivery vehicles, and gives residents live information about their deliveries.	Increased traffic causes congestion and worsens air quality.	Install smart sensors that monitor traffic patterns and prioritize sustainable transport modes by giving them signal priority.
Alternative fuel driven vehicle		Smart mobility solutions	
Problem	Solution	Problem	Solution
Too many vehicles rely on fossil fuels.	Invest in charging points and infrastructure to encourage alternative fuel usage.	Personal trips are a hassle with public transportation.	Conduct tests to compare bike sharing shuttle services, carsharing, and taxis to determine which is most effective.

Lighthouse Cities and Knowledge Application

Knowledge exchange and transfer is key to the success of GrowSmarter. The GrowSmarter project will be led by 3 Lighthouse cities -Stockholm, Cologne, and Barcelona, with 5 Follower cities closely following in their footsteps. The 12 smart solutions above will be rolled out at designated sites in the 3 cities including industrial areas, suburban and downtown districts, ensuring a sample base representative of many European cities. The three Lighthouse cities will each host a number of study visits and European workshops, which are free to attend and provide opportunities to see first-hand technological application of the smart solutions.

The 5 Follower cities - Valetta, Suceava, Porto, Cork and Graz – will learn about the experiences of the 3 Lighthouse cities, identify measures suitable for their specific local context, and develop a replication plan tailored to local needs.

GROWSMARTER IN A NUTSHELL

GrowSmarter is a smart city project funded under the European Commission's Horizon 2020 programme, which kicked off on 1 January 2015 and will run until 31 December 2019.

3 Lighthouse cities



Stockholm, Cologne,
Barcelona

will be using an integrated
approach to roll out.....

12 smart solutions



... in partnership with
industry, solutions in 3 areas:
• low energy districts,
• integrated infrastructure
• and urban mobility....

5 Follower cities



... and Valetta, Suceava,
Porto, Cork and Graz will
follow the progress & create
their own replication plans..

3 targets



... to achieve targets in:
• improve quality of life
• growth in local enterprises
• save the municipality money

Cross-Cutting Partnership

The GrowSmarter project is run by city governments. Stockholm coordinates the initiative, while the other cities follow the project as take-up cities. However, a multitude of different institutions and organizations contribute to the success of the project:

- Twenty industrial partners provide the necessary technologies and help showcase these smart solutions.
- The Royal Institute of Technology in Stockholm validates the results and ensures that the solutions cut the expected 60% of climate-impacting gas emissions.
- The Business School of Navarra, IESE, ensures that the solutions have short pay-back periods and create new jobs.
- ICLEI, Local Governments for Sustainability, helps disseminate the results.



Results & Reflections

The GrowSmarter Project has received €25 million in funding from the European Commission as a Smart City and Community project within the Horizon 2020 research and innovation initiative. As a result, GrowSmarter has signed a common manifesto which lays out a framework and a timeline for its smart solutions up through December 31, 2019.

Already, many of the 20 industrial partners in the project have received orders from other cities thanks to the project. All solutions are up and running. Moreover, approximately twenty new cities have joined as take-up cities. There is a huge international interest in the project. The following figures demonstrate the ongoing projects under the three themes:

Low energy districts			Integrated Infrastructures			Sustainable Urban Mobility				
Smart building shell refurbishment			Smart street lighting			Sustainable delivery				
Climate shell refurbishment	Energy quality assurance	Re-build of an industrial site: Ca L'aler	Smart LED street lighting	Streetlights as wifi	Smart meter information analysis	Communal service boxes	Micro-distribution of freight			
Smart shell and equipment refurbishment: 200 unit apartment building	Smart shell and equipment refurbishment: tertiary buildings	Smart shell and equipment refurbishment: residential buildings	Waste heat recovery			Smart traffic management				
Smart building logistics			Smart waste collection			Alternative fuel driven vehicles				
Construction consolidation centre			Automated waste collection			eTank electric charging	Fast charging infrastructure for EVs	Standard speed charging infrastructure for EVs		
Smart energy-saving tenants			Big data management			Renewable fuels for heavy duty vehicles	Vehicle to grid charging (V2X)			
Home Energy Management	The Active House	An Open Home Net	Urban Cockpit	Urban Traffic	Urban Environment	Smart mobility solutions				
Hubgrade Energy Savings Centre	Home Energy Management System	Virtual Energy Advisor	Big consolidated open data platform				Green parking index	Mobility hub		
Dynamic Pricing Models						Smart taxi stand system				
Smart building shell refurbishment										
Climate shell refurbishment streams	Energy quality assurance	Re-build of an industrial site: Ca L'aler								
Coming soon										

On September 7, 2018, the Lighthouse cities of Stockholm and Cologne, and the Follower city of Cork, are being awarded by the Euro-China Green & Smart City Award for innovative and sustainable urban development. This recognition highlights the cities participation in GrowSmarter with 12 smart solutions reducing greenhouse gas emissions while creating new jobs.

Review Comments

1. The legal side of the project to overcome tender processes among 3 partner cities would be the most interesting aspect.
2. The construction of the collaborative network between municipalities, universities, ICLEI, and industries among three cities gives a clear advantage to being more innovative to bring ideas to the market.
3. The project is commendable since it provides solutions to most of the existing problems in key cities.
4. It would be more comprehensive to evaluate the resource and energy use that goes into ICT solutions and infrastructure itself. For example, how much data traffic does the big data platform generate and how much CO₂ emissions result from it? Is the smart lighting initiative taking into account resources like copper, rare earth materials or chemical compounds in the smart lighting infrastructure? How easy can such new infrastructure be recycled, repaired etc.?
5. Climate change, urbanization, security issues make it necessary to adapt and improve energy efficiency buildings infrastructure and sustainable mobility. There are four global goals of sustainable mobility: (1) equitable access; (2) security and safety; (3) efficiency; and (4) pollution and climate-responsiveness. It requires all the stakeholders to work together to achieve these four global goals.

Future City and the Next-Generation Community

— City of Yokohama



©City of Yokohama

An Open-Minded Port City

The city of Yokohama, literally "horizontal beach" in Japanese, is the most populous municipality in Japan. Lying on Tokyo Bay just south of Tokyo, Yokohama is a major commercial hub of the Greater Tokyo Area, and is one of the top 3 productive cities in Japan, following only Tokyo and Osaka, with a GDP of approximately US\$127 billion annually.

In 1859, Yokohama was the site of the first Japanese ports opened to foreign trade after two centuries of isolation. Taking advantage of its great geographic location, advanced transportation networks, and open-minded public engagement, Yokohama has rapidly developed itself as one of Japan's prominent harbor cities over the past 150 years.



City Solutions

2-2 Future City: The Next-Gen-
eration Community

Contributor:

Hiroyuki Kasuya, City of Yoko-
hama, Chinghui Liao

Linking SDGs



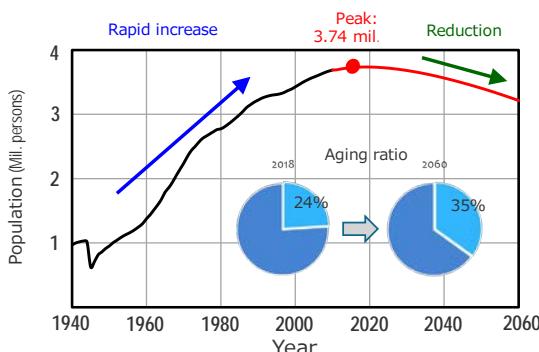
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Nowadays, Yokohama is a global leading city with remarkable transport accessibility, friendly support from central governments, deep capacities and vibrant civil society while tackling its looming issues. As a result, the city is well recognized and awarded in various demonstrative city programs initiated by the Japanese government (i.e. FucureCity, Eco-Model City, etc.) and international organizations.

A Turning Point: Ageing Population, Old Infrastructures

The rapid growth and urbanization have catalyzed Yokohama into one of the most prosperous cities in Japan and around the world. With its current urban challenges (water, energy, food, waste, etc.) and impacts from climate change, Yokohama is confronting another hurdle: the aging and shrinking population. The municipal statistics suggest that the City's population has rapidly expanded from 1 million to 3.74 million since War World II. Despite this, the population will reach its peak in 2019 and then start to decrease due to the dual impacts of the aging population and low birthrate. 2018 records show an extremely high aging population of 24% (people more than 65 years old in the total population), and this is expected to increase to 35% by 2060. With these looming expectations, Yokohama has identified the key challenges of its future-oriented urban development:

- The accelerating aging population along with low birthrates could hinder growing urban areas' ability to function as engines of growth and might trigger the collapse of the current urban system.
- In the last 50 years, Yokohama's suburban residential areas have been home to a large and burgeoning number of Tokyo Metropolitan commuters. However, the ageing demographics raise enormous demand for local amenities and accessible housing services. In addition, outdated infrastructure and housing conditions barely attract the young generation to move in, and in fact drive residents to move elsewhere.



Kinds of data: Past results (1940-2010), Estimated values (2010-2035), Reference values (2035-2060)

Future-Oriented (Sub-)Urban Redevelopment

In line with the national program, FutureCity, the City of Yokohama is taking the lead to structure a sound framework and implement pilot projects to accommodate various urban challenges. The City aims to build a model sustainable residential area with consideration for the super-ageing society and stressed environment.

Suburban Development in Yokohama

- The population of Yokohama City is over 3.7 million. 2/3 of them live in the suburbs.
- 1/5 of the housing in Yokohama are over 40 years old and many are housing complex of 5-story building with no elevators.
- The aging of the residents and housing brings higher possibilities of the community getting less active.

Tokaichiba-cho: A Community for All

As one of the four model projects, the Tokaichiba case could be a great potential solution for the entire Yokohama in terms of addressing all challenges in this typical, downscaling residential community. Tokaichiba-cho is a typical suburban town of Yokohama which is an ageing neighborhood challenged with declining local vitality and weakening community engagement.

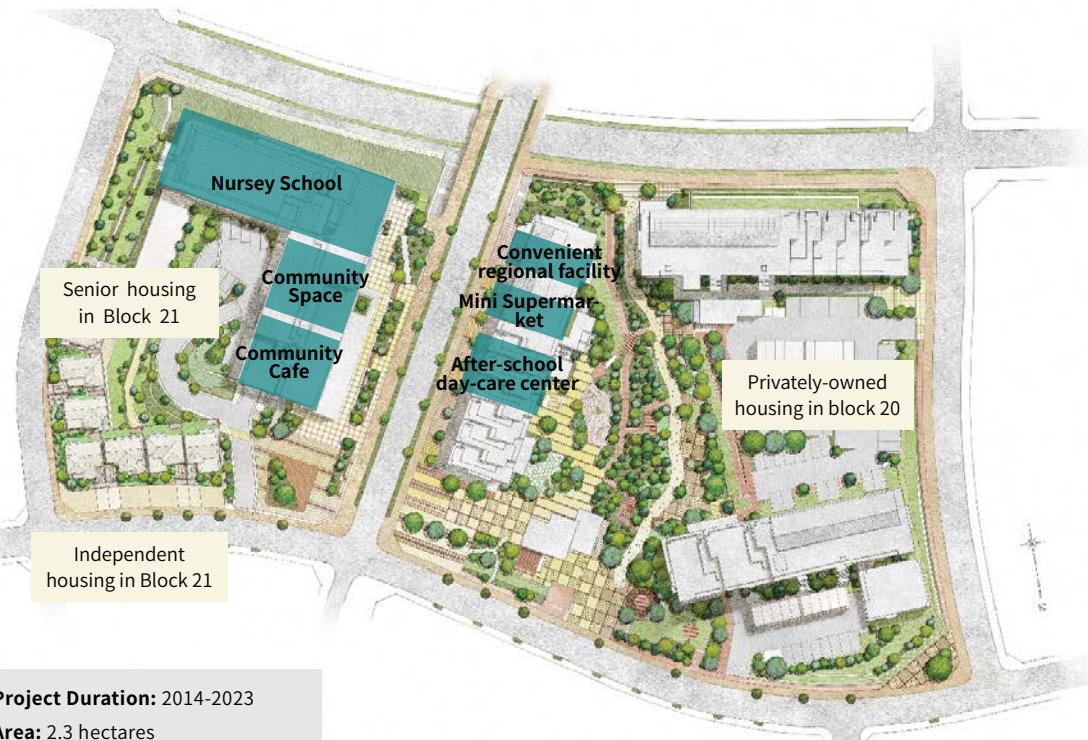


As one “Model Project for a Sustainable Residential District”, the redevelopment of Tokaichiba started in 2014 and is scheduled to be completed by 2023. As a comprehensive solution package, the project is envisioned to revitalize the area to be future-adaptive and attractive for younger generations. With plans to build a dynamic residential complex utilizing a city-owned land, it has incorporated a series of modern amenities and smart designs to accommodate the future needs of all ages.

To achieve this, the city has mobilized all potential support, both financially and non-financially, from diverse stakeholders including multilevel governments, private industry, academic communities and civil society. In this case, the City has capitalized on the advanced technology and creativity of the private sector, including railway and real estate companies, to build a community for all generations with a systematic approach:

City Solutions

2-2 Future City: The Next-Generation Community



Project Duration: 2014-2023

Area: 2.3 hectares

Functions:

Houses for sale, childcare center, senior residence, rental apartments, etc.

Layout map of Blocks 20 and 21 © City of Yokohama

- **List housing typology by demographics and household income statistics**

First, Yokohama listed the housing typology by demographics and household income statistics in Yokohama City and Tokaichiba areas. This was aimed at targeting potential tenants and formating blueprints, based on the existing dataset and its forecasts. In order to meet the future needs of tenants, the whole housing area has been divided into 3 main segments: general housing, senior residence, and public facilities (nursery, child care, and other community facilities).

- **Collaborate with private sectors on land utilization and planning**

The Tokaichiba redevelopment has been focusing on the utilization of city-owned, public housing land, through public-private partnership (PPP). Based on a 50-year agreement, Yokohama works as the main facilitator and supervisor while the main developers: Tokyo Kyuko Railway Corporation, Tokyu Real Estate Co., Ltd., and NTT Urban Development Co. Ltd. are in charge of all operations. Another crucial strategy is to engage the representation of local communities, the “Tokaichiba Area Management Council”, to gather their ideas and earn their support throughout the planning process and construction.

The principles of the Yokohama Smart City Project (YSCP, 2011) have also been implemented through this redevelopment. It focused on providing a visible and user-friendly system optimizing energy supply and demand for individual houses, in cooperation with leading telecom, energy management and security management companies.



The Implementation of complex rebuilding in Tokaichiba © City of Yokohama

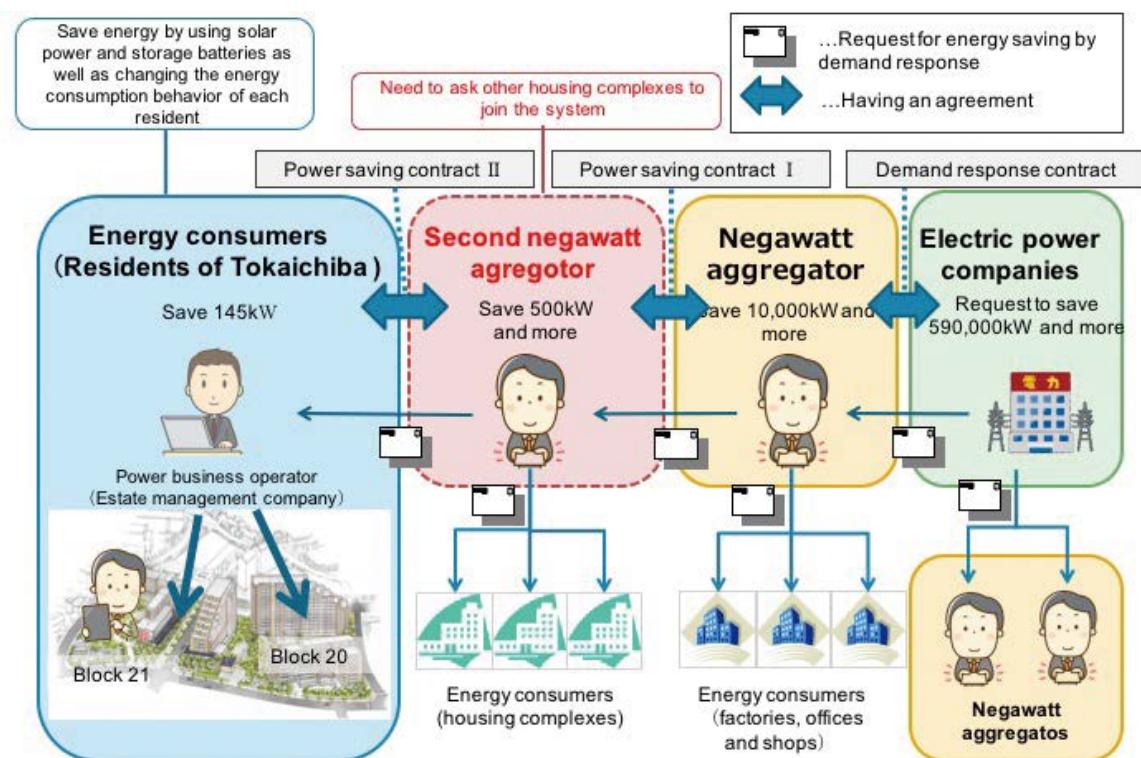
City Solutions

2-2 Future City: The Next-Generation Community

• Implement smart energy management

Yokohama's energy vision is to be an energy-efficient and energy-recyclable city that is environmentally robust, resistant to disasters, and economically strong. Home Energy Management Systems (HEMS) and Micro Electro Mechanical Systems (MEMS) were installed to enhance the visibility of energy consumption, as well as the on-site energy generation of PV generation systems and storage batteries.

In addition, the "peak cut" control scheme and "negawatt (negative megawatt) system", which gain more energy saved by increasing efficiency or reducing consumption, have been introduced to Tokaichiba.



Community Development from Participation to Collaboration

Yokohama has always been proud of its open-mindedness and active civil society. Since the 1980s, the collaboration between citizens and the administration has been an essential approach to advance community development. In the case of Tokaichiba, the Tokaichiba Area Management Council is going to be established to represent local residents, supporters, local experts and other stakeholders. Not only have they closely engaged in the planning of the district, they will be valuable members of the future community management team, which is key to the success of the project implementation. Innovative concepts such as housing diversity, smart energy systems and carbon reduction elements have been widely discussed and promoted through numerous workshops and seminars.

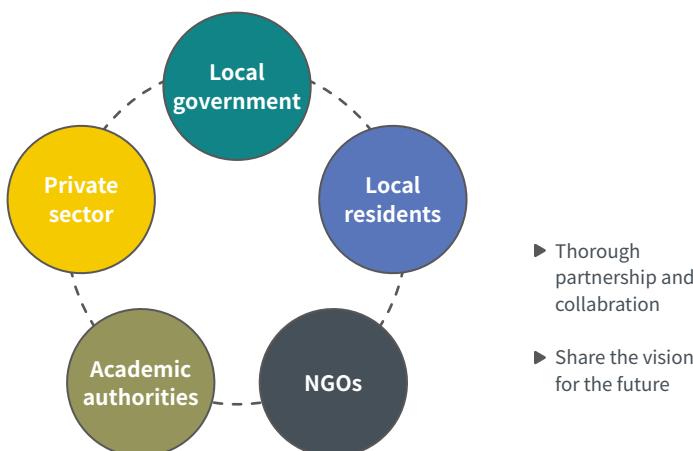
Furthermore, to foster a local consensus on local sustainability, public communication has gone beyond administrative boundaries to the surrounding districts, and the results and knowledge will be spread throughout the city.

The City of Yokohama has also played an important role in coordinating different opinions and bridging knowledge gaps among different stakeholders. It is strongly believed that although communication among all stakeholders is always time- and effort-consuming, it is still the best cost-efficient solution from a long-term perspective.



©City of Yokohama

Build a community for all



City strategy to create Yokohama in partnership with multi-stakeholders © City of Yokohama

City Solutions

2-2 Future City: The Next-Generation Community

Prospects

With the ambition to doubly benefit the city's competitiveness and sustainability, Yokohama has been working together with all stakeholders on revitalizing residential areas into a smart future lifestyle centers in Tokaichiba.

The city has kept in mind that all successful Yokohama models should be transferable to the rest of Yokohama, to other Japanese cities and eventually overseas. Furthermore, the Tokaichiba model may provide an alternative solution for other global cities who are also struggling with shrinking and aging populations.

While it is still an ongoing project, the “negawatt system” model introduced in Tokaichiba could be a model mechanism in future housing energy management in Japan, for both new and existing development. It is also expected that more cases are to implement the smart energy management systems in the near future.

Review Comments

1. The Yokohama City faces the challenges which most cities in the developed countries will encounter. What sets this project apart is how the city government manages to create a friendly environment for citizens in the future.
2. The cooperation with 5 different sectors is a good exemplar for achieving SDG17 (strengthening the means of implementation and revitalize the global partnership for sustainable development).
3. The smart energy development plan demonstrated in this case has the potential to become a common practice for urban areas.

Green City in Transformation

— Kaohsiung City



©Kaohsiung Tourism Bureau

Environmental and Social Challenges

Since the central government announced the "Greenhouse Gas Reduction and Management Act (溫室氣體減量及管理法)" on July 1, 2015, Taiwan has officially entered a new era of carbon reduction. The "Greenhouse Gas Reduction and Management Act" is the first law that explicitly authorizes the government to respond to climate change. It clearly sets a long-term carbon emissions reduction target for 2050, five-year phase control objectives and management measures with economic incentives. In the meantime, the government will gradually establish a carbon emissions cap-and-trade system through setting up a Carbon Trading Platform as well as its related systems. In the future, mitigation, adaptation and green growth will be three main themes motivating Taiwan's response to climate change.

City Profile



Area: 2,951.85 km²(1,139.72 sq mi)
Population: 2,773,093

In Kaohsiung City, the total greenhouse gas (GHG) emissions in the administrative region in 2016 were 58,890,336.3695 metric tons of CO₂e. The major sources of GHG emissions were the energy-industrial sector and industrial process sector, with combined emissions of 48,663,254.9036 metric tons of CO₂e, accounting for 82.63% of the total. The residential sector and the energy-transport sector were the next most important. These sectors' emissions were 5,399,679.8436 metric tons of CO₂e and 4,290,830.4651 metric tons of CO₂e respectively, accounting for 9.17% and 7.29% of the total.

Objectives

To get rid of its reputation as a heavy industrial city, and to fight against global warming, the Kaohsiung city government collected short-term, medium-term, and long-term governance proposals to formulate strategies and action plans for greenhouse gas emission reduction, echoing the "Greenhouse Gas Reduction and Management Act." The short-term target is for GHG emissions to be reduced by 20% in 2020 compared to 2005 levels. Related mitigation and adaptation policies and actions include economic development, city buildings, public transport and ecosystems. The five main sectors promoted are energy, industry, residence, transport, and waste.

To meet their carbon reduction goal, Kaohsiung City Government has promoted 47 mitigation strategies/plans with 10 environmental indicators. The main strategies/plans include:

- Promoting renewable energy
- Formulating greenhouse gas management in the industrial sector
- Expanding the integration of resources in industrial zones
- Providing subsidies and incentives for replacing newly purchased electric motorbikes for old motorbikes
- Providing ticket consolidation and transfer preferences for mass transit systems
- Launching public bicycle ride promotions and enhancing the use of intentions

Two carbon-reduction projects that Kaohsiung City initiated are the Kao-Haus program and the C-bike sharing system.

Pilot Green Building Project

Kaohsiung City faces a variety of environmental challenges including high temperatures, air pollution and extreme climate events. Construction of new buildings in Kaohsiung increases by about 140 thousand square meters per year. However, rapid urbanization has resulted in the gradual erosion of natural soil and land. When runoff causes siltation in storm runoff drains, it can exacerbate the effects of global warming by increasing groundwater replenishment and worsening droughts.

Kaohsiung is especially vulnerable during the warmest months from March to November. According to data from the Meteorological Bureau, Kaohsiung reaches temperatures over 30°C approximately 165 days a year. Additionally, while the city only experiences an average of 88 days of rain per year, the rainfall may reach up to 1885 mm. As a consequence, rain may cause damage to a roof's waterproof layer, resulting in leakage.

Another challenge Kaohsiung faces is its aging population. There are 380 thousand senior citizens in Kaohsiung, accounting for 13.71% of the city. To prepare for the upcoming aging society, it is essential to establish policies and infrastructures which are more user friendly to the elderly.

Kaohsiung City faces a variety of environmental challenges including high temperatures, air pollution and extreme climate events. Construction of new buildings in Kaohsiung increases by about 140 thousand square meters per year. However, rapid urbanization has resulted in the gradual erosion of natural soil and land. When runoff causes siltation in storm runoff drains, it can exacerbate the effects of global warming by increasing groundwater replenishment and worsening droughts.

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Kaohsiung LOHAS
Building Label

KAOHAUS logo@kaohsiung design festival

Contributor:

TU Chang-Chen, Assistant Engineer, Kaohsiung City Government

Linking SDGs



© sdg knowledge platform

The three core values of KAOHAUS



City Solutions

2-3 Green City in Transformation

Another challenge Kaohsiung faces is its aging population. There are 380 thousand senior citizens in Kaohsiung, accounting for 13.71% of the city. To prepare for the upcoming aging society, it is essential to establish policies and infrastructures which are more user friendly to the elderly.



Human-Centered Urban Design

The design of KAOHAUS building takes inspiration from the Vertical Forest concept in Milan, Italy. For example, a comprehensive academic study of the design determined that the buildings' 3-meter balconies reduced direct sunlight. Therefore, Kaohsiung has encouraged the construction of similar terraces to reduce the heat load of the buildings' roofs and facades. Vertical garden designs also create a green urban landscape instead of a cement and metal facade. Ultimately, KAOHAUS aims to develop a unique architectural vocabulary and a brand signaling high quality and internationalism.

KAOHAUS confronts the problem of illegal construction by encouraging green designs that do not sacrifice building capacity but achieve afforestation vertically. KAOHAUS also simplifies construction application procedures to reduce barriers to building. For example, green buildings receive exemptions from regulations on area and volume if they meet outlined sustainability requirements. These initiatives reduce the urban heat island effect while curbing illegal building activity and promoting development.

KAOHAUS guidelines promote general-purpose designs that are accessible to all ages, especially children and the increasing proportion of senior citizens. Features of universal design include layouts for baths and toilets, community gathering spaces and handicapped-accessible lifts.



KAOHOUS building example©Promote Kaohsiung House Information website

Public Engagement

The KAOHAUS policy aims to spread environmental education and awareness. Program promotion efforts help people understand the mutual dependency between architecture and the environment and enhance people's sense of environmental responsibility. Related activities include the following:

- **Open public participation:**

KAOHAUS has engaged the public in various activities, including 19 seminars with 2053 participants and 12 site visits with 215 participants. They have communicated with relevant industry associations and academic groups to promote inter-sector cooperation and host educational workshops.

- **Training land designers in KAOHAUS design:**

KAOHAUS has provided training activities for construction workers, students, professors and designers to learn about modern architecture and environmental sustainability.

- **Providing guidance and consultation:**

A KAOHAUS project counseling studio and technical manuals have been made available to designers and construction experts. Directors conduct regular on-site inspections to ensure the safety of buildings and promote open communication with the bureau.

- **Establishing channels for public inquiry:**

The "KAOHAUS promotion information network" provides the public with the latest project updates and includes web-based channels for help inquiries. The use of social media such as Facebook takes advantage of widespread technologies to engage the public.

- **Filming educational documentaries:**

KAOHAUS has shot short videos and documentaries to educate and inform all age groups about the project's benefits to the city. These include overviews of general-purpose design features.

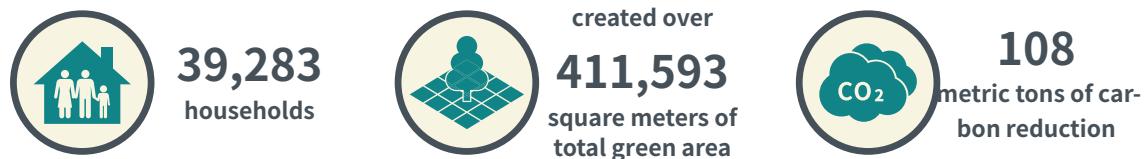
- **Making project data openly available:**

KAOHAUS has cooperated with the municipal government's open data platform to provide a wide range of project-related statistics. This information may be used by the public, enterprises and academic institutions for research or feedback.

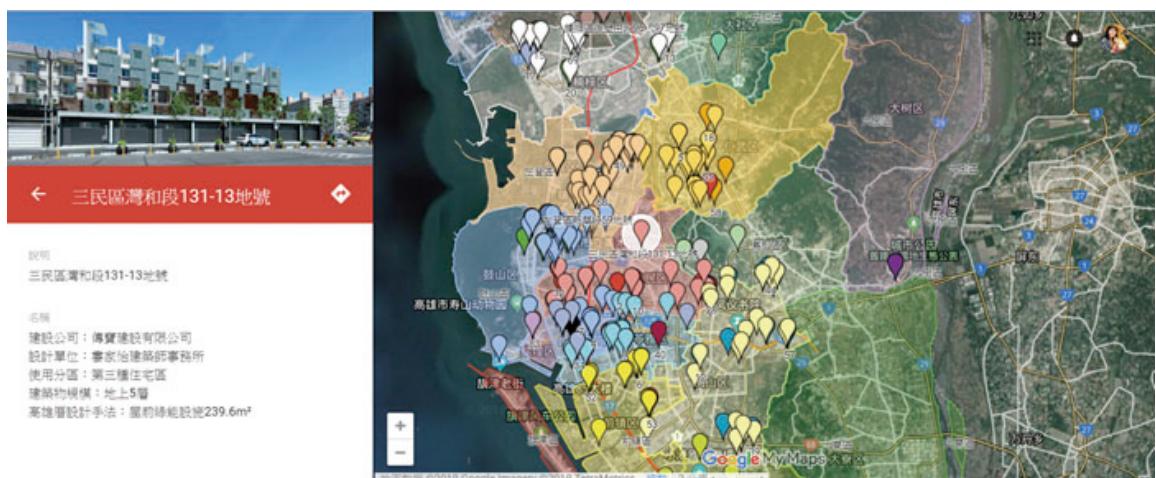
The open data platform could be referred to the following link:
<https://data.kcg.gov.tw/dataset?organization=pwb>

Results

The “KAOHAUS” brand has demonstrated its legitimacy by highlighting an innovative, sustainable and internationally-competitive building industry. Their construction licenses have reached over 39,283 households and created over 411,593 square meters of total green area. The project is expected to achieve 108 metric tons of carbon reduction per year as a result of the initiative. Furthermore, universal design has vastly increased the amount of space accessible to wheelchair users. Overall, a positive public perception toward the city’s “green revolution” will improve quality of life and the community’s sense of environmental responsibility.



The KAOHAUS program has myriad benefits for the Kaohsiung City as well. For instance, the city set up a sustainable green building management fund supported by government experts. It serves as a funding mechanism for disaster prevention, environmental and low-carbon development needs. To date, the fund has managed over 600 million NTD and anticipates a continued income of 200 million NTD in the coming years. This will enable ongoing environmental building construction and innovation efforts. An additional benefit of KAOHAUS is reducing the cost of dismantling illegal buildings. Rather than shouldering the cost of demolishing structures such as illegally built garages, KAOHAUS provides on-site counseling to improve the facilities instead.



The Future of KAOHAUS

The next iteration of KAOHAUS will put a greater emphasis on human-centered innovations. Dubbed “KAOHAUS GO,” it will integrate localized architecture with “Green” sustainability strategies and “Orange” human considerations (Kao + haus + G + O). KAOHAUS will also incorporate the latest technologies from the Taiwan’s thriving ICT industry with the ultimate goal of designing new ways to improve residents’ happiness and safety.

KAOHAUS aims to achieve this goal through seven major initiatives:

Construction techniques	KAOHAUS will promote new systems for construction quality and efficiency, such as inspections, process monitoring, comprehensive documentation and open data provision regarding construction projects.
Expansion of age-inclusive facilities	KAOHAUS will expand all-age accessibility facilities and universal design. This may include rest areas for the elderly and common kitchens with dietary services. Other facilities include parking and charging for electric vehicles.
Dimensional greening	KAOHAUS will promote green corridor facilities by planting trees and vines on building facades and installing green roofs. This will follow the three-dimensional aesthetic landscape of Milan’s vertical garden.
“The box of life” home shelters	KAOHAUS will encourage building shelters for families to seek refuge during strong earthquakes. Shelters should be equipped with thick walls, a fire-resistant steel plate door, a vent, and fire-fighting tools
Smart living technologies	KAOHAUS will apply “smart” technologies to increase the sustainability of everyday living, including strengthening intelligent construction, energy management, water resource management and disaster warning systems.
Air parking	KAOHAUS will promote air parking among different building types. The elevators assist both human and vehicle transportation. Besides increasing convenience, it can also save time for transferring and stopping as society ages.
Experimental architecture	KAOHAUS hopes to inspire Kaohsiung to become a hub of architectural innovation and experimentation. It can become a test site to verify the benefits of construction methods that integrate health, social, environmental and economic concerns.

KAOHAUS seven initiatives

Shared-Bike Model

It is believed that encouraging the use of public transport can effectively reduce carbon emissions. By offering a public bicycle rental system (City-Bike, hereinafter referred to as "C-bike"), the public is provided with convenient low-carbon transportation options. Kaohsiung City promoted the first public bike rental system in March 2009 to create a convenient way for people to eschew cars and scooters. People use credit cards or "iPASS" to rent bikes; they can rent bikes from one C-bike station and return them to another. It is a convenient system, and the number of users exceeded 4 million in 2017. Currently, there are 450 C-bike stations, providing 3,800 C-bikes for public rental.

Among all the C-bike stations, 50 of them are equipped with air quality micro sensing systems. They can not only detect temperature, moisture, and Carbon Monoxide, but also PM10 and PM2.5. Citizens can therefore get the latest air quality news when they rent a bike.

By launching the 'green point collection' scheme, the city expects citizens in Kaohsiung to cultivate low-carbon living habits, supports low-carbon transportation and green consumption, makes joint efforts to reduce waste of resources, reduces environmental impacts, and encourages businesses to invest in green product development. Businesses are expected to improve production process and reduce carbon emissions, thereby mitigating the greenhouse effect and creating a better living environment.

Kaohsiung City Government has cooperated with Kaohsiung Rapid Transit Corp. (KRTC) to provide discounted fares for Metro-Bike Transfer (雙向轉乘優惠) since 2012. People can take advantage of these benefits by either taking Kaohsiung Metro or riding C-bike and then making a transfer. The discounted rate encourages people to reach the Metro by riding public bikes.

Contributor:

Chin-chun Hsu, Division Chief,
Kaohsiung City Government

Linking SDGs



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C-bike station at KRTC ©ICLEI EcoMobility

Results

Kaohsiung City has provided more complete public transport connection by constructing an improved public transportation network including the underground railway, the second stage of light rail, and extension of the Metro (Luzhu, Yellow Line, Linyuan). It has also set up new public bike rental stations, increased the quantity of downtown rental stations and expanded service range. The following table shows the total C-bike users and estimated CO2 emission reduction from 2015 to 2017.

Year	C-bike users	Emission reduction
2015	20152.685 million	2,206 tons
2016	3.336 million	2,700 tons
2017	4.525 million	3,000 tons

The total C-bike users and estimated CO2 reduction

Building Partnerships

The City has designed and planned various mechanisms of multi-stakeholder engagement including organizing GHG reduction cooperation meetings, investigating and collecting information and resources in its jurisdiction, and promoting cooperation on GHG reduction. These activities aim to enhance the social responsibility of enterprises within its jurisdiction, but also promoted new technologies and concepts of energy-saving and carbon reduction.

Kaohsiung City is also building an online system for climate change cooperation partnership, where public and private actors can upload their requests, including GHG reduction and adaptation. The internet platform will provide services for people in need and will increase efficiency. The following describes some functions provided by the platform:

1. Offering cases for departments to select
2. Automatically combining, collecting, and rewarding partners on the Internet
3. Increasing the reputation of city departments and sponsors
4. Engaging in cooperative GHG reduction and adaptation
5. Developing alternative solutions for self-managed executive action
6. Increasing cooperation between local, public, and private actors

Review Comments

1. 'KAOHAUS' is a well-developed prototype to demonstrate smart building technology. More information on the "aging population" component could be useful.
2. 'KAOHAUS' is a great architectural project that supports the reintegration of green infrastructure into our cities. It's one of the best possible solutions in the Smart Cities space, as it relies on nature-based solutions and reconciles them with man-made grey infrastructure, rather than trying to engineer its way to sustainability with ICT as a panacea.

Since the KAOHAUS project has been running for seven years, it would

3. be interesting to have more information about how it has developed over the years, and how the project has been coordinated among various stakeholders.
4. Kaohsiung is often at the forefront of progressive thinking in Taiwan, but this environmental project by the city government adds a new significance to the description 'green'. Were there really 4.5 million bicycle users in 2017, or merely 4.5 million journeys? Either way, the project's growth rate is impressive.
5. The idea of taking the bike-sharing system as the platform to further engage with citizens regarding issues of sustainability, or the platform to further integration of other technological systems such as air quality sensors is an intriguing one. The connection between the bike-sharing system in Kaohsiung and the 'green point collection' or Green Economy Model can be clarified further.
6. The Low Carbon Cities and Carbon Reduction initiative is a solid climate change mitigation initiative that tackles the key sectors of transport and buildings. While the project does not stick out in terms of its uniqueness or innovation compared to climate action in other cities, it is likely one of the most impactful and hence important projects among the Smart City Solutions reviewed here. Particular note should be taken of the carbon trading platform, which is a very necessary tool for meaningfully implementing carbon emission reduction on the local level. If successful, the carbon trading system implemented in Kaohsiung may be a key initiative for other cities to examine more closely and replicate.



Healthy Cities : Clean Air, Water and Public Sanitation

2-4 SafeSwim

 **Auckland City**

2-5 Glass Hospital

 **Darkhan City**

2-6 Intelligent Cloud System for Wastewater Management

 **Taoyuan City**

2-7 Healthy City Tainan: Clean Air and Disease Prevention

 **Tainan City**

SafeSwim

— Auckland City



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Auckland City Image ©Flickr craigusmalaigus

A Strong Public Desire on Healthy Water

Auckland's beaches are central to the region's image both nationally and internationally. Aucklanders expect to be able to swim and play in clean water and on safe beaches.

Despite the importance Aucklanders place on clean, safe, healthy water, Auckland's beaches suffer from poor water quality from time to time, especially after heavy rain events in areas serviced by ageing network infrastructure in the city center and ageing onsite septic systems on the urban periphery.

The persistent and lingering nature of this issue has fostered public frustration. There is a strong public desire for corrective action to improve the

City Profile



Area: 1,102.9 km² (425.8 sq mi)
Population: 1,534,700

Contributor:

Matt Montgomery, Head of Innovation, Auckland Council

Linking SDGs

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performance of Auckland's water management network and increase the resilience of the region's infrastructure.

In response to public demand, the mayor of Auckland has proposed significant increases to the level of funding available for water management (including through the introduction of a targeted rate) and supported revisions to the Auckland Plan, to ensure that Auckland 'restores its environment as it grows', 'accounts fully for the past and future impacts of growth' and 'adapts effectively to a changing water future'.

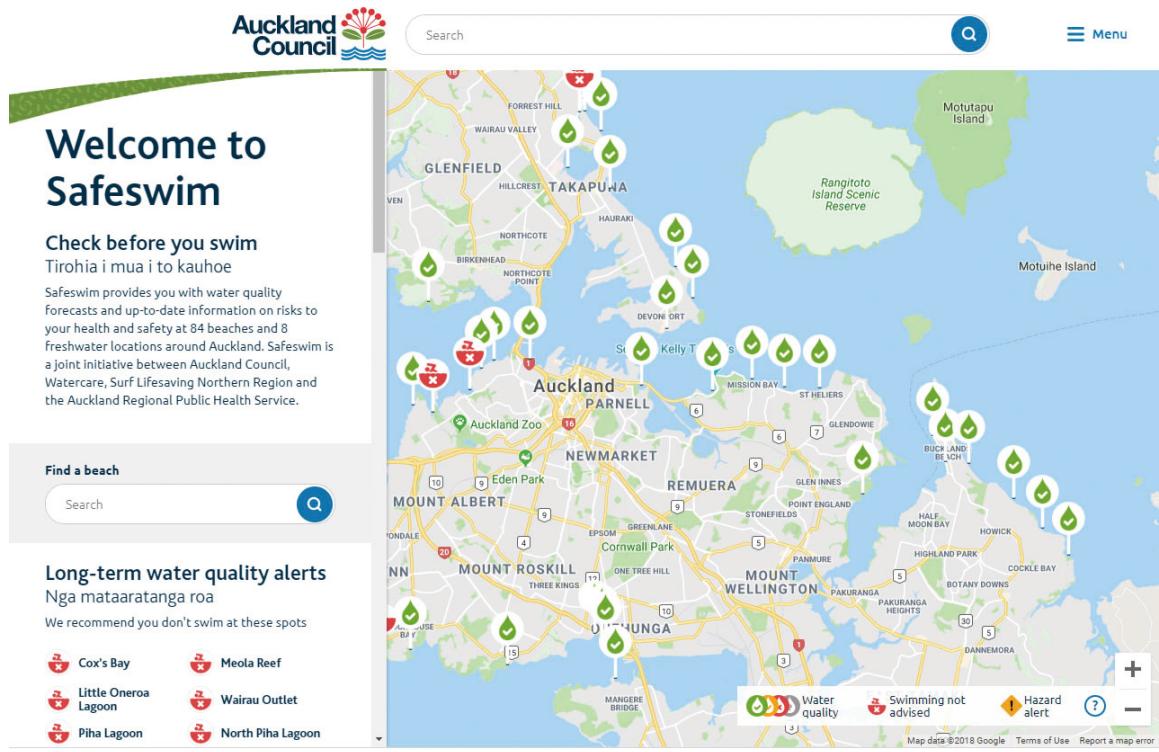
One specific aim is to ensure that Auckland's beaches meet water quality guidelines for safe swimming at least 95% of the time.

Check Before You Swim — The Safeswim Program

In late 2016, Auckland Council commissioned an independent review of its beach bathing water quality monitoring and reporting program - 'Safeswim'. This review identified issues with the design and delivery of the program - issues that created a public health risk and perpetuated a false sense of security about the health and safety of Auckland's beaches.

Knowing that issues with the design and operation of the Safeswim program created a risk of poor public health outcomes, council staff took the view that it was prudent to act quickly to revise the program ahead of the upcoming summer swimming season - persisting with the old system when it routinely failed to identify exceedances of guidelines for fecal indicator bacteria was considered untenable.

From February to November 2017, Auckland Council and Watercare worked in partnership with Surf Life Saving Northern Region and the Auckland Regional Public Health Service to upgrade the 'Safeswim' program. Safeswim now provides a fully-integrated web and digital sign platform of advice for beach users, allowing them to 'check before they swim' and make informed decisions about when and where to swim.



Water Quality Prediction with Multi-data

Safeswim now combines real-time data on the performance of the wastewater and stormwater networks with predictive models, underpinned by validation sampling, to provide forecasts of water quality at 92 swimming sites around the Auckland region. The water quality predictions take into account rain intensity, duration and location, as well as tide, wind speed and direction and sunlight. Data from rain gauges around the region are fed into the system to ensure the current prediction reflects actual/observed rainfall. Water quality predictions are automatically overridden if sensors - at pump stations and Engineered Overflow Points on the wastewater network and at key points on the stormwater network - detect overflows that are likely to cause a public health risk at time when models hadn't predicted poor water quality.

Water quality information is complemented by advice from Surf Life Saving Northern Region and the Auckland Regional Public Health Service on other safety hazards (e.g. dangerous wind and wave conditions, rip currents

City Solutions

2-4 SafeSwim

and the presence of hazardous marine life). Credentialed users from these organizations are able to manually upload public advisory notices, alerting the public to hazards such as dangerous wind or wave conditions, rip currents, jellyfish swarms or shark sightings.

The safeswim.org.nz website is the primary channel in the Safeswim program for communicating information to the public, but physical signage is also an important part of the program.

Basic Sign	Between two and eight ‘static’ signs have been installed at the main approach points to all the beaches in the program. These signs prompt people to ‘check before you swim’ and point people to the Safeswim website.
Dial Sign	‘Dynamic’ signs are being used at the 11 beaches across the region patrolled by surf lifesavers. These signs have a movable arrow that surf lifesavers set to match the current status of water quality on safeswim.org.nz.
Digital Sign	The program is trialling digital signs at three beaches around the region. The digital signs provide close to real time information (refreshing every 15 minutes) and reflect what is shown on safeswim.org.nz.

Safeswim physical signage typologies



Safeswim sign typologies©Safeswim

Multi-Stakeholder Engagement

In a large organization like Auckland Council the process of planning and designing large-scale cross-cutting programs like Safeswim can take years - and years more can elapse before they are implemented. In this case, the project team gained approval to begin work on 14 February 2017 and had a deadline of 1 November 2017 for implementing a fully-revised program.

An innovative approach to project management and governance was called for. The council responded by forming a virtual team incorporating members from across all the departments and organizations affected by, and with an interest in, the program. Program leadership was allocated to staff seconded to the Safeswim program (rather than reporting to a 'home team') who were given a mandate to operate across silos and the performance target of delivering a fully-functioning platform on time and within budget.

From the outset it was clear that parties outside of council had to be involved in the design and delivery of Safeswim if the project was to be a success. Water quality is important, but it is a subset of safety and other agencies have roles in ensuring the safety of Auckland's beaches. Similarly, Auckland Council can take samples that establish the environmental state, but translating these findings into statements regarding public health or making judgements that relate to project health needed to be made by the relevant public health agencies.

At the very beginning of the project, team members approached Surf Life Saving Northern Region, the Auckland Regional Public Health Service, Waitemata and the region's Mana Whenua (Maori tribes with authority in the region) to explain Safeswim's objectives, outline its general direction and invite participation.

Members of these organizations were integrated into the programming roles that matched their self-determined interests and resourcing. As the program began to take shape and where significant decisions on program direction were required, these partners were invited to step in to governance and steering roles.

Project governance was provided by senior members of each contributing department and partner agency. As the program took shape and began to approach launch, the membership of the program steering group was expanded to formally include representatives of external partners and the region's Mana Whenua.



©Auckland council



©Auckland council



©Auckland regional public health service

The virtual team met fortnightly to agree on tasks that needed to be achieved by the following fortnight, report on progress, and find solutions to any barriers that had prevented achievement of tasks in the previous 'sprint'. These meetings helped ensure horizontal integration across the project's workstreams.

At each fortnightly meeting, work stream leaders presented the current status of their work package and the team collectively offered suggestions on how to improve the work package, and integrate it with other aspects of the project to achieve overall coherence and integration. This avoided the risk of project components failing to integrate effectively at the back-end of the project and created opportunities for project team members to provide insights outside their area of expertise: 'outsiders' and 'non-experts' can often see problems more clearly than those embroiled in the detail of an area they know extremely well. Throughout this process, staffs from the partner agencies were invited to review and assess the solutions being developed by the project team.



Partners at the launch of the Safeswim program©Auckland Council

Results

Safeswim now provides a fully-integrated web and signage platform of advice for beach users, allowing them to 'check before they swim' and make informed decisions about when and where to swim.

Auckland beach users now have access to real-time data on the performance of the wastewater and stormwater networks, and are able to see forecasts of water quality underpinned by predictive models. These forecasts are automatically overridden if sensors detect unpredicted overflows that are likely to cause a public health risk, and additional beach-specific warnings are uploaded if Surf Life Saving Northern Region or the Auckland Regional Public Health Service identifies other safety hazards (i.e. dangerous wind and wave conditions, rip currents and the presence of hazardous marine life).



Safeswim on smartphone©digital platform

water quality forecast©translate digital

Water quality forecast		Tides	
Today	Tomorrow	Today	Tomorrow
Morning Low risk Afternoon Low risk Evening Low risk	Morning Fair Afternoon Alert Evening Low risk	Low: 05:10 (1.4m) High: 11:14 (2.4m) Low: 17:36 (1.4m) High: 23:40 (2.4m)	Low: 05:10 (1.4m) High: 11:14 (2.4m) Low: 17:36 (1.4m) High: 23:40 (2.4m)
Beach hazards Please take caution		Wind speed Today	
 Strong current		Morning: 12km SW Afternoon: 12km SW Evening: 12km SW	
 Sharks		Morning: 2m Afternoon: 2m Evening: 2m	
 Sewage effluent outfall			
 Tsunami hazard zone			
 Quicksand			
 Strong winds			

The Safeswim website has attracted over 130,000 unique users since its launch, and gained nearly 300,000 hits. The interface is performing well and we're receiving feedback is received that it is easy to access, easy to use and informative. Usage rates continue to grow.

Taking into account monitored overflows, the Safeswim alerts (incorporating model predictions and overflow monitoring) for exemplar validation sites indicate that models are accurately identifying between 67% and 86% of exceedances, meeting performance standards published by the USGS (50%) and comparing well with the previous monitoring program (4%).



Safeswim was promoted in a recent independent 'value for money' review conducted under section 17A of the Local Government Act, as an exemplar of the kind of cross-agency, cross-department projects necessary to deliver value to Aucklanders. The picture of water quality at Auckland's beaches revealed by Safeswim was used by the Mayor as evidence in support of his proposal to allocate an additional budget in the next Long Term Plan towards lifting water quality at Auckland's beaches and streams.

Despite it being in place as a branded program since 2010, no one at Surf Life Saving had heard of Safeswim before the project team reached out to them. Now Safeswim is an integrated water quality and beach safety program providing surf lifesavers with a highly effective platform for providing public advice on beach safety - allowing them to upload warnings about dangerous wind and wave conditions, rip currents, and marine life.

Factors Critical to Success

A project-oriented virtual team	The establishment of a virtual team, led by people responsible to the objectives of the project rather than the objectives of their home team. This allowed the project team to keep returning to the overarching objective of improving the region's water quality and avoid being 'trapped' by the status quo.
Early Engagement with partners and stakeholders	The emphasis placed on engaging early with politicians and Mana Whenua representatives, and on building relationships with leaders of partner agencies. Giving these parties time to understand the program fostered well-informed political debate and governance, and allowed the council to build the public/private partnerships necessary to ensure Safeswim is resilient to contextual change.
A clear outcome-focused objective	It can be difficult to work across a large organization like Auckland Council as each department has its own, entirely legitimate, objectives and processes. In this case the complexity was multiplied by having to work across different agencies. A clear outcome-focused objective, even if it is some distance away, helped the project team keep people directly and indirectly involved with the project oriented towards the outcome. At certain times in the project it was a great help to be able to ask how a particular action or position was going to help the project improve water quality and safety at Auckland's beaches.
Continual inspection and improvement	The willingness of council managers to view this project as a prototype. This allowed the project team to build bespoke systems and trial solutions as the project moved through its phases. Now the revised platform is up and running, council units are working with project team members to integrate the project's operational requirements with their long-term work programs. This transition is made easier by the presence of project team members who have rotated back to their 'home' teams, bringing with them an intimate knowledge of the project's objective and mechanics.
Smart living technologies	The willingness of council managers to view this project as a prototype. This allowed the project team to build bespoke systems and trial solutions as the project moved through its phases. Now the revised platform is up and running, council units are working with project team members to integrate the project's operational requirements with their long-term work programs. This transition is made easier by the presence of project team members who have rotated back to their 'home' teams, bringing with them an intimate knowledge of the project's objective and mechanics.
Strict Adherence to the timeframe and the budget	As a project gains momentum it is very easy for it to generate ideas, or for people to see how their ideas could be complementary. This tendency to expand needs to be carefully managed to ensure delivery of key objectives. To avoid the trap of trying to do too much (and consequently failing to do anything), the project team borrowed the software development concept of MVP - minimum viable product - and stuck to delivering the minimum possible to deliver a fully-functional product within the timeframe and budget available. If new requirements or good ideas surfaced through the process, they were added to a backlog and evaluated against a set of project priorities. If they were judged to be a priority they were added to the program and another task was dropped off to make way. Sticking to this discipline is easier said than done. The project steering group's commitment to continual improvement helped - if someone's idea or action dropped down or didn't make it on to the priority list, it could be picked up in subsequent cycles of the program.

Plan for the Future

Auckland Council plans to extend the scope of the program to include additional contaminants (e.g. heavy metals), and to add more freshwater sites. Partnering with Surf Life Saving Northern Region, Safeswim is investigating the potential to develop a predictive model for rip currents, and trialing a 'virtual lifeguard' system for providing 'push notifications' to beach users about current hazards, and a system for matching lifeguards and equipment to demand.

The Auckland Regional Public Health Service is working with members of the Safeswim project team to coordinate datasets to help establish whether an observed and previously unexplained spike in cases of gastroenteritis and cryptosporidium following summer storms could be attributed to water quality at Auckland's beaches.

The Safeswim models and validation sampling program are being used to evaluate the impact of possible alternative management interventions, and to inform business cases for public investment.

To achieve this level of impact so rapidly the Safeswim project team had to overcome:

- A natural and logical desire to integrate Safeswim within existing workstreams and use in-house resources to develop and implement the upgrade. This would have required the project team to work within very tight resource constraints - constraints that would have challenged the project team's ability to meet the delivery deadline and react in an agile and timely way to issues and opportunities that cropped up.
- A natural and understandable tendency to view Safeswim's transparency as a risk, given it would be revealing that water quality at Auckland's beaches was worse than previously thought.
- The inevitable gaps between departments in a large bureaucracy and across organizations with responsibilities for water quality and beach safety - each having their own organizational culture in relation to risk-management and decision-making.



safeswim signage©Australian Leisure Management

Review Comments

1. Keeping the beaches safe is important especially when risk to health is considered, and a warning system for the general public is a good start.
2. The project has the potential to generate awareness and catalyze more substantial action to actually reduce water pollution at the source.
3. This project is interesting in that it describes the implementation of the project and the experience of the project team in detail and constitutes a very well written proposal for a solution, which provides interesting procedural lessons for public servants to read through.
4. An impressive feature of this project is the degree of public 'ownership' of the strategy which is envisaged. This will enhance the 'public desire' identified.
5. It would be more comprehensive to provide specific solutions as well as the role that the government of the authorities has to play in reducing the risk to health of the beaches, i. e. control of fecal release and other contaminants in beaches.

Glass Hospital

— Darkhan City



Darkhan City©Flickr vanhalligan

Urban Challenges

Darkhan-Uul Province has 103,002 people and 80.7 percent of its total population lives in the capital city of Darkhan. Only 2 public hospitals deliver health care to 70 percent of the entire population, and more than 700 people are treated and diagnosed every day, which is already double the hospitals' capacity.

Within hospitals, the situation was similarly bleak. Emergency service wait hours were up to 30 minutes, MRI result waiting times were up to 3 days, 28 percent of patients were left out of service daily and repeatedly and the hospitalization queue was up to 3-5 days.

 **City Profile**



Area: 103 km²
Population: 83,880 (2017)

City Solutions

2-5 Glass Hospital

Contributor:

Ms. Bolortuul Tsoodol, Officer in foreign relations, Darkhan City Government

Linking SDGs



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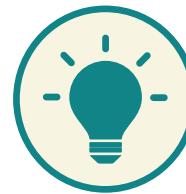
These numbers were especially high in winter and spring, leading to unequal opportunity and unqualified care. Because of these factors, public satisfaction for healthcare was the lowest among all public services. In order to make the public health care system more efficient, faster, more equitable and more qualified, we brought the innovative "Glass Hospital" project to the field.

Objectives

The goal of the "Glass Hospital" project is to create a 3E system in healthcare on the basis of e-service and innovative management. The following values are highlighted:



Equal
access



Equal
opportunity



Efficient
care

To reach our 3E system, the city has decided to introduce electronic registration, information and control software throughout entire hospitals, especially emergency services; improve the management of the healthcare system; increase the transparency of service and decrease the wait hours of patients.

Implementation Process:

During the project implementation, 32 control CCTVs, 37 LCD TVs, 28 printers, 2 IP Phones, 6 notebooks, a WiFi router, a GPS system, registration software and other related devices were installed throughout the hospital.

- **Queue ticket machine:**

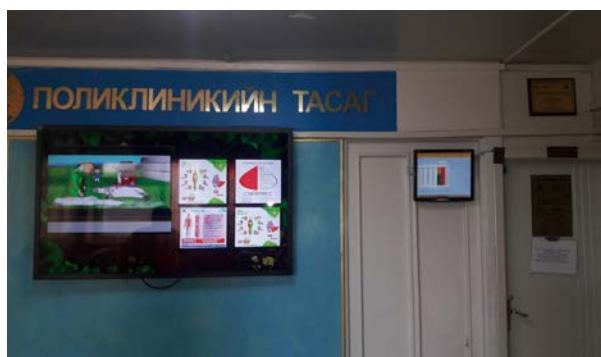
Receptionists stand near the entry door and guide patients to the ticket machine while they ask what service is needed. All services are delivered by queue number.

- **Electronic registration software**

Receptionists can register patients' information into the software and share it with doctors.

- **Electronic LCD board:**

Each inspection room has an electronic board outside, which provides information about the doctor, wait time and number of patients.



Electronic LCD Board@Darkhan City Government

- **WiFi space:**

Maternal and emergency rooms have a WiFi connection that allows mothers and their newborn babies to make video calls back home.



Mothers and newborn babies making video calls back home through WiFi connection ©Darkhan City Government

- **GPS system in ambulance cars:**

Emergency wait hours decreased by 2 times after installation.

- **Call center:**

A call center provides real time information to callers to reserve appointments.

- **Control CCTV:**

The CCTV system helps patients monitor services. For the hospital, it helps control workers' time management.



The CCTV Monitor©Darkhan City Government

- **Wireless computers:**

Computers are used in emergency and maternal rooms to allow mothers to connect with their families online.

- **Printers and copy machines:**

The printing devices print out MRI results and other related information.

Results & Reflections

The project implemented and integrated a variety of smart devices into hospital operations as described in the Solution Description. 32 control CCTVs, 37 LCD TVs, 28 printers, 2 IP Phones, 6 notebooks, a WiFi router, a GPS system, registration software and other related devices were installed throughout the hospital.

After the project implementation, emergency wait hours decreased by 2 times, inspection wait hours dropped by 7.9 percent and patient satisfaction increased by 30.7 percent.

The city is currently tackling the challenge of improving the building capacity and increasing the number of workers. Additionally, it aims to connect hospitals in remote areas and family clinics to central hospitals.

Review Comments

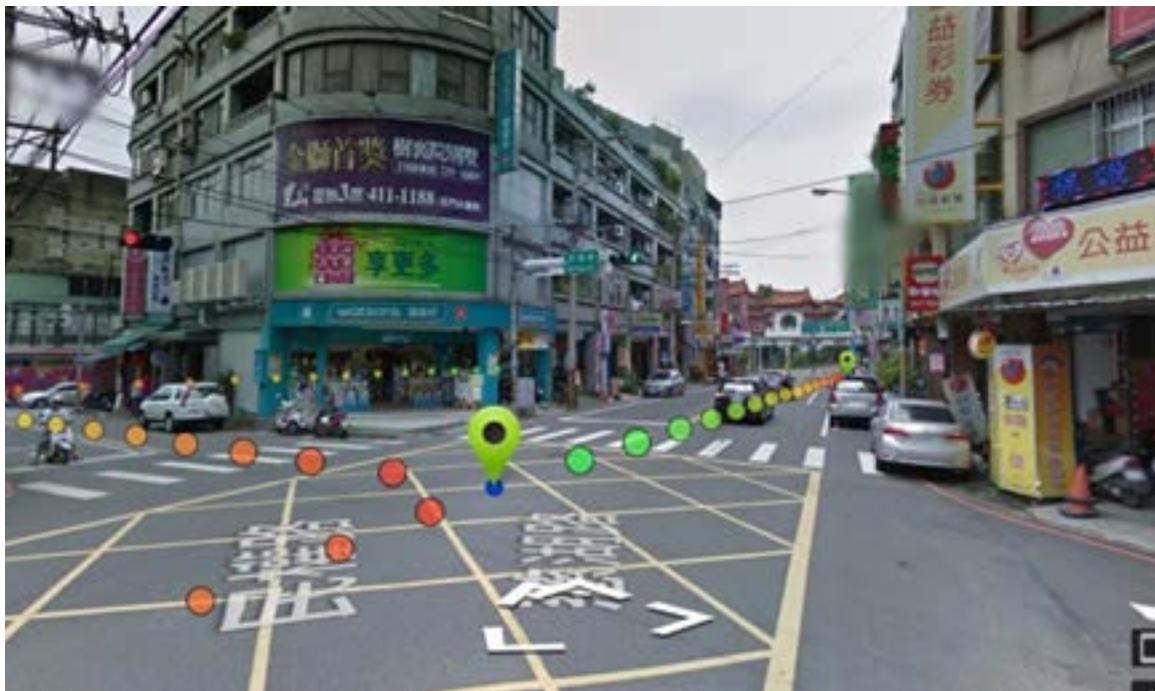
1. This case demonstrates a good example of integrating healthcare and IoT to improve the efficiency of the health care system, which shares a great deal of similarity with the services of some hospitals in Taiwan.
2. This small scale project in Darkhan City is a good example of how a very small budget can achieve tangible improvements for citizens through e-services. Reduced waiting times in hospitals is a good achievement that benefits residents tangibly. Also, Transparency and interconnection of services will enhance public trust in healthcare provision. Are there also ideas about how these ideas might be extended to primary care in smaller health facilities?
3. The utilized e-system is awesome, though it would really be helpful if more satellite clinics were established to cater to the needs of the people.

City Solutions

2-6 Intelligent Cloud System for
Wastewater Management

Intelligent Cloud System for Wastewater Management

— Taoyuan City



The AR view of underground sewer pipe ©Taoyuan City Government

City Profile



Country: Taiwan
Area: 1,220.95 km² (471.41 sq mi)
Population: 2,116,988

Urban Challenges

Water treatment is always a crucial challenge to cities in Taiwan. With the development of sewer and water recycling center construction in Taoyuan City, the connection rate of pipelines to sewage treatment has increased significantly and is on track to expand in the future. In early 2018, the sewerage system was about 115 kilometers long. It is expected that the connection rate will reach 13% by the end of 2018 and could reach 60% within eight years. Additionally, the construction progress for the storm sewerage system is anticipated to reach 373.39 km in length and a 78.2% connection rate by the end of 2021.

Consequently, pipeline data management is vital. Proper facilities management for the completed sewerage system and sewage treatment plant are crucial to ensure quality operations.

Cloud System for Wastewater Management

"Combining with advanced technologies today including IoT, AR and GIS, Taoyuan City Sewerage Cloud Management System could enhance the efficiency of sewage facilities management." (Quote from Department of Water Resources, Taoyuan)

Taoyuan City 'Intelligent Cloud System for Wastewater Management' integrates Internet of Things (IoT), augmented reality (AR) and geographic information systems (GIS) technologies to monitor the condition of the sewerage system in real time. The operation application modules help carry out routine maintenance more effectively and improve efficiency in administrative work. The system converts all sewerage construction data into a unique attribute format and uses GIS to document and manage information. Additionally, this information can be viewed in a web application accessible to the public.

The project is hosted by the Taoyuan City Government in partnership with Stantec Consulting Services Inc., Taiwan Branch. The following figure provides a systematic overview of this project.

Contributor:

Shu-nu Chung, Section Manager,
Taoyuan City Government

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© sdg knowledge platform



Operational Diagram of the Intelligent Cloud System ©Taoyuan City Government

City Solutions

2-6 Intelligent Cloud System for
Wastewater Management

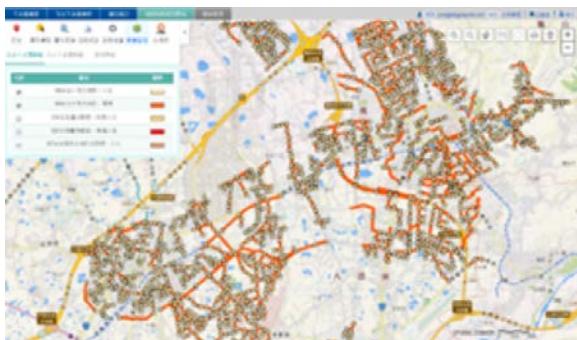
Results & Reflections

Currently, the cloud system manages over 7,500 manholes/pipes of sewerage, 7,700 manholes/pipes of storm sewerage and six water recycling centers. The system is designed for sustainable sewerage management, and it has achieved targets including the following:

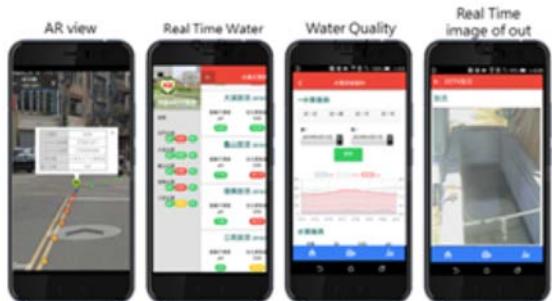
1	Unified the sewerage attributes format of Taoyuan City
2	Built a complete database by integrating and importing the existing drawing information and data of sewer systems
3	Upgraded service to the public by establishing an online viewing application
4	Defined IoT infrastructure and created an app as sewerage management tool
5	Created a real-time water quality monitor app for six water recycling centers to achieve instant management
6	Reduced reaction time after receiving a sewer facility repair request by APP
7	Displayed the GIS map layers by connecting to the Taoyuan GIS data warehouse
8	Built an online form to intake public help requests and expedite repairs [i1]

One year after implementation, the cloud system has succeeded in gaining widespread usage, including the following:

- Digitized more than 7,500 manholes/pipes of sewerage
- Digitized more than 7,700 manholes/pipes of storm sewer
- Obtained real-time data and online documentation of six water recycling centers
- Monitored 121 ongoing construction sites in real time via the system
- Monitored 33 subcontractors with 1456 car rips for water fertilizer station
- Dredged a 28.8 km length of storm sewerage
- Enabled eight cable TV companies to attach 196 km length wires in the storm sewer
- Received reports of 226 damage issues from the public



Import the existing drawings of sewer system/©Taoyuan City Government



Real time data and on-line documents of 6 water recycling centers and
sewer AR view/©Taoyuan City Government

The first step of “Wastewater Management” involved integrating the project database, GIS and building a business communication platform and application modules for storm and sewerage operation.

In the future, we envision expanding the content. Potential next steps might be to integrate the rain and sewerage facilities data collection, auto-register operating information systems combined with IoT, use CCTV to conduct longitudinal inspections and evaluate structural performance, add real-time information management of the pipeline, and assess the plant site’s energy performance.

Based on the potential strategies above, we have divided the project timeline into four phases, including (1) Solid Foundation, (2) Real-time Monitoring, (3) Assessment Review, and (4) Sustainable Development.

The aforementioned improvements will contribute to a more sustainable development strategy and management of risks, budget, performance, demonstration and assets.

Furthermore, collecting all maintenance data such as water quality, repair and event logs, and an intelligent system could suggest an appropriate maintenance frequency of each sewer facility.

Review Comments

1. With the increasing population, water management will be a critical issue in the future. This project shows how the intelligent use of IT can enhance understanding of sewage management systems and the various techniques which can be employed.
2. Overflow of sewage has been a major problem in many developed and underdeveloped cities as well. Therefore, it is benefit to use IoT, AR, GIS to enhance the efficiency of sewage facilities management. The system should be designed to be comprised of sensors to sense the wastewater level, command controllers, communication networks to register complaints regarding blockage and the continuous increase in the level of sewage. The level sensors should be efficiently used and system should be designed in a socially relevant way, to create an impact on hygiene and cleanliness by simply avoiding the problem of sewers and also to ensure compulsory cleaning of blockages which cause increases in the sewage level by registering repeated complaints to relevant departments unless action is taken.
3. While it is certainly interesting to be able to monitor the functionality of a sewer system in real time, the main benefit of this project for the city and its residents remains unclear. For example, one benefit named includes 196 km of cable inserted into the city's sewer system by local companies. This does not in itself constitute a benefit for the city and the wider public but resembles a mere subsidy for the local economy through public tenders. The question remains whether the new system provides enough of a benefit for the actual operation of the sewer system and in the form of a public service to justify the creation of an expansive digital overlay onto the city's infrastructure.
4. This is one of the more useful and highly applicable case studies. I would further suggest testimonials from the maintenance and operations personnel; for example, has this system actually reduced their workload? Has it improved their efficiency? Would they recommend other cities use it? What kind of savings does it achieve?

Healthy City Tainan: Clean Air and Disease Prevention

— Tainan City



©Intelligent Community Forum

Case
Study
1

Mosquito Control Facilitated by GIS & IOT in the Cloud

Outbreak of Dengue Fever

Dengue fever is an environmental infectious disease that spreads in tropical and subtropical countries in Asia, Africa and the Americas through the Aedes aegypti and Aedes albopictus mosquitoes. In 2015, annual record high temperatures, torrential rains and typhoons in Tainan City created an appropriate environment for mosquitoes. As a result, Tainan experienced a record-setting outbreak of dengue fever with 22,754 cases and 112 deaths. The outbreak threatened public health and safety and damaged the economy. This event informed Tainan City's objectives of overcoming climate change impacts by using scientific and technological methods to prevent and reduce the spread of dengue fever.

City Profile



Area: 2,191.65 km² (846.20 sq mi)
Population: 1,885,252

Contributor:

Ching-Fen Tsai, Public Health Bureau, Tainan City Government

City Solutions

2-7 Healthy City Tainan: Clean Air and Disease Prevention

Linking SDGs

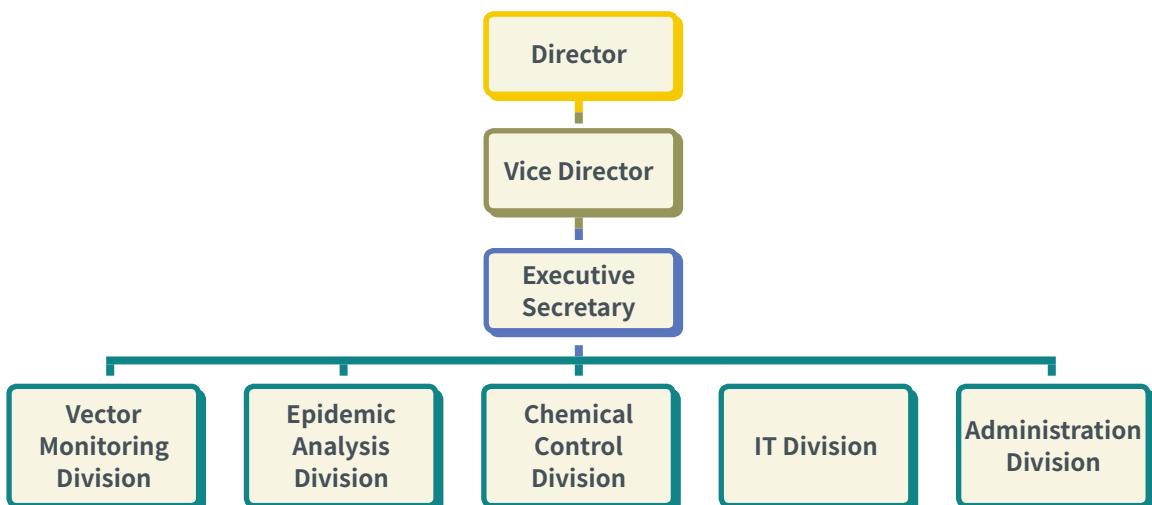


© sdg knowledge platform

Inclusive Solutions with Multi-sectoral Cooperation

In response to the dengue fever challenge, the city government took an interdisciplinary approach to set up mechanisms for cooperation and data sharing.

In April 2016, the Center for Dengue Prevention and Control was established. Separated into five divisions, the center coordinates communication among government, hospitals, experts in healthcare and the central government. The specific functions include developing annual plans, measuring vector mosquito densities, installing prevention and control measures, monitoring the outbreak, increasing public information access, formulating and deploying pesticides, managing city resources and imposing administrative penalties. The following figure shows the organization and the five divisions of the center.

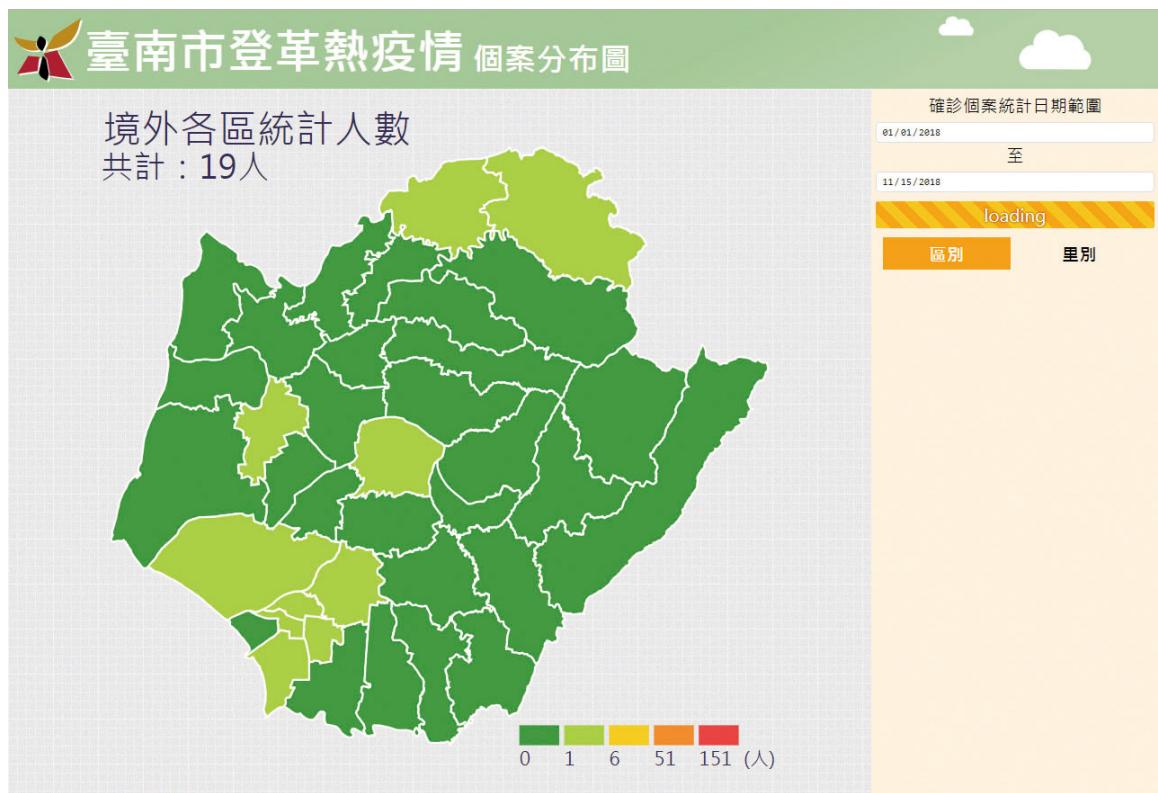


Organization of the Center for Dengue Prevention and Control

Tainan Dengue Epidemic Geographic Information System (TDEGIS)

Under the Center for Dengue Prevention and Control, the Tainan Dengue Epidemic Geographic Information System (TDEGIS) was set up as an inter-agency dengue prevention and control platform. The TDEGIS combines government prevention strategies and public engagement via information technologies such as big data analysis, cloud computing, IoT, and GIS. The ultimate goal is to integrate information and develop a thorough Dengue prevention network.

The household densities of vector-mosquitoes measured by field workers in all districts are uploaded to the GIS platform. The data collected are processed to identify hot spots and generate a table of Breteau index by village in real time so that prompt disease control measures can be taken accordingly in every district.



Tainan City Case Distribution Map ©Public Health Bureau, Tainan City Government

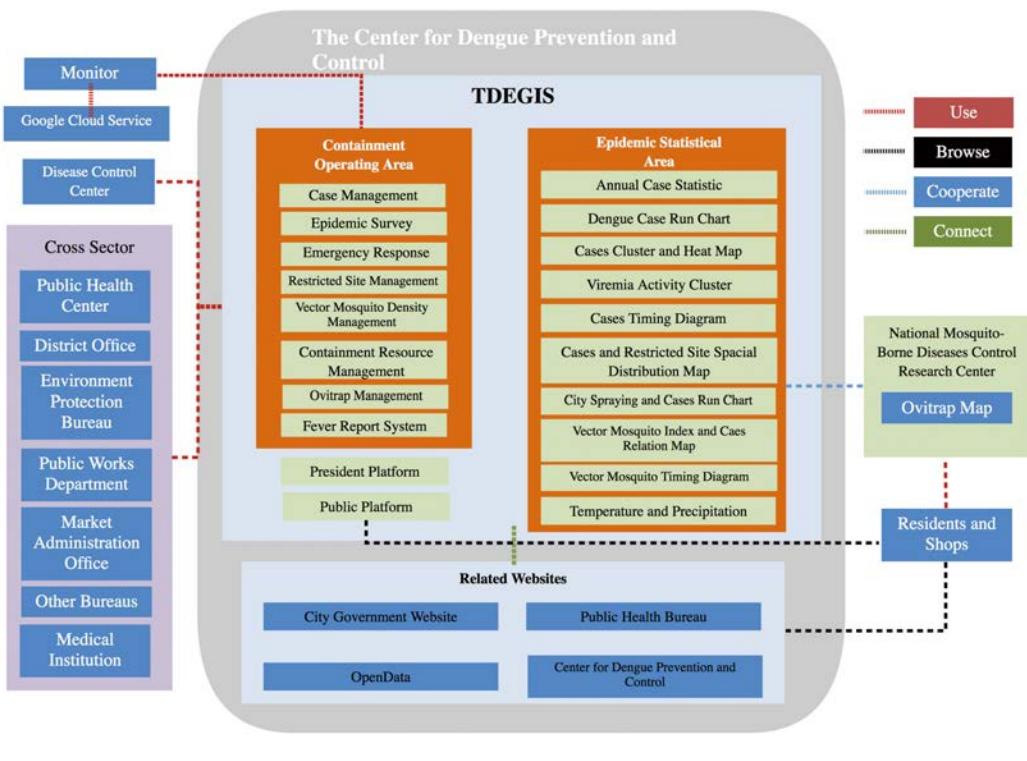
As the GIS platform facilitates inter-agency coordination and communications, prevention and control efficiency is improved by 100 times in surveying vector-mosquitoes density, by 10 times in updating insecticide spraying maps and by 6 times in alerting and notification. The platform is also used for audits, statistics and analyses that further strengthen dengue prevention. The statistics section shows the correlations between variables to be taken into account in decision making.

Additionally, the administrative view of the platform provides a consolidated dashboard view of numbers and statistics, while the public view provides dengue situation updates on both web and mobile. The included data warehouses include "Diagnosed Fever Cases", "Mosquito Density Survey",

City Solutions

2-7 Healthy City Tainan: Clean Air and Disease Prevention

"Dengue Fighting Schedule", "Outdoor Chemical Epidemic Track", "Construction Case Information", "Building Site", "Enlisting Dengue Epidemic Prevention", "City Residents' Announcement on Empty Materials for Empty Land", "Temperature and Humidity Data in Tainan" and "Taiwan City Rainfall Data." All data is published online as open and readily accessible by the public. The figure below shows the operational system of the TDEGIS.



Operational Structure of TDEGIS

Implementing a Prompt Notification System

After the standard operating procedures (SOPs) were established and a map of hospitals and clinics offering rapid dengue tests was made available on the platform, users were able to consult the map to seek prompt and convenient medical attention. Hospitals and clinics can also immediately report a case with fever through the fever reporting system on the platform.

Reducing the Population of Vector-mosquitoes

The GeoJSON data is shared with National Cheng Kung University (NCKU) to co-create an app called “Mosquito Man”, and smart mosquito lamps, and a smart electric mosquito killer were developed in cooperation with MediaTek to geographically locate vector-mosquito ovitraps. The data obtained through Internet-connected monitoring devices are transmitted to the GIS systems through Wi-Fi. Based on the climate data and the numbers of eggs in ovitraps in different districts, dengue hotspots are identified in order to facilitate fast and effective vector elimination. Furthermore, locations of high adult mosquito densities can be identified and tracked for changes in real time.



Mosquito Man APP ©Tainan City Government

Application of Cloud Computing

In a cloud environment, the Center for Dengue Prevention and Control obtains real-time information from those dispatched to the field to take photos, obtain geographic information and describe and record the locations of the ovitraps.



Mosquito Lamp ©Tainan City Government

Results

Through the above strategies and cooperation on every level of society, the number of local dengue fever cases decreased to only 10 in 2016 and 0 by 2017. With this impressive statistical outcome, Tainan City received the 2017 IoT Innovation Award and the 2018 Smart City Summit and Expo Innovation Application Award for its disease prevention efforts.

The additional benefits of the disease prevention program are shown in the following table.

Community Well-being	<ul style="list-style-type: none">Prevention of public panic as the outbreak slowedReturn of touristsClean up support for affected households
Institutional Strengthening	<ul style="list-style-type: none">A well-structured organization and sustainable servicesImproved administrative operations through innovative technologiesAccurate analysis and decision-making as efficiency improvedBetter deployment with real-time data visualizationInvolvement of public health and subject experts in decision makingLowered resource and materials consumption over time
Environment Benefits	<ul style="list-style-type: none">Decrease in insecticide sprayingImproved land use

Additional benefits of the disease prevention program

Knowledge Sharing and Future Development

Although Tainan City has solved its local dengue fever problems, the increasing frequency of international travel has led to an increase in the number of dengue cases transferred abroad. Therefore, the city aims to use its expertise to share knowledge with other cities and prevent overseas disease migration. Tactics include dengue fever information campaigns at airports, exit-entry symptom monitoring for passengers and the NS1 fast screening test for dengue.

Other future objectives include strengthening the GIS system, integrating various resources, expanding monitoring and the IoT network for vector mosquitoes, and improving early detection and prevention of dengue fever cases.

Review Comments

1. The utilization of IT on disease prevention, and specifically dengue, is highly impressive.
2. The project is recommendable particularly to tropical countries that are often visited by typhoons because it will eliminate the transfer of disease from one country to another.
3. The project has demonstrated a good example to identify the risk of the city and find a good solution with technological tools. Similar methodology could be applied to cities which face the same risk.

Urban Challenges

The causes and sources of air pollution in Tainan City are complex. The main pollutant is PM2.5, which refers to atmospheric particulate matter with a diameter of less than 2.5 micrometers. 30% of PM2.5 pollution comes from sources including local factories, gas exhaust from motor vehicles, vehicle dust, construction sites, the food service industry, agricultural operations and bare land. The remaining 70% is contributed by other counties and cities through cross-border pollutant transfer.

To improve Tainan's air quality, the city's PM2.5 and PM10 concentrations should meet national air quality standards. Air pollution and weather must be monitored throughout the country. Changes in air pollutant concentration and long-term weather analysis should be formulated in order to develop control strategies to improve air quality and maintain a friendly environment for urban living.

Contributor:

Mei-Kuei Chu, Division Chief, Tainan City Government

Linking SDGs



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Suspended Particulate Reduction Plan

The Tainan Environmental Protection Bureau has been cooperating with other municipal bureaus to promote "bright and clear air, suspended particulate reduction plan (亮麗晴空懸浮微粒管制削減計畫)". The city has implemented pollution source control and planning control measures to improve Tainan city's air quality. Specific strategies and progress are as follows:

1. Installed a hierarchical air quality monitoring network of environmental sensors for the intelligent management of air quality deterioration events. Set up 4 national air quality monitoring stations, 2 local auxiliary stations and 12 artificial monitoring stations. Set up an additional 4 monitoring stations in sensitive industrial areas.
2. Develop community protection measures in industrial areas, including increased education about the environment to raise citizens' awareness of how air quality affects their quality of life. Set up 240 sensing points in cities to respond quickly to affected areas during air quality deterioration events (overseas pollution, fire incidents, and regional poor air quality), quickly adopt response measures, and issue warnings to mitigate the impact of air pollution on citizen health.

City Solutions

2-7 Healthy City Tainan: Clean Air and Disease Prevention

3. Use scientific instruments to identify, inspect and curb major sources of air pollutants. Conducted inspections of stationary pollution sources, gas stations, and construction sites, using Unmanned Aerial Vehicles (UAVs), Light Detection and Ranging and Infrared Gas Imaging instruments. Identify abnormal emissions and pollution sources that exceed emissions standards and require improvements.
4. Set up real-time air quality monitoring facilities in large factories that are connected to the Environmental Protection Administration. Equip 13 large-scale factory chimneys with real-time air quality monitoring facilities connected to the EPA; facilities monitor items such as opacity, sulfur oxides and nitrogen oxides.
5. Implement a license plate recognition system to control highly polluting vehicles. Announce the Clean Air Zones to control the entry of highly polluting vehicles. A license plate recognition system is used to screen out vehicles that do not comply with the regulations.

Results & Reflections

Over the past seven years (2011-2017), Tainan air quality has improved substantially. The annual and daily average of PM2.5 concentration has decreased by 32% over this period. The PM10 annual and daily average concentrations have been lower than the air quality standard for three consecutive years (2015-2017). Furthermore, in 2015 and 2016, Tainan City earned the Taiwan Environmental Protection Administration's evaluation of "Excellent" performance.

Looking forward to the future, Tainan City's vision for 2026 is that the average concentration of PM2.5 will reach the national air quality standard ($15\mu\text{g}/\text{m}^3$). To build on the success of existing initiatives, Tainan City plans to implement the following strategies:

1. Gradually replace the commercial and industrial use of oil-fired boilers with clean fuels
2. Announce the Air Quality Maintenance Areas (Clean Air Zones) to control the entry of diesel vehicles obtains autonomous management entities; Confirm the vehicles will be in line with the air pollution index regulations to improve the Clean Air Zones' air quality
3. Introduce policies regarding the Provision of Air Pollution Prevention in the catering industry
4. Build a miniature air quality sensor for improved environmental management



Clean Air Zones © Tainan City Government

Review Comments

1. Air quality management is one of the common issues in Asia countries.
This project demonstrate one of the solutions which can share to other cities.
2. The diesel vehicles control is key to improve the air quality in cities. The cities may need also to initiate plan for e-car policy.



Social Engagement & Community Innovation

2-8 Vector Lights

 **Auckland City**

2-9 Share the Road Environmental Transport Program

 **Pasig City**

2-10 Upsouth: A Youth Empowerment Platform

 **Auckland City**

Vector Lights

— Auckland City



Vector Lights on Auckland Harbor Bridge@Auckland Council

Urban Challenges

New Zealand faces significant vulnerability to the effects of climate change, especially because many of its major population centers, including Auckland, lie on coastal regions or along major rivers. As a result, issues like sea level rise, extreme weather events and dwindling freshwater supply threaten the vitality of urban life.

Because the country is so reliant on the natural environment for its prosperity, New Zealand has emerged as a green energy leader with one of the lowest rates of carbon emissions. Approximately 80% of its electricity is renewable, with hydropower, geothermal power and wind energy comprising the majority of the energy mix. Photovoltaic solar energy has been taken up on a small scale, but overall comprises only 0.2% of the energy

 **City Profile**



Country: New Zealand
Area: 1,102.9 km² (425.8 sq mi)
Population: 1,534,700

City Solutions

2-8 Vector Lights

Contributor:

Matt Montgomery, Head of Innovation, Auckland Council

supply and has expanded more slowly compared to other OECD countries. It remains an opportunity ripe for disruption as installation prices continue to drop.

Linking SDGs



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10-year Commitment to Energy Efficiency

The Vector Lights project aims to make use of an iconic piece of urban infrastructure as a continual storytelling canvas to promote renewable energy and raise awareness of the critical role of renewable energy. Through it, we are telling the story of our shared commitment to energy efficiency, carbon emission reduction, and innovation, all the while transforming an iconic structure with stunning light shows celebrating this diverse city for the next decade and beyond.

Objectives	
Auckland Council	<ul style="list-style-type: none">Increase awareness of energy consumption and carbon reduction targetsInspire and excite Aucklanders and increase awareness of eventsPosition Auckland as a leader in sustainable energy and clean technology
Vector Group	<ul style="list-style-type: none">Demonstrate leadership in new energy technology integrationReposition the brand as innovativeIncrease consumer awareness and consideration of solar and battery energy solutions
Communication objectives for Vector Lights	<ul style="list-style-type: none">Attract 20-25% of Aucklanders to see the launch of Vector LightsPromote an understanding of solar and battery storage technology to local communitiesInspire all audiences - local, national, and global - with a one-of-kind creative displayBuild awareness of the name 'Vector Lights' and establish the social media hashtag #vectorlights

Vector Lights aims to achieve the following objectives

Bridging to a Smart Energy Future

Vector Lights on Auckland Harbour Bridge is a partnership between Auckland Council and Vector Group that creates a world-class landmark championing a smart energy future. It is the first installation of its kind in the world: a main city bridge lit entirely by solar energy, with battery and

peer-to-peer technology. The lights are programmed for public viewing on special events and holidays throughout the year, such as to celebrate Maori New Year and Auckland Pride.

Vector Lights is a collaborative effort among many stakeholders from the public sector, private sector and civil society. The core partners are Vector Group, the Auckland City Council and the New Zealand Transport Agency. Other stakeholders included Panuku Development Auckland, creative agencies Colenso and Assembly, the Office of the Mayor of Auckland, Ministry of Transport, Auckland Transport, Auckland's iwi, local residents, Auckland Council governing body and more.

For the build-up and launch, Vector Lights engaged schoolchildren by creating a competition called Design The Future, in which kids brainstormed and submitted their own smart energy inventions. This was spearheaded by engineer and educator Dr Michelle Dickinson (known publicly as Nano-girl), who has extensive experience engaging children from diverse backgrounds to build confidence around science and technology. Furthermore, the competition winners were invited to be the guests of honor at launch, making young people the focal point of the 'lights-on' event. Centering children is also more appealing to audiences and media outlets compared to featuring dignitaries or executives.



Design The Future Competition events/©Auckland Council

The Vector Lights launch event needed to be informal and accessible, with the bridge as 'hero', and with media having access to spokespeople. A casual BBQ at Little Shoal Bay in Northcote was hosted with members from stakeholder organizations, elected city representatives and Prime Minister Jacinda Ardern. The viral, wide-reaching power of social media was also leveraged by emphasizing the Facebook live-stream. Cameras were stationed at either side of the bridge and crowds were managed to ensure viewability.

Since the initial launch, Vector Lights has continued to host popular light shows to celebrate special events and holidays year-round. A calendar of all upcoming light events is available on the Vector website. These programs appeal to diverse members of society, raising awareness for causes from Blue September (prostate cancer) to the Hindu festival of Diwali.



Vector Lights Brochure & Behind the Scenes/©Auckland Council

Raising Awareness

Vector Lights' six minute launch show reached 5.4 million people (combined statistics from all media, streaming, social engagement, etc..) Vector Lights has received media coverage from every major national outlet as well as hundreds of pick-ups from international media organizations. Research conducted by Vector post-launch has shown that 59% of adult Aucklanders have heard of Vector Lights, 34% have watched a Vector Lights show, and 83% of viewers said they 'enjoyed' or 'loved' watching Vector Lights (against a target of 25%).

Metrics highlighting public engagement with the Vector Lights launch are showcased below:

Launch Announcement	
Local media	Smart building logistics
35+ individual news items in 2 days • 95% positive reaction • 80% attribution	338,879 • Impressions: 399,331
Launch Statistics	
Tens of thousands of people turned out around the harbour. Crowd estimates include:	
1,000+ on Mt Eden, 800+ on Mt Victoria, 500+ in Devonport, 500+ at Te Atatu Peninsula, 3,000 at Little Shoal Bay, and thousands more along the city and North Shore waterfronts.	
Facebook launch event reach	Facebook sentiment analysis
471,000+	• Positive or neutral = 765 • Negative = 54
Auckland Council social media reach	Vector social media reach
350,000+ (Facebook, Instagram, Twitter)	250,000+ (Facebook, Instagram, Snapchat)
Hero launch video	Online streaming
74,000 views in 2 days (via all social and news platforms)[i2]	• 14,000 views of Vector's Facebook livestream • Increased to 77,000 within 3 days

City Solutions

2-8 Vector Lights

Further post-campaign research has demonstrated that awareness of Vector's solar business has increased to 11% (up from 9%) and battery awareness is now 6% (up from 4%). These improvements demonstrate the capacity of public landmarks like Vector Lights to increase positive public perceptions of clean energy solutions. It is especially effective in raising awareness among younger demographics who will shape Auckland's energy future, many of whom attend light shows with their families or competed in the "Design the Future" competition. As Vector Lights continues, the project will aim to increase awareness numbers as viewers connect the events to support for green energy.

Design the Future Website:
[https://www.vector.co.nz/
about-us/sponsorship/lights/
competition-entries](https://www.vector.co.nz/about-us/sponsorship/lights/competition-entries)

Vector Lights is a 10-year commitment and will continue to champion innovation as Auckland grows. An array of new stories will be told via events. Lessons learned from the launch will allow us to continue to improve, inspire and excite Auckland and the world.



Vector Lights on Auckland Harbor Bridge©Auckland Council

Review Comments

1. Vector Lights is admirable in its successful attempt to raise awareness of citizens and the general public for energy efficiency and climate change. The numbers of people reached are impressive and other campaigning initiatives may be able to draw valuable lessons from the project. However, arguably, the focus of Smart Cities very often lies on energy efficiency and climate change while neglecting other pressing urban sustainability issues, such as biodiversity loss, plastic waste pollution, e-waste, food waste and a deteriorating nutrient cycle, social and resource impacts of digitization, etc. Arguably, a campaigning approach should best focus on issues that are overlooked by the public and even experts - as such, it is recommended to see how the Vector Lights campaign approach can be applied to issues that are not yet on the general public's radar.
2. This is an excellent project which could easily be replicated on other major public infrastructure works. No mention is made of consultation or involvement of shipping or pleasure craft organizations, however. This is important because their safety at night relies on navigation lights; and these can be difficult to distinguish if there is a profusion of other lights. The same might be applied to aircraft if tall buildings are lit.
3. This project uses the obvious idea of a "Lighthouse" project or a "Demonstrator" to bring the visibility of the film and technology know-how. The interesting strategy of combining technological demonstration with cultural development of the city of Auckland is effective. However the connection between the public visibility of the project and raising awareness of sustainable energy can be communicated further with continued events and programs.
4. A good example of how to change culture, which targeted the youth, regarding use of efficient renewable energy alternatives. Solution Descriptions and data in the Reflections section are very useful and persuasive.

Share the Road Environmental Transport Program

— Pasig City



Pasig City/©Flickr John Westbrock

City Profile



Area: 31.00 km² (11.97 sq mi)
Population: 772,695

Urbanization and its Accompanying Challenges

Pasig City is the eighth largest city in Metro Manila in terms of land area. The population of Pasig City increased sharply between 2010 and 2017. Moreover, due to higher purchasing power and a more widespread car-centric mentality, the number of vehicles began to increase remarkably in 2014.

Additionally, Pasig City serves as the gateway to the East Philippines, including all municipalities and cities of Rizal Province. It is home to 121 subdivisions, 176 condominiums and 26,780 business establishments, not to

mention commercial centers and malls. As per data from the Metropolitan Manila Development Authority (MMDA) 2016, car dealers roll out 820 new units per day. As a result, traffic conditions in Pasig City have worsened, leading to a rapid increase in road congestion costs. With traffic congestion in the country's highly urbanized areas reaching a total gridlock, Pasig City residents are eager for a workable solution.

Contributor:

Raquel A. Naciongayo, Department Head of City Environment and Natural Resources Office (CENRO)

Linking SDGs



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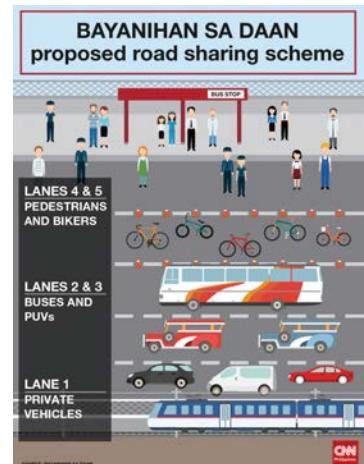
Share the Road Environmental Transport Strategies

Realizing the importance of bridging the gap between economic progress and sustainability, Pasig City began to formulate real-world solutions and employ proactive governance to solve its road congestion problems. The city government adopted the concept of Road Sharing Principles called "Bayanihan sa Daan", which represents a sustainable urban transport strategy integrating pedestrianization, walking, cycling and public transportation.

Pasig City has taken the lead to demonstrate four roads for Carless Sunday Streets. It has also shown proof of concept of road sharing in the 2.5 kilometer road along the Manggahan Floodway, including these complementary strategies:

• Improve Environmentally Sustainable Transport (EST)

Improving the service capacity of public transportation can reduce reliance on private vehicles. For example, Pasig City Community Shuttle Service and electric tricycles were established to redirect current development to favor safer and greener transport systems. Additionally, reducing the number of private vehicles can alleviate congestion and reduce travel delays, because public transport occupies less road space per passenger. This is shown by the implementation of the Odd-Even Scheme on six Pasig City's six major gateways.



Bayanihan-sa-Daan_infographics©CNNPH

City Solutions

2-9 Share the Road Environmental Transport Program



Distribution of Cargo Type Etrike to Different Communities©City Government of Pasig



Etrike Beneficiaries from tricycle drivers©City Government of Pasig

• Intelligent Traffic System (ITS)

The ITS connects the interactions of drivers, pedestrians, public transportation and traffic management systems. It receives real-time data from various sensors installed all over the city like VDS-CCTV, inductive loop and RSE , which will be sent to commuters through smart phone apps and the internet. This would lessen the number of traffic accidents and deaths and make roads generally safer for motorists and the general public. This smart technology solution encourages people to consider more environmentally friendly methods of transportation during high traffic hours.

• Continuous, Well-Connected Pedestrian Network

The City requires the provision of pedestrian facilities on all existing, new, and reconstructed roads as well as retrofitting old road networks. Today, cities can be designed compactly to reduce the need for motorized transport by making streets well-connected and walkable. Additionally, pedestrian networks should be integrated with sustainable long-distance transportation infrastructure, such as mass transit and land use planning.

In addition, the City will continue to implement solar-powered blinking pedestrian signals that help pedestrians know when they may cross safely. The City will also continue to implement pedestrian countdown signals that reduce uncertainty about safe crossing times. The City will continue to improve pedestrian crossings at signalized and non-signalized intersections, with the goal of reducing the frequency and severity of preventable collisions involving pedestrians.

• Develop a Network of Cycling Facilities

The City has installed protected bike lanes, bike racks and demonstrated a bike sharing system to encourage cycling, which is one indicator of a vibrant, sustainable city. Along with walking, transit and carpooling, cycling conserves natural resources and reduces pressure on the road network. Ancillary benefits include improving health, supporting more compact development, preserving the environment and supporting economic activity. Finally, it offers speed and convenience for shorter trips.



Protected Bike Lanes at CBD©City Government of Pasig



Bike Sharing Program at the CDB and City Hall Compound©City Government of Pasig

City Solutions

2-9 Share the Road Environmental Transport Program

• **Implement Pedestrian Signals Countdown**

The City will continue to implement solar-powered blinking pedestrian signals that help pedestrians know when they may cross safely. The City will also continue to implement pedestrian countdown signals that reduce uncertainty about safe crossing times. The City will continue to improve pedestrian crossings at signalized and non-signalized intersections, with the goal of reducing the frequency and severity of preventable collisions involving pedestrians.

Smart Governance: Holistic and Inclusive

Pasig City's long-standing efforts to provide Carless Sunday Streets, free public transport, financial and e-tricycle loan assistance and traffic de-congestion programs all have empowerment at their core: ensuring that people have the opportunities they need to live better lives with dignity and security. With this value, Pasig city adopted the following approaches to encourage not only cross-sectoral cooperation but public engagement.

The combination of soft and hard creative innovations includes the following:

• **Sandwich Approach**

The "Sandwich Approach" or "Bibingka" Paradigm for planning engages the entire community by brainstorming simultaneously from the bottom up and top-down. Starting with a vision from the city leadership or other stakeholders, solutions are formed via consultations and are translated into a local law or ordinance. Stakeholders also include members of the technical working group and implementers. Feedback mechanisms are installed to ensure a successful project, and detailed documentations allows for replication and knowledge sharing with other cities.

• **Streets Owned by People: Bayanihan sa Daan**

Bayanihan sa Daan inculcates the values of family and community bonding as well as road sharing principles. The City continues to create many places for people to assemble, play and associate with others within their neighborhood despite the limited urban space. Examples include innovating Carless Sunday Streets, pedestrianization, and all forms of non-motorized transportation.

Active community participation is also an end in itself. Participatory planning allows people to realize their full potential and make their best contribution to society. This is the wisdom behind the Bayanihan sa Daan Programs. Rather than arranging people around development, urban spaces should be woven by people and for people.

“Pro-active” governance means preparing to roll up our sleeves and get hands dirty to create truly sustainable transportation. Barangay-level consultations take place in relaxed but regular coffee sessions where project implementation at the grassroots is monitored. Regular feedback mechanisms for stakeholders are institutionalized, which encourages people’s participation and instills a sense of ownership.

• Odd-Even Scheme

The Odd-Even Traffic Scheme, also known as “The Revised Traffic and Parking Management Code of Pasig,” is a congestion-reducing measure included in Ordinance No. 23, Series of 2016. Pasig City is a gateway for vehicles from Rizal Province to Metro Manila, Makati City to Quezon City, and vice versa. The Odd-Even scheme mandates that vehicles with license plate numbers ending in 1, 3, 5, 7 and 9 cannot use specific roads on Tuesdays, Thursdays and Saturdays, while vehicles with license plate numbers ending in 0, 2, 4, 6 and 8 may not pass on Mondays, Wednesdays and Fridays. Traffic congestion within the city was reduced when the National Government modified the Number Coding within Metro Manila. With the help and participation of Pasig residents, the traffic scheme was a success.

City Solutions

2-9 Share the Road Environmental Transport Program



Carless Sunday Streets Brochure/©City Government of Pasig

Carless Sunday Streets

Pasig City's long-standing efforts to provide Carless Sunday Streets, free public transport, financial and e-tricycle loan assistance, and traffic de-congestion programs all have empowerment at their core: ensuring that people have the opportunities they need to live better lives in dignity and security. The city is guided by the Clean Air Asia's "avoid, shift and improve" strategies to implement the sustainable urban transport programs. Pasig City is exploring new frontiers of empowerment with the following indicators during program planning, implementation and monitoring:

• Confidence and Understanding

For Bayanihan sa Daan Program, the community and recipients initiated requests to the City Government about their project proposals. These requests included installing bike lanes or a Carless Sunday Streets program in their locality.

• Analysis and Communication

The City Government facilitates forums, public hearings and community discussions regarding urban planning. It mobilizes experts and support groups in the Central Business District, homeowners' associations, interest groups and health and wellness enthusiasts.

• Trust, Caring and Tolerance

Through the Technical Working Group for every project, the City delegated responsibilities to achieve a sense of community ownership. They involve vulnerable people such as persons with disabilities, tricycle drivers, senior citizens and other target beneficiaries.

• Communication and Cooperation

Homeowners' associations, interested groups and advocacy leaders are empowered to implement and assist in the enforcement of guidelines to protect the Share the Road program from rejections and opposing parties.

• Access to Information

All members and stakeholders of the community involved in the Sustainable Transport Programs can access data and information about the project. This transparency allows stakeholders to discuss improvements and give feedback to improve project implementation.



Partnership agreement and citizen engagement towards low carbon city/©City Government of Pasig

City Transport Development and Management Office

This office centralizes different offices and experts to promote the development of well-integrated and sustainable urban transport with the following functions:

1	Study, create and recommend policies and plans where transport planning is concerned
2	Review existing and relevant city ordinance and resolutions relevant to transport planning and management and propose enactment of new ones
3	Create the Pasig City Transport Master Plan
4	Promote mass public transport (bus, jeepneys, ferry, company shuttle service)
5	Spearhead and represent the city in public consultations regarding transport concerns
6	Manage the implementation and monitoring of the transport master plan, its objectives, concepts and accessibility
7	Coordinate and collaborate with neighboring cities to ensure good connectivity and safety of movement.

Functions of the City Transport Development and Management Office

City Solutions

2-9 Share the Road Environmental Transport Program

At present, there are eight active technical working groups and a special ad hoc transport committee handling Carless Sunday Streets programs, free public buses, bike share, bike for life and other special transport projects. They schedule regular informal meetings and consultations on how to sustain, synergize and intensify people's participation. Consultation improves the quality of rules, programs and compliance while reducing enforcement costs for both the government and citizens. Regulation and its reforms affect all participants in civil society, and therefore, in order to better assess the impacts and minimize costs, all parties involved should be able to participate somehow in the regulatory processes. The committee's strong working belief is that **"when you want to walk fast, walk alone, but when you want to go far, walk with many."**



Bike for Life©City Government of Pasig



Carless Weekend Zumba©City Government of Pasig

During the process of the Share the Road project, one challenge facing was the business sector questioning the legality of road closure to institute Carless Sunday Streets. In response, the City Government invoked the stakeholders' engagement and bike ordinance, as well as Executive Order 774 favoring "non-motorized transportation and that those who have less in wheels must have more in roads."

Results & Reflections

Programs	Accomplishments / Impact	Outcomes
A. Free Community Shuttle Service Buses	<ul style="list-style-type: none"> — Serviced 125,038 passengers on four routes in the Pasig City CBD and other identified routes 	<ul style="list-style-type: none"> — Increased purchasing power of constituents — Promoted clean, safe and comfortable public transportation
B. Bike Facilities (bike lanes, bike share)	<ul style="list-style-type: none"> — 15 kilometers of bike lanes were implemented along with 660 bike parking facilities in buildings and establishments 	<ul style="list-style-type: none"> — Ensured safety of cyclists — Reduced amount of fuel consumption — Promoted clean air
C. Bike for Life	<ul style="list-style-type: none"> — 2,500 bikers have been participating in special and monthly bike events since 2011 	<ul style="list-style-type: none"> — Promoted healthy lifestyle and non-motorized transport to constituents and the general public
D. Carless Sunday Streets/ Share the Road	<ul style="list-style-type: none"> — Five major roads implemented and sustained with 185,000 visitors and Carless loyalists for five years resulting in 360 events and activities 	<ul style="list-style-type: none"> — Improved air quality by 72% — Promoted entrepreneurship by increasing traffic to bazaars and businesses — Promoted family and community bonding spirit — Promoted active transport such as walking, jogging and biking
E. Pedestrianization and Walkability Promotion	<ul style="list-style-type: none"> — Three kilometers of elevated skywalk were implemented at City Hall and other buildings along with 25 elevated skywalk and walkways at the Pasig CBD and citywide 	<ul style="list-style-type: none"> — Provided convenience, connectivity and safety for pedestrians — Reduced traffic congestion
F. Odd-Even Traffic Vehicle Volume Reduction Scheme	<ul style="list-style-type: none"> — Six major city gateways have been following the scheme which has reduced travel time from 2 hours to 30 minutes 	<ul style="list-style-type: none"> — Stabilized flow of people and vehicles — Promoted quality time for self and family — Reduced vehicle traffic by 40%
G. Etrike Replacement and Upgrading	<ul style="list-style-type: none"> — Ordinance for phase-out of old two stroke trikes had passed while there were 50 etrike beneficiaries 	<ul style="list-style-type: none"> — Increased income by 50% for Etrike Drivers — Reduced carbon dioxide emissions through cleaner fuel
H. Intelligent Traffic System (ITS)	<ul style="list-style-type: none"> — 82 Road Safety Blinking Solar Pedestrian Lights were installed along with six LED Monitoring Advisories installed in strategic areas 	<ul style="list-style-type: none"> — Decreased the risk of traffic accidents or deaths — Improved road safety for pedestrians — Reduced carbon dioxide emissions

Outcome of the Share the Road Environment Transport Program

Lessons Sharing

Recommendations for peer cities considering similar projects to Share the Road include the following:

1. Conduct consultation with diverse stakeholders in the community;
2. Enact a local ordinance;
3. Create an independent project management unit in the City Government;
4. Organize a Technical Working Group involving the affected sectors and stakeholders.

These strategies towards increasing transportation efficiency simultaneously reduce greenhouse gas emissions in the city. People are encouraged to consider alternative methods of transport such as shared biking or public transportation which helps slow down global warming.

Review Comments

1. The traffic issue in Pasig represents the overall issue in the emerging countries in Asia; therefore the comprehensive improvement can be very informative for regions which have common challenges.
2. The Share the Road Environment Transport Program in Pasig City is an excellent example of a holistic and inclusive approach to city wide improvement of the transportation system.
3. The initiative is admirable for its inclusive governance approach which includes stakeholders and citizens in the transformation of its transportation system.
4. The Share the Road Environment Transport Program constitutes an ideal approach to the Smart City: Good Governance, supported by both institutional and technological innovation as tools to reach social and environmental urban development targets.
5. To take a more sustainable mobility path, besides odd-even scheme, the critical role of non-motorized transport needs to be recognized and factored into road infrastructure investments.

Upsouth: A Youth Empowerment Platform

— Auckland City



Auckland City/©DXR, wikipedia

City Profile



Country: New Zealand
Area: 1,102.9 km² (425.8 sq mi)
Population: 1,534,700

Urban Challenges

New Zealand faces significant vulnerability to the effects of climate change, South Auckland's favorable geographic location, strong Māori heritage, and creative potential make the area unlike any other in New Zealand. However, it's also an area which faces complex social and economic challenges:

- High unemployment and underemployment
- Low educational attainment
- Low incomes
- Social harms caused by hardship and poverty

Contributor:
Gael Surgenor, Director of Community and Social Innovation, Auckland Council

More than 270,000 people - almost 20 percent of all Aucklanders - live in South Auckland. Nearly 40 percent of residents are under 25 years of age, making South Auckland home to 23 percent of all Auckland's youth. Furthermore, South Auckland is part of the most dynamic center of economic

activity in New Zealand. However, as Auckland grows, so too does the risk of regional (and national) failure.

Objectives

South Auckland's economic importance, abundance of talent, and large youthful population are strengths waiting to be unlocked. For these reasons, social, economic, and physical regeneration in South Auckland is a strategic priority for Auckland Council.

The Southern Initiative (TSI) sits within Auckland Council and its role is to stimulate social and community innovation in South Auckland. It tackles complex socio-economic challenges and creates opportunities that will benefit its people. It has three areas of priority with a particular focus on social innovation and entrepreneurship:

- Shared prosperity
- Resilience
- Thriving children and whānau (family)

Its core functions include:

1. Raising incomes through quality employment opportunities and establishing businesses that create shared prosperity;
2. Implementing environmental, technological, economic and demographic changes to build long-term resilience and adaptability;
3. Supporting whānau (family), especially those with very young children, to develop their own lifelong solutions for success.



Solutions

Upsouth is a youth empowerment and civic engagement digital platform operating in South Auckland. It is one of a number of initiatives and programs delivered by The Southern Initiative. Through Upsouth, diverse agencies may receive young people's feedback and ideas on a range of social, environmental, business and civic challenges. Furthermore, Upsouth users earn micropayments for their contributions from sponsors. Members have the option to share the money they've earned with other Upsouth members, whose contributions they support.

The screenshot shows the Upsouth platform homepage. At the top, there's a decorative header bar with a repeating pattern of small squares in various colors. Below it, the word "UPSOUTH" is written in a bold, black, sans-serif font. To the right of "UPSOUTH" are three links: "Login", "Sign Up", and "About Us". A large banner dominates the center of the page. It features a woman in a yellow dress with a white flower in her hair, smiling and pointing towards the camera. The background of the banner is a colorful, abstract mural. Overlaid on the banner is the text "KIA ORA AND WELCOME TO UPSOUTH!" in large, bold, yellow letters. Below this, four bullet points are listed: "Connect", "Create", "Thrive", and "Earn money". At the bottom right of the banner, the text "Image credit: Stacy Benn" is visible. Below the banner, the text "Get started on our callUPs" is displayed in a teal font. To the left, a blue box contains a "NOTICE" section with text about an upgrade and a "WATCH THIS SPACE!" message. To the right, another box features a question from Aroha Lulu: "Who is supporting you to reach your full potential?". At the bottom of the page, there's a call-to-action: "Create an account or login to start sharing your ideas".

Image of the Upsouth Platform©Upsouth

This method engages a community of young people who don't often participate in traditional forms of engagement such as surveys and public meetings. Ideas can be submitted via video, poem, image, drawing, text or any other format. The value of micropayments depends on the originality, insight, creativity and critical thinking of responses. These requests have injected thousands of dollars into the South Auckland economy, enabling young people to earn money while using 21st century skills to contribute to their community.

Beyond workforce skills and extra income, Upsouth empowers young people to be civically engaged in their communities. This platform enables young people to get in touch with their cultural identities and think critically about relevant issues. Furthermore, allowing users to share their rewards strengthens community ties. In short, Upsouth builds civic innovation and a common entrepreneurial spirit.

How can we reduce the gap between rich or poor?

AUTHOR

Tatiana
on 26/09/2017

GIVE

give \$

\$210.00
1

created for the call if you had the power, what changes would you make to remove children and young people out of poverty in NZ?

SHARE

<https://upsouth.nz/po>

All rights reserved

The Example of the Auckland Youth Proposing Ideas and Solutions to the Social Events©Upsouth

The Upsouth program has achieved substantial success in achieving its objectives. The innovative community engagement model which advances youth participation (especially young Māori and Pasifika) in public meetings and local businesses. This model allows young people to invest in their own small businesses. According to user feedback, Upsouth is considered a safe space for self-expression, idea exchange and earned income. The platform has gained active support and promotion from South Auckland schools.

In its first eighteen months of operation, more than 2,700 young Māori and Pasifika people, mostly aged 15-24, signed up to give feedback and respond to sponsored questions. Thirty eight call-ups have been made on the platform to date by council departments, local boards, corporations and community organizations. Furthermore, Upsouth has partnered with sponsors including philanthropic groups, private sector members including Z Energy, and other agencies. Upsouth partnered with Itsnoon, a Brazilian software company, which developed its human empowerment software. Itsnoon's experience, with 400 similar deployments globally, was the foundation to a close working relationship and overcoming the initial learning curve at launch. The TSI team's collective skill and connections were also instrumental to developing grassroots partnerships.

Case Studies

The following two case studies highlight benefits and results of the platforms so far:

- **Case study 1:**

18-year old Neihana Lowe from Papakura set up his own photography and videography business after receiving an Upsouth payment for his contribution. He used the money to buy equipment and is now working with several clients in South Auckland. In a short amount of time, he was named the Māoriland Film Festival Filmmaker of the Year and held his own exhibition in conjunction with his kuia (Tūhoe) called Whēnua I at the Papakura Art Gallery.

- **Case study 2:**

Janet Akai became increasingly more confident in her creative and photographic skills through Upsouth. With the money she made from her contributions, she bought professional camera gear and is now the communications manager at the Cook Island Development Agency (CIDANZ). Janet was responsible for designing the impressive photography for the national campaign used to profile 2017's Cook Island Language Week.

Results & Reflections

Challenges and conflict are inevitable during the initial stages of operation. The key difficulties encountered were the following:

- Identifying the most effective human empowerment technology
- Expanding the user base
- Developing a sustainable sponsorship pipeline
- Achieving scale

At the same time, Upsouth is working on increasing collaborations with schools and workshops. Word-of-mouth marketing from students has been successful in engaging larger communities, which ultimately play an instrumental role in forming partnerships with educational institutions.

Upsouth is the perfect platform to find out how young people in the city feel about environmental sustainability and for young people to be able to share their concerns about a very important local and global issue. Recently, Upsouth ran a call-up asking for ideas on how council and a partner

organization could make a part of the city's drains and waterways more beautiful. It received a number of innovative designs and ideas which are now being considered for implementation. In the future, the Auckland Council is planning to do a specific environmental sustainability call-up. The resulting contributions could well feed into the council's environmental policymaking.

Looking ahead, The Ministry of Youth Development and The Ministry for Vulnerable Children (Oranga Tamariki) have both expressed interest in investing in the platform so it can scale nationally and that investment is currently being explored. Upsouth will continue working on expanding its user base. Ultimately, the goal is nationwide adoption of this platform so that youth across the country can connect with each other through civic engagement.

Find out more

explore ideas

Little dolphin

The dolphin makes her way through the waters she has known all her life, swimming with the family she loves so dearly. Today there is a new taste to the water, a pollutant, though they have no vocabulary for such things and so she tells her loved ones that the water tastes like "feels bad." They already know but like her they can't understand why. Their eyes sting and there is no option to escape the toxins. They surface, breaking the top to feel cool

darshi 15 Mar 2019 **\$ 1.00**

What is essential for future wa...

Nice fresh and clean water is vitally essential for kiwis. As a key part of life water is a very essential thing we need. To make sure our water is clean in the future we need to take care of our local natural water bodies and also we need to protect the water over time and even when there is construction in place like development. We also need to prepare our water for the future and future climate change.

aneel bala 15 Mar 2019 **\$ 0.00**

Ryan

lol

Rang! Trey 15 Mar 2019 **\$ 1.00**

Call up ideas on the future of Auckland's water © Upsouth

Review Comments

1. The Upsouth project's high sign-up rate, with 2700 young Māori and Pasifika citizens, is promising. The mechanism for distributing funds on the platform is also very innovative. I would be intrigued to know more about how the trust mechanism is built and governed and how the innovative idea is up scaled and accelerated in the market. Overall, it is a very promising case that can be used in Taiwan or other places in the world where social innovation movement is building. Blockchain technology is potentially a useful tool for upscaling this kind of project.
2. Upsouth is a great project that focuses on human capital and social innovation rather than the often applied utopian approach of "cherry-picking citizens" found in other smart city initiatives. Rather than asking who will be able to operate technology, this project asks what technology actually enables and empowers people to fulfill their potential. So far, this is a great example of tackling smart cities "the right way": Unfolding the potential of people, not the potential of technology.
3. This object claims to promote youth empowerment and civic engagement, but very few details of direct and successful outcomes are provided. It would be interesting to know what has been learned from less successful ideas and how these have been adapted to cope with experience.
4. The solutions provided are very good because it utilizes the people or the youth who are actually experiencing the problems and their solutions surely have bases since they are the ones looking into the problems. The process by which the activities could be sustained is likewise important.
5. It is great to see the focus on a social program—we need this in cities. It would be more comprehensive to highlight the elements that make this "smart" or "innovative" different than other government programs for social and youth engagement, for example their specific outreach through social media, and how other cities could learn from that. Also, more statistics are needed to show "before" and "after" intervention strategies, or at least to estimate the numbers of youth assisted, and what the longer-term impacts might be.

3

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