United 4 Smart Sustainable Cities

Connecting cities and communities with the Sustainable Development Goals

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Foreword

This publication on “Connecting cities and communities with the SDGs" has been developed within the framework of the United for Smart Sustainable Cities (U4SSC) initiative. This publication provides an overview of how cities can use information and communication technologies (ICTs) to achieve the Sustainable Development Goals (SDGs). It also maps the case studies to the various international agreements as well as the SDGs.

Acknowledgements

This publication has been researched and written by John Smiciklas (BOMA Canada), Mythili Menon (ITU), Domenica Carriero (UNECE), Vimal Wakhlu (ITU-APT Foundation), Okan Geray (Smart Dubai Office), Hanna Vartto (South Pole Group), Austin Stankus (Food and Agriculture Organization of the United Nations (FAO), Hazem Galal (PricewaterhouseCoopers-PwC) and Hamda Bin Demaithan (Dubai Data Establishment).

The authors wish to thank the U4SSC management team, Gloria Placer Maruri and Nasser Al Marzouqi (U4SSC Co-chairmen) and Victoria Sukenik and Paolo Gemma (U4SSC Vice-chairmen) for their respective assistance and contributions.

The authors also wish to extend their gratitude to the contributing organizations along with their representatives: Oliver Hillel from the Convention on Biological Diversity (CBD), Lucy Winchester and Vera Kiss from the Economic Commission for Latin America and the Caribbean (ECLAC), Simone Borelli from the Food and Agriculture Organization (FAO), Cristina Bueti and Reyna Ubeda from the International Telecommunication Union (ITU), Iryna Usava from the United Nations Development Programme (UNDP), James Murombedzi from the United Nations Economic Commission for Africa (UNECA), Ivonne Higuero from the United Nations Economic Commission for Europe (UNECE), Guilherme Canela from the Regional Bureau for Sciences in Latin America and the Caribbean of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Martina Otto and Garrigan Curt from United Nations Environment (UN Environment), Maria Atkinson Am and Gary Pivo from the United Nations Environment Programme Finance Initiative (UNEP-FI), Motsomi Maletjane from the United Nations Framework Convention for Climate Change (UNFCCC), Andre Dzikus, Tania Lim, Jean Yves and Robert Lewis from the United Nations Human Settlements Programme (UN-Habitat), Pradeep Monga, Toni Lim and Katarina Barunica from the United Nations Industrial Development Organization (UNIDO), Nuno Lopes, Soumaya Ben Dhaou and Morten Meyerhoff Nielsen from the United Nations University – Operating Unit on Policy-Driven Electronic Governance (UNU-EGOV), and Alexander Baklanov from the World Meteorological Organization (WMO).

The opinions expressed in this publication are those of the authors and do not necessarily represent the views of their respective organizations or members.

ISBN
978-92-61-25361-5 (Paper version)
978-92-61-25371-4 (Electronic version)

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1 INTRODUCTION

Introduction

The United for Smart Sustainable Cities (U4SSC) initiative is a distinctive global smart-city platform. This unique initiative launched by the International Telecommunication Union (ITU) and United Nations Economic Commission for Europe (UNECE) in May 2016, is supported by 16 United Nations agencies, programmes and secretariats.

U4SSC has embraced the following definition for smart sustainable cities developed by ITU and UNECE:

> ***"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental, as well as cultural, aspects."***

U4SSC has been facilitating knowledge sharing and partnership building on smart cities, with the aim of formulating strategic guidelines to implement, among others, the New Urban Agenda, the Paris Agreement, the Connect 2020 Agenda and the 2030 Agenda for Sustainable Development.

Within a short time frame, the initiative has grown by leaps and bounds and continues to receive contributions to its work from across the globe.

Following the launch of the Sustainable Development Goals (SDGs) by the UN General Assembly in September 2015, countries have struggled to find a way to implement the SDGs at the national level. This report aims to show that not only is the implementation of the SDGs possible, but that some countries and cities are already making good progress in this domain.

The U4SSC members have prepared a series of case studies, output documents and products, which will catapult successful smart-city measures into the global spotlight, for adoption.

This flipbook provides an overview of how cities can use information and communication technologies (ICTs) to achieve the SDGs. It also maps the case studies to the various international agreements as well as the SDGs. Based on the mapping in this flipbook, U4SSC aims to derive the best practices and guidelines with the final goal of propelling transitions to smart cities while simultaneously achieving the SDGs. The outputs presented in this flipbook are expected to provide urban stakeholders with an overview of innovative concepts, policies and frameworks that have been adopted in various countries, to facilitate smart-city transformations.

CONNECTING CITIES AND COMMUNITIES WITH THE SDGs

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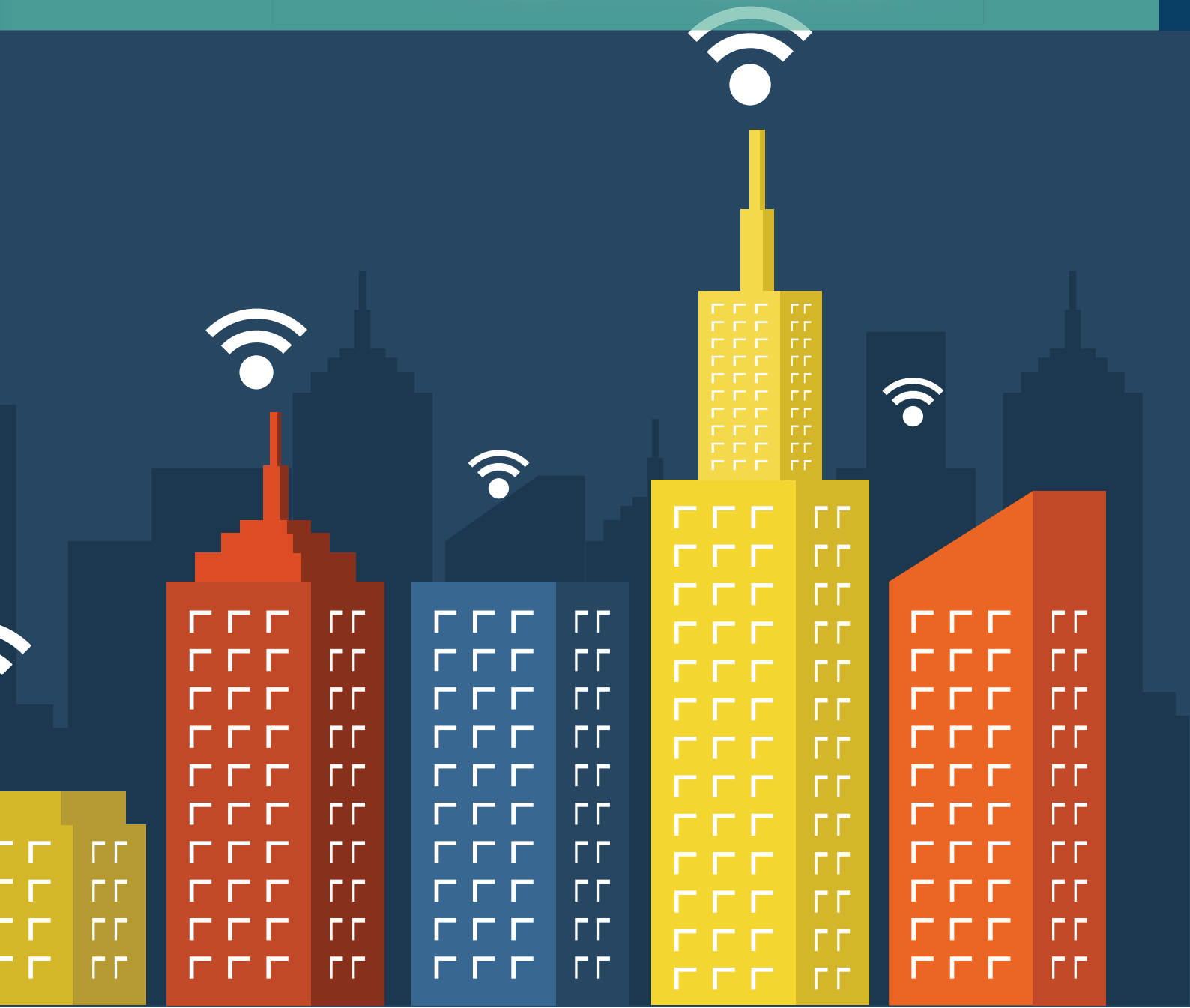

Goal 1:
No Poverty – Green Bond for Cities

1 NO POVERTY

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1 Introduction

1.1 Background

This case study introduces two examples of cities that have issued green bonds, namely Gothenburg and Mexico City. The City of Gothenburg has in many terms been a positive example within the city green bonds market as a result of the city's experience in green bond issuance since 2013, and the transparent design of its green bond framework. Mexico City offers an example of a more recent green bond issuance in a less developed Latin American market.

Gothenburg, located on the western coast, is Sweden's second largest city and home to Scandinavia's largest port. The city of Gothenburg was originally focused on heavy industry; however, over the years it has successfully transformed into one of the global leaders on climate change issues, and became the first city in the world to issue a green bond. The city is currently experiencing a significant growth in population and it has been calculated that by the year 2035, the city will experience a 27% increase in its population. As the population grows, so does the challenge of providing all the necessary services to its residents. The challenges faced by the metropolitan area of Mexico city with over 20 million inhabitants, are not only focused on population growth, but also on many of its derivatives such as pollution, traffic, insufficient waste management, scarce water supply, lack of sustainable housing etc. In 1992, the United Nations labelled Mexico City as "the most polluted city", which for the first time set in motion the city's environmental management efforts.

The increased focus on environmental issues and sustainability in general has been a catalyst in increasing interest in green bond issuance. More recently, the Sustainable Development Goals (SDGs) and the Paris Agreement (COP21) are also being reflected in cities' development plans. It is important to note that the concept of green bonds is specifically important to SDG 1, target 1.5[1]. Therefore, implementing this concept in cities will assist with the attainment of SDG 1.

1.2 Challenge and response

In the case of Gothenburg, the root of the problem that led to the design and implementation of the city's green bond framework was related to the city's industrial setup. The transition towards greener initiatives was set in motion in 1987 when Gothenburg's Environmental Project was established. Since then, the city has adopted a number of environmental best practices and implemented sustainable initiatives in the city context. More recently, the population growth has extended the city's needs for realizing sustainable city development projects. Mexico City has faced various challenges related to the geographical location of the city (as it is built on what used to be a lake), rapid growth of the population and city expansion, socio-economic situation (social inequality, poverty), natural disasters (earthquakes, floods) and the effects of climate change[2] (rains, floods, droughts, heat waves, landslides).

After setting environmental and climate-related goals, Gothenburg decided to allocate funding for the achievement of their environmental goals. Likewise, to address the challenges the city faces today, Mexico City has had to consider innovative ways to access financing through capital markets. By issuing green bonds, cities can mobilize capital for climate change related investments and hence promote sustainable development that will improve the well-being of their residents.

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1 SDG 1, target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

2 According to the Mexico City Climate Action Program (PACCM) 2014-2020, approximately 5.6 million people in the city are vulnerable to the effects of climate change.

2 The project(s)

2.1 Vision and content

Issuing green bonds allows cities to support the implementation of sustainable development projects with the help of additional capital from the green bond market. The eligible projects under Gothenburg's green bond framework closely follow the focus areas of the city's strategy.

For example, the city has specified that the eligible energy efficiency projects should produce at least a 25% reduction in energy usage. Related to the city's development boom, an estimated 80 000 new homes and workplaces will be built by 2035. This is reflected in the eligible green bond projects under "sustainable housing", which comprises the infrastructure and construction of new green buildings with specific energy efficiency requirements (e.g. new apartment constructions up to 60 kWh/sqm year), as well as major renovations to make buildings more energy efficient (e.g. apartment renovation reduction of at least 40% or up to 90 kWh/sqm year). Being home to Scandinavia's largest port, Gothenburg gives emphasis to sustainable transport by including in its eligible projects, a list of elements on sustainable shipping and sustainable freight to decrease the use of fossil fuels. In addition, sustainable transport can include projects on biking and pedestrian infrastructure, or public transportation. All of this is aligned with the city's long-term vision and development strategy[3].

In general, Mexico City has strong local climate action plans, and has participated actively in international forums to report on its commitments and actions. The city's local climate change vision and commitments consist of two main elements, Climate Action Local Strategy 2014-2020 (ELAC) and Climate Action Program 2014-2020 (PACCM), which together define the broad guidelines for the city's climate strategy and corresponding action plans. Mexico City's recent Resilience Strategy[4], published as part of the 100 Resilient Cities Initiative by the Rockefeller Foundation, addresses the challenges faced by the city through a five-pillar structure including aspects of planning for urban and regional resilience, promoting water resilience as a new paradigm to manage water in the Mexico basin, and improving mobility through an integrated, safe and sustainable system.

Under a green bond framework, the proceeds from bond issuances are earmarked for eligible green projects only. In the case of Gothenburg, green bonds are issued to finance environmental projects on renewable energy, city planning, public transport, waste management, smart grids and water treatment. In general, the projects chosen have to comply with Swedish and EU legislation. These projects should promote the transition to low-carbon and climate-resilient growth, and are in line with Gothenburg's environmental programme and climate strategy. Usually, when a city issues a green bond, the net proceeds of the issuance are transferred to a specific budget account that supports the city's lending to the eligible projects.

Since the first issuance of green bonds in 2013, Gothenburg has raised a total of 4.36 billion SEK (458 million EUR) through the green bond market. The first green bond issued by Mexico City in December 2016, had a value of 1000 million MXN (46 million EUR). As per the Mexico City green bond framework's eligibility criteria, the proceeds of the bond will be used to support projects in sustainable transport, sustainable buildings, renewable energy, energy efficiency, water efficiency and wastewater management, pollution prevention and control, conservation of biodiversity and climate change adaptation.

2.2 Implementation

The decisions made by local governments play a significant role in the issuance of green bonds. In the case of Gothenburg and Mexico City alike, the change has not happened at once, but has instead required

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[3] Explained in more detail in the city of Gothenburg's annual report 2015 and strategy document "Development Strategy Göteborg 2035".

[4] Mexico City, CDMX Resilience Strategy – Adaptive, inclusive and equitable transformation, 2016, http://lghttp.60358.nexcesscdn.net/8046264/images/page/-/100rc/pdfs/CDMX%20Resilience%20Strategy%20-%20English.pdf (accessed on January 18, 2017).

continuous efforts to promote the cities' sustainability agendas. One of the main drivers for issuing city green bonds has been the gradual transition in public policy and legislation towards sustainability over the last few years. In many cases the development has been led by international commitments, national government policies and strategies, and later adopted by local city governments. For example, Mexico becoming the first developing country to adopt a General Climate Change Law (LGCC) in 2012, highlighted the country's strong commitment to reducing its emissions. The National Climate Change Strategy was adopted in 2013 and from there on the country has been on the path to transition towards more sustainable city policies.

Although Mexico City was the first city in Latin America to issue green bonds, it was able to look into previous experiences on green bond issuances, e.g. in Europe, for reference. A local Mexican development bank, Nacional Financiera (NAFIN), issued its first green bond in November 2015, which in turn paved the way for the issuance of the city's first green bond. Also, the city's urgent need for sustainable infrastructure (e.g. low-carbon infrastructure, energy efficiency, water infrastructure) influenced the decision to seek financing through the issuance of a green bond.

For a city to be able to issue green bonds, it must be creditworthy to raise capital in the financial markets. However, approximately 80% of cities in general do not have an investment grade credit rating, which means that if they are interested in issuing green bonds, they must first consider options to increase their creditworthiness (e.g. credit enhancement, third-party guarantees)[5]. Both Gothenburg and Mexico City had a sufficient credit rating for issuing green bonds, which made the process more straightforward.

The complexity of the implementation of a city green bond framework depends on the city's initial circumstances i.e., mainly the legal setup and city's creditworthiness.[6] For assistance on how to proceed in the initial phases of green bond issuance, cities can closely monitor successful green bond schemes in other countries. Following this, the city has to set eligibility criteria and identify the projects it would like to include under the framework. The Green Bond Principles[7] are used as reference for determining the general process under which the framework should operate. These principles also contain the details on reporting and transparency requirements.

Green bond issuance can sometimes be accompanied by specific marketing initiatives to promote the climate awareness of the issuer. Also, prior to issuing a green bond, the issuer usually looks for a second opinion[8] to increase investors' confidence on the quality of the issuance. For Gothenburg's green bond framework, the second opinion was provided by Cicero (Centre for International Climate and Environmental Research – University of Oslo), whereas Sustainalytics evaluated the Mexico City green bond framework.

The management of the green bond framework requires engagement and collective efforts from various levels of public administration. Setting up a monitoring, reporting and verification structure requires high levels of cooperation between different government entities. For example, Gothenburg's Environment Administration oversees the monitoring and reporting regarding the implementation of the environmental

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5 South Pole Group, Climate Policy Initiative, ICLEI – Local governments for Sustainability and Climate Bonds Initiative; Green Bonds for Cities. http://local.climate-kic.org/wp-content/uploads/2016/09/160825_Flyer_Green-Bonds-for-Cities_LR.pdf.

6 For more information and guidance on cities' options for accessing financial flows from the green bonds, see the report "Green Bonds for Cities: A Strategic Guide for City-level Policymakers in Developing Countries" https://climatepolicyinitiative.org/wp-content/uploads/2016/12/Green-Bonds-for-Cities-A-Strategic-Guide-for-City-level-Policymakers-in-Developing-Countries.pdf.

7 International Capital Market Association (ICMA), "Green Bond Principles, 2016 – Voluntary Process Guidelines for Issuing Green Bonds", http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/green-bond-principles/.

8 Providing a second opinion refers to the process of an independent evaluator assessing the mechanisms or framework the issuer has in place for evaluating and selecting eligible projects. The evaluation can also assess the use of proceeds, management of proceeds and reporting, as well as their alignment with ICMA's Green Bond Principles. (http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/green-bond-principles/).

programme (of which the green bond framework is a part of) and the climate strategy. The projects funded by Gothenburg's Green Bond Program are publicly reported; this includes an annual investor letter that is available on the city's homepage. Publishing project-level information also allows the public to access information on how the proceeds are invested.

2.3 Results

The green bond's underlying projects contribute to Gothenburg's sustainability agenda, as well as to the well-being of the city's residents. Through the issuance of green bonds, Gothenburg has supported investments in a variety of sustainable city projects such as a large-scale production of biogas by gasification, zero emission electric cars for the city's administrative offices and companies, energy efficient housing and water treatment using the largest ultrafilter ever built in Scandinavia.[9]

The issuance of green bonds allow small-scale environmental projects to get funded by including them as part of a larger pool of projects. It can also give cities positive visibility. For example, in the case of Gothenburg, green bonds together with the city's strategic climate programme were the reasons why Gothenburg was voted "Swedish Climate City of the Year" by World Wildlife Fund (WWF) in 2015.

In addition to the benefits created by the projects financed through green bonds, the green bonds also help to limit the city's financial risks by diversifying the sources of funding. Instead of relying completely on tax money, cities can tap into additional sources of finance, and access low-cost capital that is needed for infrastructure investments by issuing green bonds. Green bonds also allow cities to access new investors compared to mainstream bonds.

3 Conclusions

Many cities that have been actively participating in environmental initiatives and implementing sustainable projects, are taking the next logical step towards sustainability by including their finances in their environmental agenda.

Although Gothenburg issued its first green bond in September 2013, COP21 results further encouraged the city to create funding flows through the issuance of green bonds. One of the elements of the Paris Agreement urges the creation of financing flows that would support the "below 1.5 degrees'" scenario. This is expected to be reflected in the emerging interest in city green bonds.

Green bond frameworks can be created within any city context as long as the relevant legal and regulatory setup and level of creditworthiness permit the creation of such schemes. Gothenburg's green bond framework has already been taken as an example by cities in the EU, as well as in developing and emerging economies, to consider the option of issuing their own green bonds. Gothenburg's green bond framework has been useful in terms of transferability particularly because of its transparent management practices. In addition, the city has actively engaged in sharing information and showed its willingness to help entities interested in similar setups. Mexico City's green bond issuance showcases the framework's high potential for transferability to other cities.

As seen in the case of Gothenburg, the first city green bond issuance is usually one of many to come. As soon as a city has the adequate legislation and financial infrastructure in place to issue green bonds, it can continue with new issuances. The first issuance can be the result of years of efforts, but when the process is in place, this method of financing sustainable city development projects is noted to be highly scalable.

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9 UNFCCC, Gothenburg Green Bonds Sweden, http://unfccc.int/secretariat/momentum_for_change/items/9935.php (accessed on January 12, 2017).

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Goal 2:

Zero Hunger – Aquaponics as innovative urban agriculture-The case of the Grown Up box

2 ZERO HUNGER

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1 Introduction

1.1 Background

Aquaponics is a symbiotic integration of two mature food production disciplines: (i) aquaculture, the practice of fish farming; and (ii) hydroponics, the cultivation of plants in water without soil. Aquaponics combines the two within a closed recirculating system.

Aquaponics has the potential for higher yields of produce and protein with less labour, less land, fewer chemicals and a fraction of the water usage. Being a strictly controlled system, it combines a high level of biosecurity with a low risk of disease and external contamination, without the need for fertilizers and pesticides. Moreover, it is a potentially useful tool for overcoming some of the challenges of traditional agriculture in the face of freshwater shortages, climate change and soil degradation. Aquaponics works well in places where the soil is poor and water is scarce, for example, in urban areas, arid climates and low-lying islands. Anecdotally, aquaponics has already shown positive impacts on the local food production in cities such as Cairo, Jakarta, New York and The Hague, though no data-based study has been conducted to date.

Despite this potential, commercial aquaponics is not appropriate in all locations, and many start-ups have not achieved the desired success. Before investing in large-scale systems, operators need to consider all factors carefully, especially the availability and affordability of inputs (i.e. fish feed, building and plumbing supplies), the cost and reliability of electricity, and access to a significant market willing to pay premium prices for locally-produced, pesticide-free vegetables. Aquaponics combines the risks of both aquaculture and hydroponics, and thus expert assessment and consultation are essential.

As an integrated system, aquaponics touches on several of the Sustainable Development Goals (SDGs), notably Zero Hunger (SDG 2) along with Good Health and Well Being (SDG 3)[10], Quality Education (SDG 4), Clean Water and Sanitation (SDG 6), Industry, Innovation and Infrastructure (SDG 9) and Responsible Consumption and Production (SDG 12).

This case study presents an example of an urban aquaponics enterprise in the United Kingdom where the aquaponics system is being used as much for supporting consumer access to healthy, nutritious and local produce and the associated education therein contained, as it is used for strict food production. This interesting case study therefore also serves to highlight the interconnectedness of the SDGs.

1.2 Challenge and response

In the future, the agriculture sector will need to produce more with less. Following the principles of efficient resource use, synergistic benefits can be realized by integrating food production systems and reducing inputs, pollution and waste, while increasing efficiency, earnings and sustainability. Thus, aquaponics has the potential to support economic development and enhance food security and nutrition through efficient resource use, and become an additional means of addressing the global challenge of food supply.

The production, transport and logistics of food can entail high environmental costs, and long-distance transportation and long storage time further contributes to pollution and GHG emissions from large machinery and infrastructure. Aquaponics can play a key role in enabling local food production that is fresh, free of pesticide residues[11] and healthy, with short supply chains in the cities, thus addressing some of these issues. Aquaponics does not require soil, and therefore these systems can be set up almost everywhere and have the potential to urbanize food production.[12] In fact, aquaponics systems already have been implemented in neglected industrial buildings with the benefits of re-establishing a sustainable activity without increasing urbanization pressure on land. Local production of both fish and vegetables, and the

10 Ensure healthy lives and promote well-being for all at all ages

11 Note that aquaponics is not certified organic/biologic and some models still use pesticides.

12 EU Common Agricultural Policy

resulting short supply chains have economic, environmental and social benefits for producers, consumers and the wider community. At the same time, aquaponics systems can facilitate job creation in cities.[13]

2 The project(s)

2.1 Vision and content

GrowUp Urban Farms is an agricultural company that grows sustainable food for a local market. The aim is to change the production and distribution of nutritious food that is consumed in cities and as a result to reduce the environmental impact of agriculture and employ local people so cities can be more self-sustaining. This company's values are at the core of what they do and they steer the decisions they make for the business. The main business principles adopted by GrowUp are as follows:

- We care about People, Profit and the Planet.
- We believe we can Do Good and Make Money.
- We search for the best environmental solution available at the time – and then revisit those decisions regularly to see if a better option is available
- We think learning about and eating good food is something everyone should get the chance to do.
- We should be producing food in cities at a commercial scale in an ecologically sustainable way.
- We can improve the level of food knowledge, education and enthusiasm in cities.
- We should reduce the environmental impact of food production for cities.
- Our systems and processes can lead innovation in urban food production[14].

Figure 2-1 – the GrowUp Box

2.2 Implementation

In 2013, GrowUp, a start-up supported by Climate-KIC UK, set up a demonstration installation, the GrowUp Box, on a playground off Union Street, not far from London's financial centre. The project consists of a

13 BBC News, June 2014.

14 GrowUp Project

second-hand shipping container, with a greenhouse on top. The installation demonstrates a unique and ultra-sustainable form of aquaponics, which forms an efficient closed-loop system with just inputting fish food and a small amount of electricity for the oxygen and the pumps into the system. The container-greenhouse combo produces a range of fresh salads, tomatoes and herbs, as well as tilapia fish. Unlike similar aquaponics projects, GrowUp's plants are stacked on top of each other using a revolutionary high-density vertical growing system and saving precious urban space. The system was built by Kate Hofman and Tom Webster with £16.500, contributed by over 300 supporters in early 2013. It is now located in Stratford, London.[15]

The team organizes private and corporate tours of the box and conducts workshops for children and schools to learn about aquaponics and sustainable food production.

Besides the demonstration box, the company has almost 2000 m^2 of growing space in Beckton. The farm also includes a visitor centre allowing people to understand more about sustainable food production in cities, and enables the business to increase its social and environmental impact in the local community and engage more people in learning about urban farming.[16]

2.3 Results

The system is 14 m^2 and produces over 500 kg of salads and herbs and 160 kg of fish per year. At the beginning it served local restaurants and was priced at a premium. They could now expand production since the new farm produces more than 20 000 kg of sustainable salads and herbs and 4 000 kg of fish each year. GrowUp is considering producing and selling additional small-scale GrowUp Box installations to fulfil requests from local community organizers, schools and companies interested in funding social and educational activities.

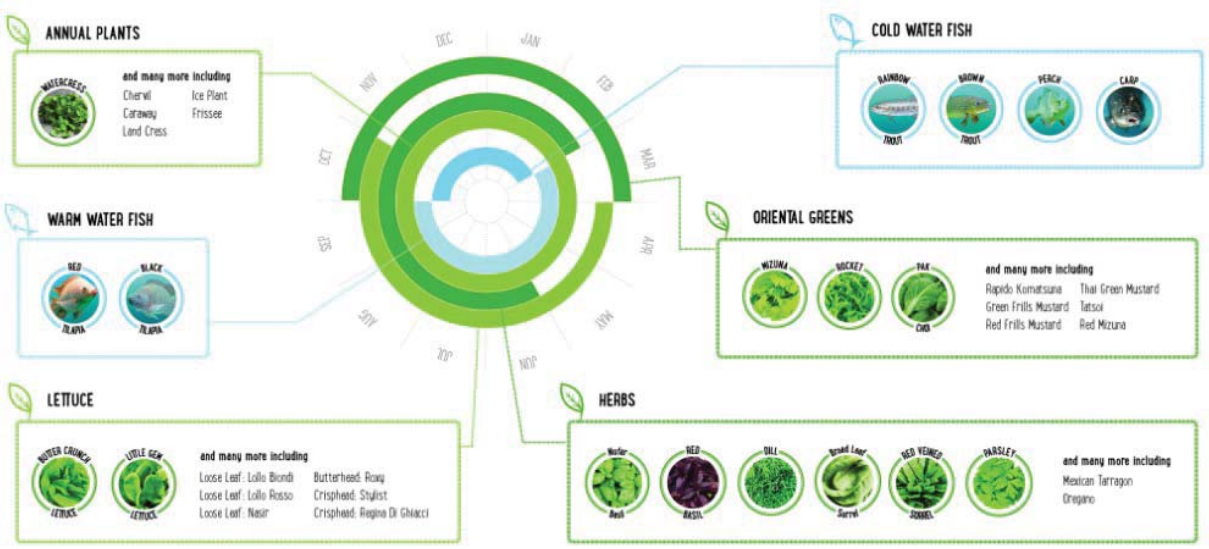

Figure 2-2 – The seasonality of the grown plants and fish

15 Case Study-Aquaponics. Climate-KIC.

16 GrowUp Project

3 Conclusions

Aquaponics is an integrated agricultural system that connects producers to consumers in a cohesive manner due to the short supply chains and to the production of organic food that is fresh and free of pesticides. It can be a source of economic growth and job opportunities, while at the same time supporting sustainable agriculture and food supplies and reducing the pressure on arable land. GrowUp Box is an aquaponics demonstration system that represents a model for sustainable food production, as well as engaging children and communities, thereby contributing to sustainable development and creating smarter and more sustainable cities worldwide.

As such, the aquaponics technique used in GrowUp helps promote soil-less agriculture and can reduce pests and soil-borne diseases which affect land crops. In countries where land and water supply is limited, this technique could even be considered a viable option for food production. However, it is noted that the apparatus required for GrowUp Box can be complicated to build and requires holistic knowledge and regular maintenance. Additionally, implementing projects similar to GrowUp Box could also require substantial start-up and labour costs. The GrowUp Box team acknowledges that their aquaponics systems are not currently designed to be a commercially viable farming system. Even if the full production capacity of GrowUp Box was utilized, it would take up to eight years to realize a return on investment.[17] While the GrowUp aquaponics model does eventually aim to generate large scale food production along with revenue, its current activities are aimed more at enlightening people about sustainable food production. Along with organized tours, GrowUp Box also hosts events, workshops and lectures to facilitate knowledge on aquaponics with the hope of promoting sustainable living.

At a technical level, aquaponics is straightforward and has proven to be successful around the world at a scale suitable for education interventions and hobbyists. However, aquaponics as a business is extremely location specific, with the availability of inputs and the access to a strong market willing to pay premium prices for locally produced, nutritious vegetables and fish seen as two key drivers for a successful enterprise. Given the unique sustainable farming model embedded in the concept of aquaponics, its potential should not be underestimated and urban stakeholders should strive to build aquaponics farms and formulate an overall plan taking into account all economic, socio-economic, labour and skills aspects. Following the principles of efficient resource use to increase the provision of goods and services from agriculture in a sustainable way, the synergistic effects of integrating separate food production systems reduce inputs, pollution and waste, while increasing efficiency, earning potential and sustainability. As one of these efficient and integrated techniques, aquaponics will support economic development and enhance food security and nutrition and will become one small piece of the collective global challenge.

[17] GrowUp Box Project

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Goal 3:

Good Health and Well-Being – Smart Life for Children Living with HIV: The Case of Kenya

3 GOOD HEALTH AND WELL-BEING

Table of Contents

1 Introduction

1.1 Background

Advancing on global health issues remains an indispensable component of Goal 3[18] of the Sustainable Development Goals (SDGs). Human Immunodeficiency Virus (HIV) finds special mention in the targets of Goal 3. Recent trends have shown that the burden of HIV has profound implications for developing countries, in particular, those in the African subcontinent. The adverse impact of HIV in Africa has been well noted. Countries like Kenya have documented high rates of HIV-related ailments and have also recorded a high mortality rate among children, which threatens the country's future development and overall health infrastructure. Infants with HIV often develop life threatening infections early on in life (compared to uninfected children).

The incidence of HIV is known to be more widespread in cities as compared to rural areas. Nairobi, the capital city of Kenya also finds itself in a similar predicament. With the high prevalence of HIV among children in Nairobi and the resultant negative effects on their health, it is of paramount importance that infants with HIV are identified and diagnosed at an early stage.[19] This will allow them to be provided with adequate HIV care, including anti-retroviral treatment (ART), which can improve their quality of life and prolong their life spans. [20]

Information and communication technologies (ICTs) are being utilized increasingly to aid HIV treatment. The main technological advances have mostly extended to the field of HIV management and future ART schedule setting. [21]

In light of the above, this case study will examine one of the key strategies, namely the HITSystem (as implemented in a pilot project carried out by the University of Kansas Medical Center and other partners), adopted in the city of Nairobi to allow for early diagnosis and a reduction in the infant mortality rate associated with HIV.[22]

1.2 Challenge and response

The National AIDS and Sexually Transmitted Infections Control Programme (NASCOP) in Kenya, had established the National Paediatric Early Infant Diagnosis (EID) Guidelines more than a decade ago in 2006. These guidelines also underscore crucial strategies aimed at the early diagnosis and management of HIV infections among infants. However, following the implementation of these guidelines in the subsequent years, it was found that children still had a disproportionate and limited access to the required treatments. In 2011, it was estimated that only 28% of the HIV-infected infants were receiving HIV care. This left majority of the HIV-positive children directly vulnerable to infections, sickness and possible mortality within one year. Furthermore, it was realized that mortality rates were the highest among children aged under the age of two and that neglect along with the absence of consistent treatment could result in nearly half of the infected children dying by their second birthday. The main problem associated with the diminished treatments application was the lack of a systematic follow-up system. In response to the growing need for a monitoring

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[18] Ensure healthy lives and promote well-being for all at all ages.

[19] Kenya AIDS Response Progress Report, 2014.

[20] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

[21] Uses of information and communication technologies in HIV self-management: A systematic review of global literature. International Journal of Information Management, pp 75-83, 2017.

[22] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya. 2015.

system, which can regulate the HIV treatments given to infants, the HITSystem, a web-based system was introduced in Nairobi and a few other peri-urban areas.[23,24]

This case will examine the design of the HITSystem (as implemented in a pilot project) to identify the gaps in its existing practices in order to provide suggestions for future research and programme streamlining.

2 The project

2.1 Vision

The HITSystem is an innovative online system for automated intervention and efficient tracking of HIV-exposed infants. This HITSystem was introduced to limit the time for the polymerase chain reaction (PCR) testing cycle and to facilitate early ART initiation for children.[25]

Deducing that 95% of HIV afflicted Kenyans seek and receive treatment through government hospitals, the HITSystem has been incorporated into the working of ten public hospitals including four in the Nairobi region. The main objective of using this system in Nairobi and other sites was to foster improved communication between the concerned hospitals, clinics laboratories and parents/guardians for improved care for HIV-exposed infants.[26]

The whole system is premised on initiating early HIV testing for pregnant women and specialized testing for infants born to HIV-positive mothers. This early testing and DNA PCR testing of prenatally exposed children allows for the early commencing of ART, which has proven to reduce infant mortality by nearly 75%. In general, after early HIV testing, the infant's date of birth is fed into the system to create alerts for the eight time-sensitive interventions specifically for HIV-exposed infants. Following the birth and enrolment of an infant into the HITSystem, they will be tracked until they are determined to be:

(i) HIV positive: The infants who are found to be HIV positive will receive lifelong paediatric HIV care (which includes ART) and their parents or guardians will receive timely alerts through mobile phones. This is expected to allow for efficient infant tracking. In case the child requires to be transferred to another hospital/clinic, every step including the transfer and treatment meted out, is supervised by the HITSystem, to maximise prevention and treatment outcomes, and to time lags in the communication of laboratory test results.

(ii) HIV negative at 24 months: These infants do not require any follow-up after the testing stage.[27]

All these efforts within the HITSystem implemented in Kenya is aimed at laying the groundwork for reduced infant mortality and catering to EID Guidelines.[28]

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[23] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

[24] Other sites were in the following regions: Rift Valley, Nyanza, Western Region (Kenya).

[25] HIV / AIDS Program | HITSystem. Global Health Innovations,2017

[26] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

[27] HIV / AIDS Program | HITSystem. Global Health Innovations,2017.

[28] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

2.2 Implementation

The application of the HITSystem was jointly conducted with the assistance of several partners including (but not limited to):

- Global Health Innovations (developers of this system)
- Kenya Medical Research Institute
- OnTarget (Internet marketing company)
- Academic Researchers (from University of Kansas Medical Center and Children's Mercy Hospital Kansas City)
- Walter Reed US Military HIV Research Program (training and implementation)
- NASCOP

For the designated hospitals for the pilot project in Kenya, the HITSystem can be accessed on computers and laptops, using mobile broadband, which eases the implementation of this system even in remote areas (if required). The HITSystem has been built to generate regular alerts directed at health providers other EID stakeholders and lab technicians, when time sensitive interventions are required in a particular child's case. These alerts are directed at tracking and identifying children who have omitted their treatments for a defined period of time. An inbuilt text messaging mechanism in the HITSystem sends messages to mobile phones of the parents when test results are ready or follow-up visits for treatment are needed.

In Kenya, especially Nairobi, the HITSystem was implemented from April 2011 to November 2013 at certain health facilities. The implementation was conducted between April 2011 and May 2014.[29]

The health facilities chosen for the pilot were selected based on logistical feasibility, absence of other EID-related interventions for HIV and the approval from the respective hospital stakeholders.[30]

2.3 Outcomes

This pilot project in Kenya has been carried out with remarkable ease and effectiveness. It was noted that relatively limited penetration of ICTs, telecommunications and Internet connectivity had minimal negative impact on the continuance of the project. The sustained efforts of the stakeholders facilitated the successful adoption, implementation and continuous maintenance of the HITSystem. With the monitoring mechanism in place, HITSystem was able to ensure that treatments were provided on time.

The principles of the HITSystem were found to be in line with EID guidelines and the results of this pilot project surpassed the expectations and outcomes observed in national statistics. A feedback mechanism was also incorporated into the implementation procedure of the HITSystem to ensure that the participants were satisfied with the services received. This also helped improve the existing line of treatments and reduced response time for emergencies.

It was noted that the HITSystem successfully reached nearly all mother–infant pairs, who were enrolled in EID services at the targeted health facilities. However, it was observed that nearly 40% of HIV-exposed infants in Kenya are never enrolled in EID, thereby not receiving the benefits of the HITSystem.[31]

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[29] The follow-up periods for this process ranged between 6 and 38 months depending on the month of initial implementation of the designated facility.

[30] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

[31] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

This pilot project proved that ICT platforms can serve as powerful tools to reduce the disparities in healthcare and awareness on HIV especially among the young populations, which will not only increase their life span but also improve their quality of life, making them less prone to HIV-related infections.[32]

3 Conclusions

The application of the HITSystem in the public health system in Kenya has provided evidence that an efficient e-health system can indeed be implemented in low-resource settings. Hence, the HITSystem shows immense potential to be utilized in other HIV-infected developing countries to promote regulation and treatment of the disease in line with SDG 3.[33]

One of the key lessons learnt through implementation of the HITSystem in Kenya was that ICTs can be efficiently adapted through e-health innovations in response to emerging requirements of the region and in keeping with technology evolution and availability.

Partners of this pilot project are also working to expand the HITSystem in order to support antenatal prevention of maternal-to-child transmission and integrate prenatal and postnatal services for HIV-infected women and children. If this is successful, it is expected to directly impact the perinatal transmission of HIV, which is expected to help minimise exposure of children to HIV.

However, the major challenges observed while implementing the HITSystem (as with other HIV management systems which use ICTs) were that of privacy and trust. As such globally, HIV management systems like HITSystem seem to have diminished geographic coverage and mostly are being piloted on small-size samples with a limited use of technical innovations. There are still several gaps pertaining to tracking treatment across countries and continents in case patients are to travel temporarily or migrate to other regions. In such cases, it would be required to implement the HITSystem or similar (interoperable) ICT-based HIV management systems to ensure that consistent treatment is given to HIV-infected children.

The factors of trust and privacy along with limited implementation may significantly affect the adoption rate of such HIV management systems across other regions of the world. If guardians or parents are unsure of how the data from the HITSystem will be utilized and protected, they may be hesitant to enrol their children. In general, ICT-based HIV management systems like the HITSystem have defined guidelines for anonymization of the data collected; however, the parents from lower income families may be unaware of these guidelines and others could also be wary of how the information sharing between the different stakeholders within the HITSystem could affect their children's privacy.[34]

Despite certain shortcomings, the HITSystem pilot project has set an ideal framework for e-health management of HIV, which can be built on in the coming years. The pilot project has also shown promising results within a short time frame. Nevertheless, it should be acknowledged that the use of ICTs in HIV interventions is still an emerging field. Therefore, further research is required to promote technical innovations and implement interactive features in ICT-based HIV management programmes, which can have a wider geographical scope, defined privacy and security guidelines, as well as utilize more of the available technologies. Future research may also be needed to explore the feasibility of applying ICT platforms in HIV management programmes that serve populations from diverse socio-economic backgrounds and ethnicities.

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[32] Uses of information and communication technologies in HIV self-management: A systematic review of global literature. International Journal of Information Management, 2017.

[33] Lessons learned from implementing the HIV infant tracking system (HITSystem): A web-based intervention to improve early infant diagnosis in Kenya, 2015.

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Goal 4:
Quality Education – Mohammad Bin Rashid Smart Learning Programme

4 QUALITY EDUCATION

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1 Introduction

1.1 Background

His Highness Sheikh Mohammed Bin Rashid Al Maktoum — Vice President and Prime Minister of the United Arab Emirates (UAE) and the Ruler of Dubai — has always been an advocate of continuous and ongoing improvements in the UAE. As Prime Minister, he envisioned a future for the UAE to be among the most recognized countries in the world. He voiced his goal back in 2010 when he declared the UAE Jubilee Year, 2021, as the year the UAE Vision would be realized. The UAE Vision 2021 is a representation of six national priorities which include a cohesive society and preserved identity, a safe public and fair judiciary, a competitive knowledge economy, world class healthcare, sustainable environment and infrastructure, and most importantly, a first-rate education system.

As a response to this vision, he launched the Mohammed Bin Rashid Smart Learning Program (MBRSLP) in 2012 by Ministerial Decree No. 25. The MBRSLP is a joint venture between the Ministry of Education (MoE) and the UAE Telecommunications Regulatory Authority (TRA) in cooperation with the Prime Minister's office of the UAE. It aims to raise the educational standards of the nation to meet international standards, while setting new precedents in smart learning worldwide. The programme presents a comprehensive approach inclusive of students, teachers, parents and principals to work collaboratively to build future leaders. Similarly, the programme works hand in hand with the vision of the Ministry of Education to ensure that the education system is constantly evolving and up to date with global changes and SDG 4[35]. The programme integrates modern technology and innovative teaching methodologies with traditional tools to transform the education system into a dynamic and interactive learning experience for educators and students alike.

1.2 Challenge and response

UAE is one of the many nations seeking to reform and improve its educational system. During recent years, the UAE has made advancements in providing quality education, however, significant challenges remain. There is an urgent need to improve the educational achievement of students in UAE's public schools in order to make the education system one of the best in the world.

The Mohammed Bin Rashid Smart Learning Program was established to raise the level of the students' educational achievements to meet and exceed international standards. The programme offers multimode integration of teaching by integrating technology and key stakeholders into the students' educational development. By using smart education solutions, teachers, classrooms, students, parents and principals are equipped with the right tools to help them connect with each other, achieve an improved learning experience and reach nationwide KPIs and targets.

2 The project(s)

2.1 Vision and content

The vision behind this project is to create a cohesive, innovative nation valuing its cultural heritage in which Emiratis will inclusively, skilfully and creatively shape the future of UAE. The programme offers a modern way of teaching through the integration of technology into the educational system.

Several world indices such as Trends in International Mathematics and Science Study (TIMMS) and Program for International Student Assessment (PISA), along with national level indices such as the Arabic skills of secondary school students and the quality of students, have been used to support the UAE Vision 2021. The programme aims to address these indices by increasing the quality and outreach of education to ensure more students receive better education by leveraging integrated technology into the improved curriculums. In

[35] Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

addition, the programme is also aligned with the UAE Vision 2021, to become a knowledge-based economy through the increased availability of information for both students and teachers.

The programme takes a holistic and comprehensive approach towards teachers, principals and school administrators and not just towards students. Essentially, the information and communications technology (ICT) services are positioned to underpin the educational opportunities of all those supporting and engaging in the educational system. The strategy focuses on aligning the device deployments, support services and educational change interventions to underpin the MoE developments in school leadership, curriculum and pedagogy. The diagram below illustrates a selected range of the levers and interventions that are part of the overall strategic approach.

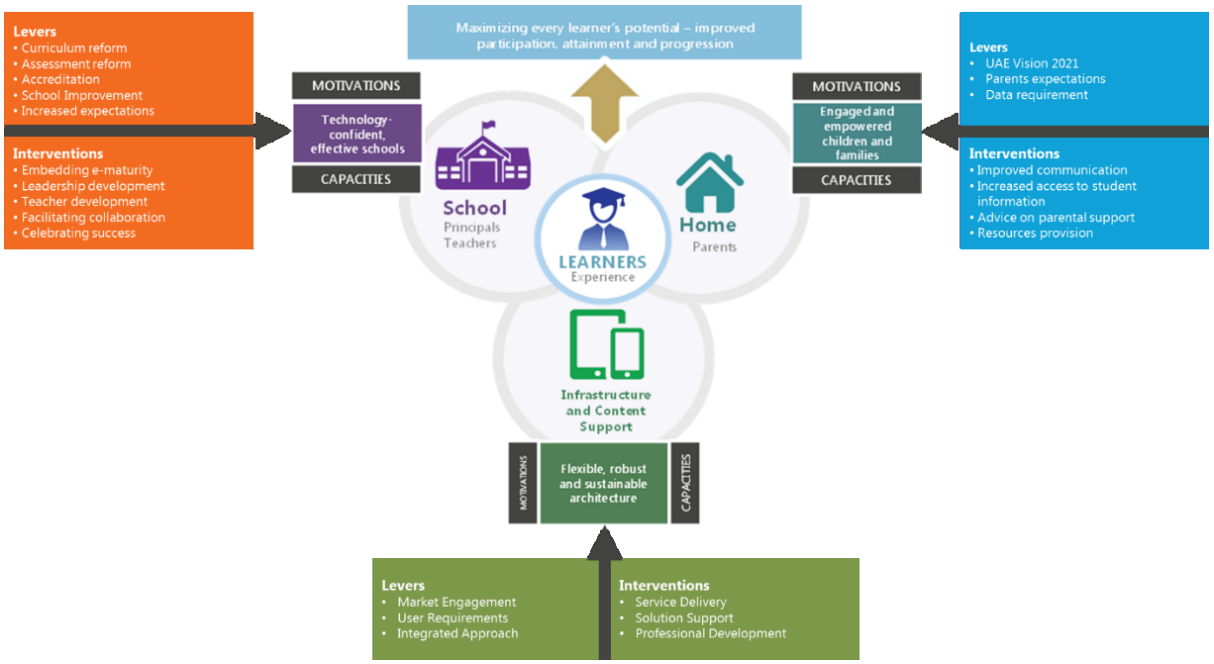

Figure 4-1 – Strategic approach for Mohammed Bin Rashid Smart Learning Program

In addition to equipping students, teachers, and principals with devices and apps aimed at facilitating their role in education, the smart-learning programme has incorporated various innovative initiatives that are technologically and educationally aimed to address broader social, cultural and national aspirations in line with UAE's Vision 2021. The details below outline how MBRSLP embeds innovation into its approach of implementation which contributes significantly to education in smart cities.

- *Smart Classroom Transformation*: This is the first in the region that seeks to introduce ICT in education by providing a complete transformational process to school infrastructure and to the tools used to deliver education to students;
- *3D Printing and Design Thinking:* The objective of the 3D Printing pilot is to introduce and integrate the technology of 3D printing to educators and students, to create a powerful learning environment in schools, to teach design thinking as a process for problem solving, to compliment Science, Technology, Engineering and Maths (STEM), and to cultivate and encourage the student's creativity and imagination while nourishing skills and experience in 3D tools for research and design.
- *School Radio:* Educators are using remote access to School Radio to motivate and inspire learners, improve writing and speaking skills and to support the development of teamwork, planning and other competencies.

- *Sharjah Science Museum Mobile App (Gamification):* The student will be able to use a mobile app on their device to explore and navigate the space and solar system in new innovative ways based on gamification approaches.
- *Al Amal School for the Deaf – Sharjah:* Transform the classrooms into smart-interaction classrooms equipped with technologies that facilitate the delivery of learning objectives for the deaf students and enhance the collaboration and communication among the students as well as their teachers.
- *International School Collaboration:* An initiative by MBRSLP to demonstrate smart-education capabilities among connected schools in different geographical locations to facilitate collaboration and an exchange of experiences.
- *Customized Interactive Digital Content:* The programme created over 3500 customized Reusable Learning Objects (RLOs) based on various subjects.

ICT plays a key role in enabling the project by means of tablets, laptops and mobile phones used by students, teachers and parents. The following key ICT factors have contributed to the MBRSLP's new learning environment:

- *Connected schools:* Schools are connected to a data centre that provides specialized education and learning systems on a 24/7 basis.
- *Connected classrooms:* Teachers and students connected to the network can interact through the classroom management systems to deliver lessons and learning objectives.
- *Personalized tablets:* Students are provided with personalized tablets that enable them to connect to the learning management system which helps them interact with their teachers and classmates.
- *Personalized laptops:* Teachers and principals are provided with personalized laptops loaded with management systems designed to help monitor and manage their work.
- *Mobile access:* Parents are provided with mobile access to interact with school staff and teachers, as well as to review the conduct and performance of students and feedback on teachers.
- *Smart interactive display boards:* A central hub for pushing electronic content and services to teacher and student devices inside the classrooms.
- *Learning Management System (LMS) with advanced features and personalized accounts:* The LMS allows students to access lessons, test their skills and use interactive visualization tools to help improve their learning.
- *Interactive content for students:* The deployment of interactive content for students involves the creation of RLOs aligned with MoE's curriculum that are easily accessible.

2.2 Implementation

A phased strategic approach has been adopted to implement this programme. It considers the priorities of the UAE education system and the objectives of the MBRSLP, as well as the readiness of schools and lessons learnt from previous international programmes. The programme has leveraged the piloting approach first followed by wider scale implementations through various regions and academic grades. During the roll-out period, extensive review by project management was carried out, where monthly reviews and recommendations took place to ensure project success.

Using a holistic approach and phasing mechanism, the following five principles have guided the approach of the MBRLP implementation in 2015:

- the leadership support from the Prime Minister's Office and the shifting of the national agenda towards smart solutions and better education;
- a strong governance system, organizational structure and robust monitoring mechanism that enable the MBRSLP and their partners to exercise a wide range of organizational and operational agility with clear lines of accountability;

- the interactive engagement model that ensure addressing the requirements and concerns of stakeholders such as principals, students and parents;
- the strategic selection of the appropriate partners in building the capacity of all staff within the school system by providing a professional development programme in the effective use of technology to improve the quality of learning for students, ease their transition and adapt to change;
- partnerships established with the academic institutions and international companies to provide an annual research measuring the effectiveness of the MBRSLP.

In 2015, during the programme, there were many formative interactions with different stakeholders, as follows:

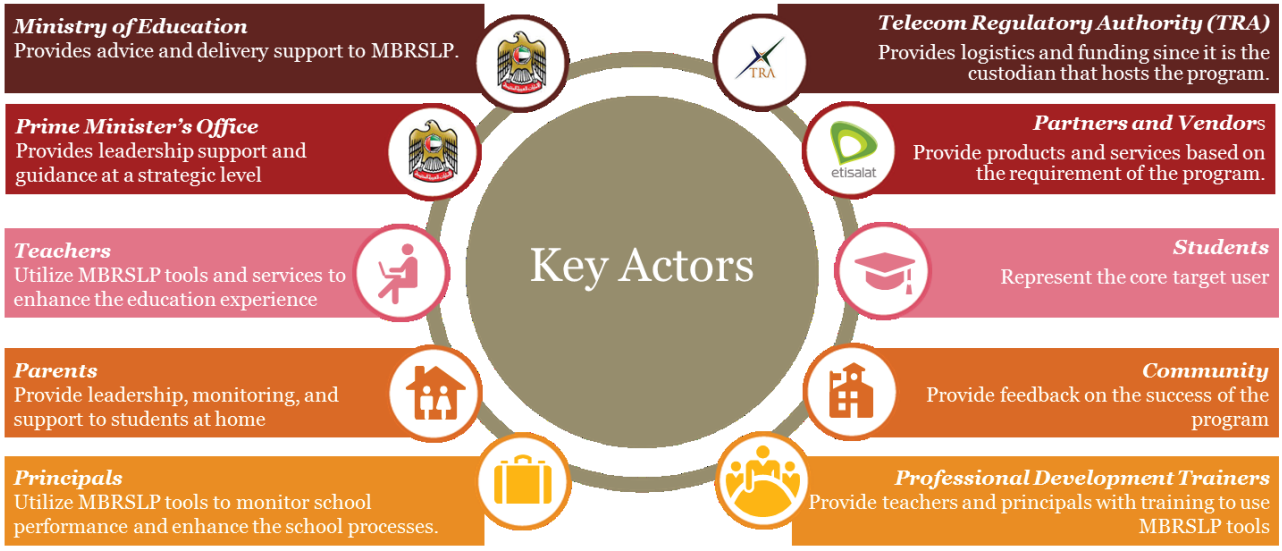

Figure 4-2 – Key stakeholders of Mohammed Bin Rashid Smart Learning Program

The following enablers have made the programme happen:

- *Leadership:* The MBRSLP was launched in 2012 by His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and the Ruler of Dubai. With the support of the leadership and the strong governance structure, the programme was able to expand at such a quick rate with the right key partners.
- *Governance:* A clear governance structure for the programme at multiple levels will provide strategic guidance, oversight and support to the delivery of the programme. The overarching governance of the MBRSLP is founded upon:
  - the 'Higher Committee', which oversees the programme at a strategic level;
  - the 'Executive Committee', which supports the executive delivery of the programme;
  - the Director General Mohammed Gheyath and Senior Management team which are responsible for a set of initiatives and accountable for the achievement of the related KPIs.
- *Financial:* The MBRSLP is funded by the TRA's fund arm, the Information and Communication Technology Fund (ICT Fund). It supports the programme for the first five years to cover the rollout into all federal schools. The programme allows a phased approach which is reflected directly in its phased financial planning.
- *Organizational (partnership; private involvement; citizen involvement; project management):* This programme was supported by key stakeholders and partners which include academic institutions, international organizations, a project management office and professional development trainers.

- *Communication (internal and external, branding):* Internal communication was an integral part of the programme's success. SMT meetings were held every two weeks to monitor and adjust the programme accordingly. The delivery is reported and the strategic and operational decisions are made related to the delivery of the programme.

The smart-learning programme provisioned the following innovative processes:

- *Smart School Transformation Implementation Process:* The Smart Classroom Transformation is the first in the region that seeks to introduce ICT in education by providing a complete transformational process to school infrastructure and to the tools used to deliver education to students.
- *E-Maturity Transformation Process & Framework:* A framework aimed at assessing schools on the level of its ICT maturity and providing a clear path of progress. Schools are assessed, rated and awarded based on this highly customized and intricate system.
- *E-Content Selection Process:* The programme created over 3500 customized RLOs based on various subjects and are used to provide a digital content layer embedded in the MoE digitized curriculum books.
- *Smart Learning Pilot Projects Process:* The pilot project process serves to help procure, commission and evaluate pilot projects specialized for specific purposes that help explore innovative technologies, ideas and methods in the educational technology industry.
- *E-Safety Processes and Procedures:* This involves providing guidelines and policies for possible technical mitigation approaches to keep students, teachers and principals safe online while accessing the Internet using MBRLSP devices.
- *Smart Learning Professional Development and Training Process:* This involves the provision of technical training services offered to staff with distributed devices.
- *Smart School Operation and Adoption Process:* This involves setting guidelines and procedures to manage and operate the smart learning IT infrastructure, as well as to provide support and training to schools and their stakeholders.
- *Smart Learning Program Management Processes:* This involves supporting the effective and successful delivery of programmes and projects. It helps manage, structure and control upcoming programmes and projects through the Project Management Office and the various formed committees that govern and control them.

The programme was educationally led where the ICT was used as an enabler to deliver the educational outcomes to students. In order to deliver these outcomes, the transformation of schools was carried out by upgrading the infrastructure, distributing devices to teachers and students loaded with specialized ICT tools for smart learning, and equipping classrooms with smart boards.

Learning inside and outside the classrooms has been enabled through network connectivity by providing access to lessons and content that help students test their skills using tools with interactive visualizations that have helped improve their knowledge and skills in various subjects thus improving their learning outcomes set forth by the smart-learning programme's objectives.

In addition to the strong governance structure used to address implementation challenges, a number of tools were developed by MBRSLP to ensure that the overall financial resilience of the programme could be assessed and managed. As part of the overall MBRSLP Business Case, the following tools have been produced:

- a Total Cost of Ownership (TCO) analysis;
- identification of the cost and ownership of key risks.

MBRSLP developed the TCO element of the business case further, to a point where it can now be used both to predict costs accurately over the ten years of the programme, but can also be used to manage a number of different scenarios through the use of a dashboard with a number of switches. The sophistication of this tool now means that MBRSLP is able to use it to forecast costs against each of these scenarios, and to compare the overall costs of these scenarios to ensure that it can manage the programme budget effectively.

2.3 Results

The direct results of the smart-learning programme are as follows:

- increased student motivation and student performance, where 70% of surveyed teachers reported a positive impact on student learning outcomes in Assessment Year 14-15;
- increased independent study and development, where 72% of teachers surveyed reported an increase in student-centred learning;
- increased professional development of leadership in educational institutes;
- increased parent engagement and support in their child's learning;
- improved quality and range of student learning opportunities.

The indirect and long term results of the smart-learning programme are as follows:

- improvement in the effectiveness of educational institutions;
- development of a strong and productive workforce, which can contribute to an increase of GDP growth, and foster future leaders that take initiative and are proactive in solving challenges;
- increased quality of management in schools and education institutions, with sub-results such as improved budget planning and resource allocation;
- increased understanding of the positive use of ICT in household and security management of information;
- diversification of the UAE economy and shift in the careers of UAE youth;
- increased opportunities for the local ICT education industry to participate in local markets and potential international markets.

MBRSLP's sustainability to education in UAE is delivered through the following:

- constant review and refinement of stakeholder needs by leadership and key specialized stakeholders on a timely basis;
- development of innovative and reliable platforms and frameworks to ensure continuous enablement for schools, students and teachers according to their development needs;
- capitalizing on current infrastructure, operation and services to build future capacity planning ensuring a sustainable programme;
- the use of financial tools to assess and monitor budgetary needs and requirements;
- the focus on local curriculums to design the ICT solutions help ensure the continuity of the current education system without interruption.

MBRSLP has positively contributed to the city's resilience, where it has had a positive impact on the future workforce. In addition to a better equipped workforce, the programme has also aided in the diversification of UAE's economy by providing a shift for local talent to move into new sectors. The combination of both impacts and the success of the programme will subsequently lead to a successful outcome on the country's economy and help to fulfil one of the UAE 2021 visions, which is to create a knowledge-based economy.

3 Conclusions

The core lessons learnt by the programme are as follows:

- *It is essential to provide numerous training to teachers and principals alike*: The programme involved all key stakeholders and had realized the importance of equipping all stakeholders in the supply chain with the appropriate knowledge and training to ensure they have completed their job successfully.

- *It is pertinent to have a strong governance system:* While implementing a large-scale project such as the MBRSLP, it was important to have a reactive governance system to deal with unexpected change and delays.
- *The review of quality should be conducted independently and continuously:* While dealing with a programme on such a large scale, it is important to ensure implementation with the same quality standards nationwide.

The following success factors can be also be taken into account:

- A well-formulated strategy: This was developed with the partners' active involvement and with full government commitment along with the political will to support the programme from planning through to implementation.
- A clear governance structure: This was essential to provide strategic guidance, oversight and support at multiple levels for the delivery of MBRSLP.
- A set of dedicated committees and councils (teachers council, innovation council for the schools' principals, and service management teams) that helped in capturing feedback, needs and facilitated their engagement with the MoE, TRA and other stakeholders.
- The active participation of the community (students, teacher, principals, school administration and parents): This support remains essential throughout the journey, especially in the planning and design phases.
- Building the capacity of all staff in the schools' system: This was done by providing a professional development programme on the effective use of technology to improve the quality of learning for students, to ease their transition and help them adapt to change.

MBRSLP faced many challenges throughout the implementation of its programme. As with any smart-transformation programme, these challenges (as given in Figure 4-3) should be taken into account.

Figure 4-3 – Challenges faced by the Mohammed Bin Rashid Smart Learning Program

(Source PwC, 2016)

Due to the nature of the programme's mission, its transferability was a vital part of its success. By expanding the outreach of high-quality education, the programme is able to increase nationwide KPIs and achieve its targets. The main issue of transferability in such programmes, with multiple remote areas involved, is connectivity. Fortunately, MBRSLP was able to successfully connect all public schools this year. The programme has been successfully implemented in six of the seven emirates, with few challenges.

The programme's strategy adopts a phased approach to the Smart School Transformation. The strategy clearly demonstrates how the programme can be scaled yearly to cover a wider range of schools and stakeholders. It has accumulated a set of best practices and know-how which have been replicated to adapt to new objectives and expanding needs in subsequent rollouts. As such, the geographical outreach of MBRSLP has extended to different locations and regions that aim to cover all of UAE's public schools except for Abu Dhabi/Al Ain.

The table below demonstrates the programme's scalability by providing actual numerical evidence of implementation data:

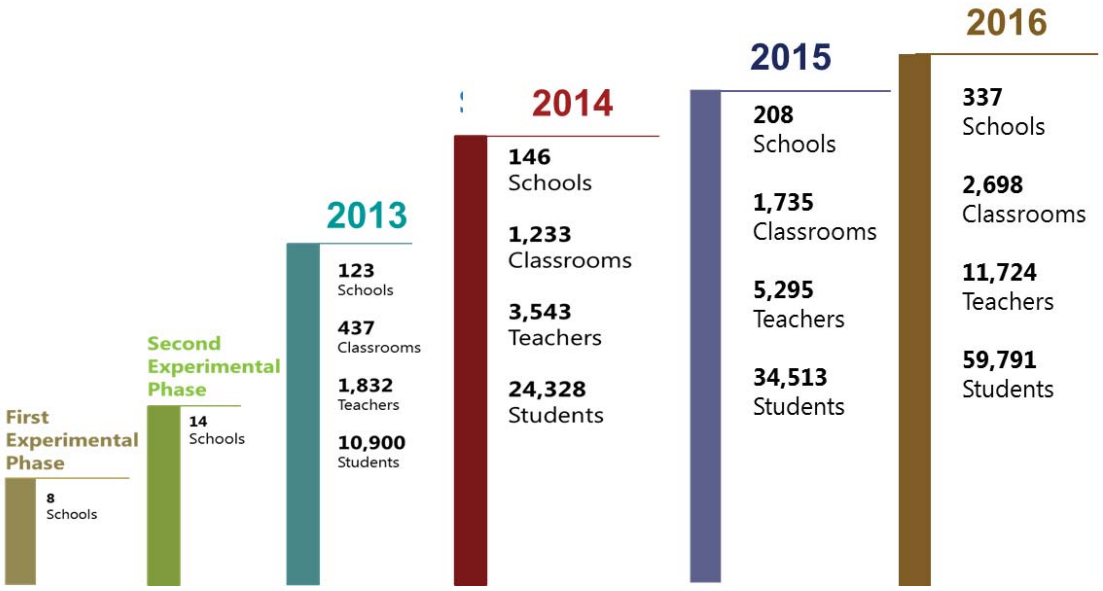

Figure 4-4 – Scalability of the Mohammed Bin Rashid Smart Learning Program

Furthermore, the programme demonstrated its international and global scalability through collaboration and engagement with international organizations such as the ITU, with which a cooperative agreement was signed, recognizing MBRSLP as a regional hub for smart learning. Additionally, the MBRSLP also has a Memorandum of Understanding with the Finnish National Board of Education, taking advantage of the experiences of the two nations in the fields of smart learning.

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B List of discussion partners/interviews

MBRSLP Project Management Team.


GEND

Goal 5:
Gender Equality – Digital Literacy Campaign

5 GENDER EQUALITY

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1 Introduction

1.1 Background

Since the inception of their joint campaign in 2011, ITU and Telecentre Foundation (TCF) have been promoting digital literacy for women and girls. Although the Digital Literacy Campaign was launched before the setting of the Sustainable Development Goals (SDGs), it is able to effectively cater to SDG 5[36], which specifically calls for enhancing the use of enabling technology, in particular information and communications technology (ICT), to promote the empowerment of women (target 5B).

1.2 Challenge and response

As is observed in target 5B of the SDGs, ICT's potential as a tool for the promotion of gender equality and the empowerment of women is well recognized. However, there remains a gender divide, with women having limited access to technology when compared to men. If this gender divide persists, there is a risk that this may exacerbate existing inequalities.

In line with the above, ITU's and TCF's Digital Literacy Campaign intends to expand on the gender dimensions of ICTs, while improving its access and use for women and creating capacity-building opportunities. This is expected to boost employment for women and in the process serve as a powerful catalyst for social empowerment and promote gender equality.

2 The project

2.1 Vision and Implementation

As mentioned above, the Digital Literacy Campaign launched by ITU and TCF is a global campaign which aims to empower women by making them digitally literate. The required digital literacy training provided through this campaign creates the required channels for the acquisition of necessary skills that are needed to operate in a broadband environment, including financial literacy skills, as well as career training and ICT-enabled career training. Such training will empower women and enable them to set up online businesses or enhance their livelihood and economic activity using other forms of ICTs.

For the purpose of this campaign, a range of training materials to promote women's digital literacy and the use of ICTs to promote women's economic activities have been developed.

The Digital Literacy Campaign is supported by a global network of partners in approximately 86 countries worldwide, covering different regions. This campaign also facilitates access to information and training for women and offers a world of new opportunities through technologies which were previously unavailable to them.

2.2 Outcomes

The Digital Literacy Campaign is known to have served and trained 1.3 million women. What sets this campaign apart from the other gender equality campaigns is that it has a curriculum focusing exclusively on digital and e-business/e-commerce skills for women, thereby allowing them to utilize their knowledge after receiving the training.

[36] Achieve gender equality and empower all women and girls.

3 Conclusions

It has been six years since the launch of the Digital Literacy Campaign. The number of women benefitting from ITU's and TCF's efforts are increasing every day. Given the significant strides that this campaign has managed to make in less than a decade, it would be advantageous to continue with it and to collaborate directly with national governments (especially in developing countries), to ensure that women are equipped with a basic knowledge of technologies to increase their digital literacy and to advance their career prospects, as envisaged by SDG 5."

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Goal 6:

Clean Water and Sanitation – Smart Water Management: SmartH2O Project

6 CLEAN WATER AND SANITATION

Table of Contents

1 Introduction

1.1 Background

In line with the "Europe 2020" strategy, the European Commission proposed different actions to create a "resource-efficient" Europe and promote awareness on the sustainable use of water resources. In the recent publication by the European Commission (EC) "A Blueprint to Safeguard Europe's Water Resources"[37], the authors clearly recommended the adoption of water-efficiency measures such as pricing policies, which can result in reducing water consumption, as well as saving energy. In particular, they point out that pricing is a powerful awareness-raising tool for consumers and combines economic benefits with environmental aspects, while at the same time stimulating innovation.

1.2 Challenge and response

Studies and tests have been conducted to evaluate the effectiveness of water demand management (WDM) policies and determine the role of consumers in it. The key findings showed that savings achieved from WDM policies can benefit the entire water and wastewater system. However, smart meters may not be effective unless consumers' habits or attitudes can be also changed. Combining real-time data derived from social media and phone applications with information on the socio-demographic and psychosocial profile of the consumers, can provide the basis to determine target water policy approaches including flexible and accurate pricing schemes, while educating citizens on their water consumption.

2 The project

2.1 Vision and content

The mission of the SmartH2O project is to develop an ICT platform (as shown in Figure 6-1) to:

- understand and influence consumers' behaviour, based on historical and real-time water usage data;
- determine how consumer behaviour can be influenced by various WDM policies: water-saving campaigns, social-awareness campaigns and dynamic water-pricing schemes;
- raise the awareness of water consumers on their current water-usage habits and implications and to encourage them to decrease their water use.

The SmartH2O platform will enable water managers to close the loop between actual water consumption levels and desired targets, using information about how consumers adapt their behaviour to new situations: new regulations, new water prices and appeals to water savings. This feedback will allow WDM polices to be aptly revised, enabling water and energy-saving goals to be maximised. The SmartH2O project also caters to SDG 6[38] as it promotes the sustainable consumption of water.

[37] EC (European Commission). A Blueprint to Safeguard Europe´s Water Resources. Communication from the Commission to the European Parliament, the European Economic and Social Committee and the Committee of the Regions [COM (2012) 673 final (14.11.2012)]. 2012. Brussels, European Commission.

[38] Ensure availability and sustainable management of water and sanitation for all

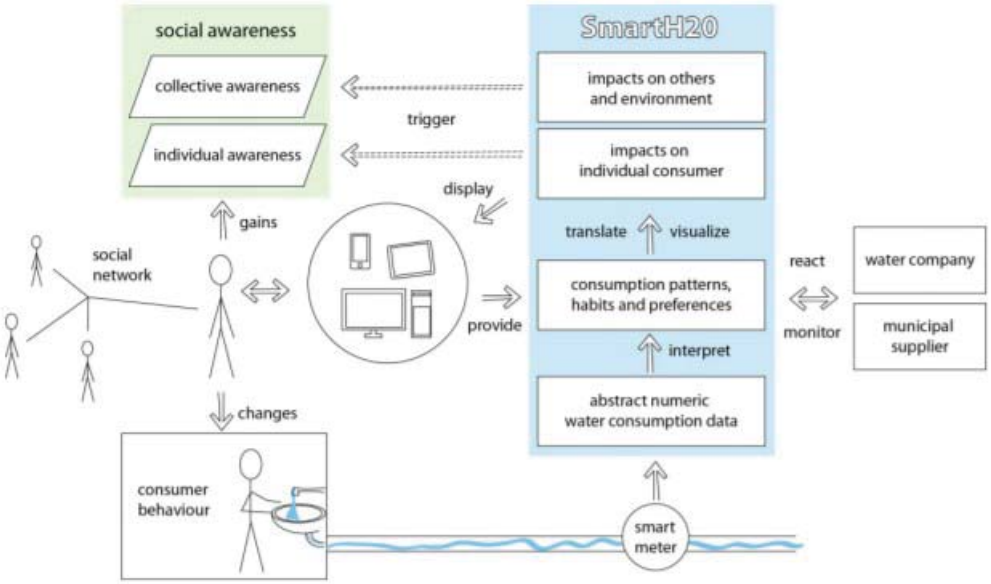

Figure 6-1 – The flow of information of the SmartH2O platform (from Smart Metering, Water Pricing and Social Media to Stimulate Residential Water Efficiency: Opportunities for the SmartH2O Project)

2.2 Implementation

The SmartH2O platform will be deployed as three case studies, by the three water utilities, Thames Water (UK), Società Elettrica Sopracenerina (CH) and EMIVASA (ES), which are partners of the project.

Thames Water, the largest UK water utility company, has installed Advanced Meter Infrastructure (AMI) equipment to collect frequent meter readings (15 min intervals) from all connections within the District Metered Area (DMA), with the aim of obtaining an accurate water balance, as well as confirming the business case benefits of a large scale rollout. This experiment covers five DMAs: two in London, two in Reading and one in Swindon with a total of 5000 properties and 2500 meters installed. Two different fixed network technologies have been used: an advanced fixed network supplied by Arqiva/Sensus and a conventional fixed network supplied by Vennsys/HomeRider.

Società Elettrica Sopracenerina (SES) is a power utility based in Locarno, which has installed 400 smart meters in selected locations in the Locarno region.

EMIVASA is leading the implementation of smart metering in Valencia. In fact, Valencia will be, by the end of 2015, the first large city in Europe fully equipped with a smart metering system, with more than 430 000 smart meters from six different manufacturers connected to a fixed network and providing near real-time data to data centres. Moreover, EMIVASA is already capable of integrating data from smart metering into the water distribution network management systems and already provides real-time information to its customers.

With the purpose of achieving the economic objectives of the project, i.e. to save water by dynamic water pricing and to increase efficiency of business operations of water companies, the SmartH2O project measured a set of key performance indicators (KPIs). Concerning the first objective, the measured KPIs were "the amount of water saved per capita per period" and "the combined effect of dynamic water pricing and user awareness".

With regard to the second objective, the KPIs were: a) peak-period reduction of water consumption: measured by comparing the historical data of peak water consumption in the two case studies with the data monitored after the introduction of SmartH2O; b) energy required for pumping water: another indicator that can indicate considerable savings in costs for the water utility; c) reduction in CO2 emissions: an indicator strictly connected to energy savings, and finally d) investments avoided: it is the total amount of money that has not been spent over a given period thanks to a reduction in water consumption.

2.3 Results

The project is demonstrating how social awareness and dynamic pricing instruments can modify the behaviour of water users. A quantifiable reduction of water consumption is expected, especially in drought periods, when water is scarce. Water utilities can therefore assess the impact of smart metering to improve the efficiency of their operations. The preliminary results of applying the incentive models for behavioural change in the project suggest the connection between the incentive and the behavioural change process. The observed positive effects on water consumption and user attitudes will be more closely assessed in the continuation of the project. Citizens are proactively engaged by means of cooperative awareness tools, such as water consumption profiling and feedback, persuasive games for behaviour change, and computer-supported community work and can easily read their water consumption by connecting to their own page on the project platform. It increases awareness and with the gamification actions it also changes the consumers' behaviour and brings significant water savings.

3 Conclusions

The SmartH20 project (2014-2017) is still ongoing. The SmartH20 project wants to deliver an information communications technology (ICT) platform to provide support on the one side to water utilities in determining optimal water pricing and on the other side to consumers in changing their water consumption habits, while at the same time contributing to a more efficient use of water. This is done with the integration of smart metering, social computation, dynamic water pricing, and consumer behavioural models. Furthermore, the SmartH20 project stresses the importance of innovation in the water sector by coupling smart meter technologies with innovative end-user services which could help realize better water management. This is achieved through rewards, automation and information which are useful to study, understand and modify consumer behaviour so as to raise consumer awareness and thus save water resources while improving the efficiency and business operations of water companies.

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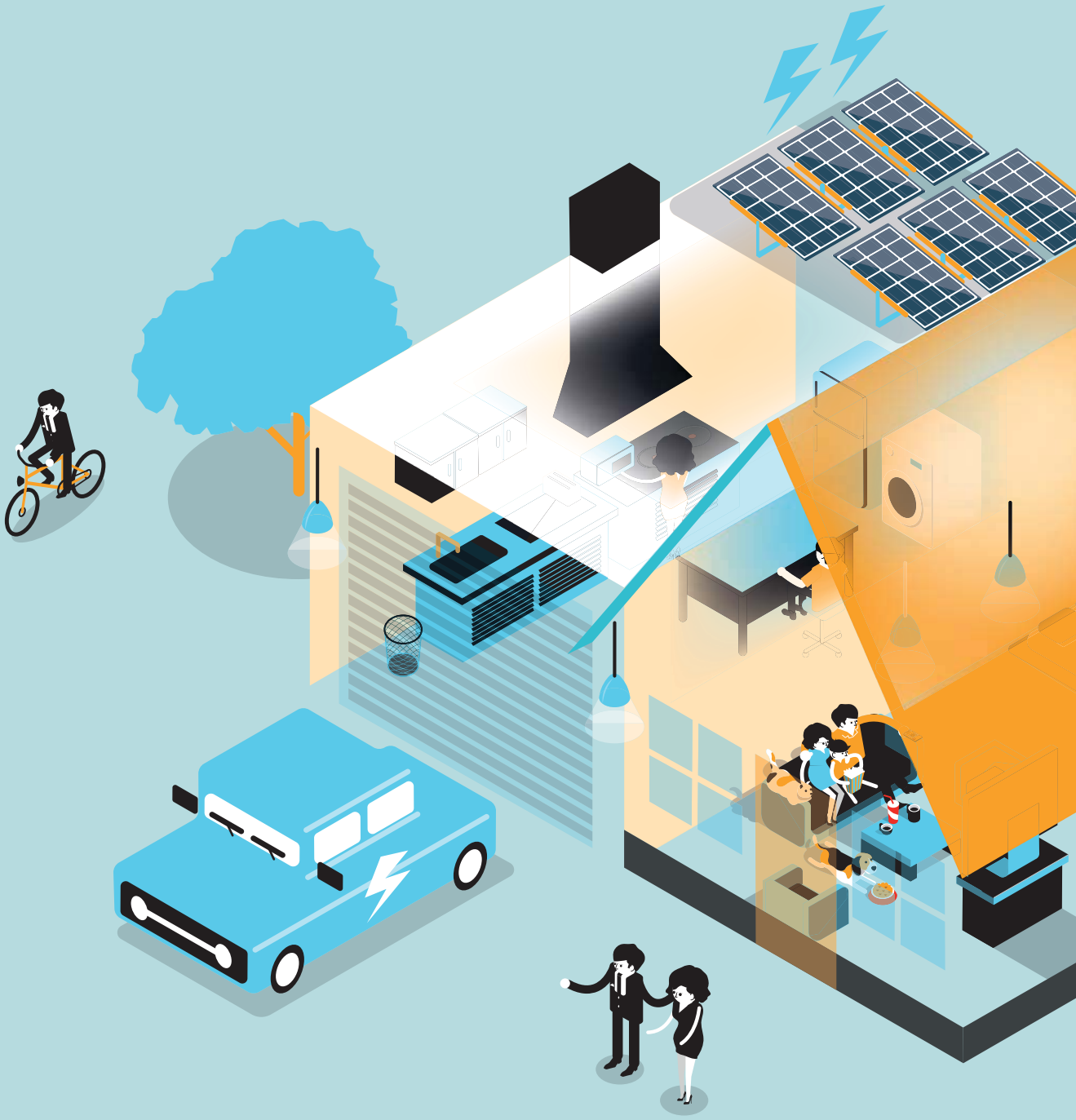
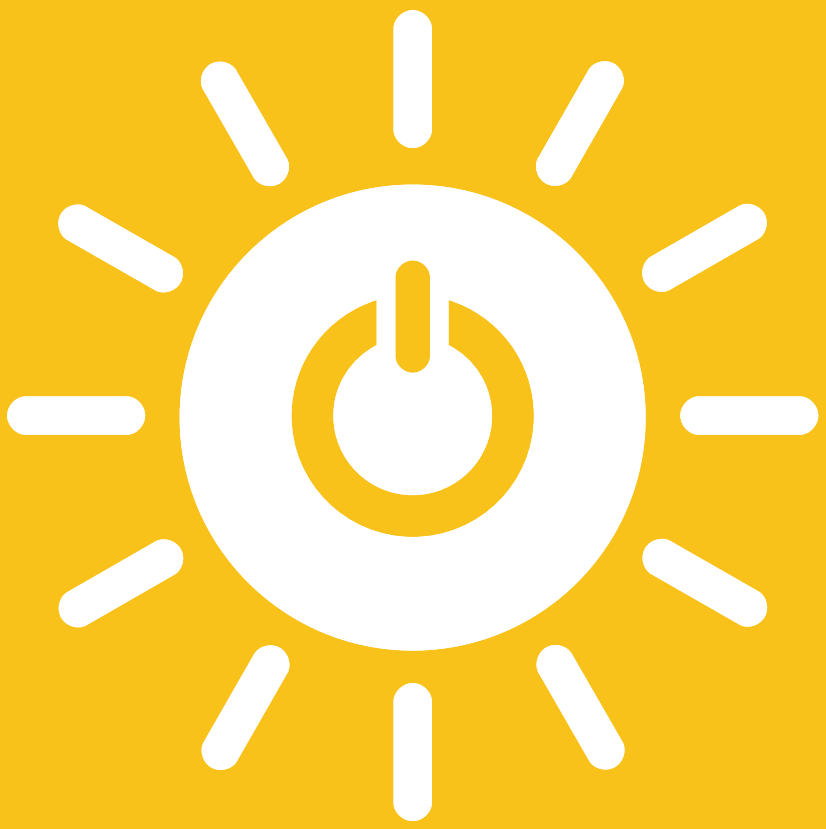


Goal 7:

Affordable and Clean Energy – Smart Grid Solutions: The Case of PowerMatching City

7 AFFORDABLE AND CLEAN ENERGY



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1 Introduction

1.1 Background

The PowerMatching concept was implemented in Groningen, in the Netherlands, as a demonstration project of a future energy-infrastructure called PowerMatching City. Twenty-five households with smart appliances, such as micro-combined-heat-power systems that match their energy use in real time based upon the available energy generation, were connected.[39] PowerMatching City is, first and foremost, the European field trial to connect supply and demand of electricity and heat in an intelligent way (smart grids). The purpose of the ongoing project is to fully profit from characteristics of both centralized and renewable energy systems. The PowerMatching concept also helps cater to one of the Sustainable Development Goals (SDGs), SDG 7[40].

1.2 Challenge and response

According to various EU projections, in the next twenty years, households will obtain an increasing part of their energy requirements from renewable and/or local resources. The smart grid is the most promising solution for the issues caused by increased electrification and the large-scale introduction of distributed power generation in the power system. The smart grid offers several significant advantages. First, it allows for two-way communication, which enables demand and response. Secondly, domestic power generation is a key component, which makes the end user both a producer and a consumer, or a prosumer, of electric power. In a smart grid, prosumers are both incentivized and empowered to contribute to the balance of power supply and demand in the system. Thirdly, by producing power locally, smart grids also minimize transmission cost, as energy is lost in the power network transmission lines. Matching supply and demand at a local level therefore can be used to minimize the losses from transportation; this is a feature of the smart grid which offers both economic and environmental gains.[41]

2 The project(s)

2.1 Vision and content

The PowerMatching City project was created to reply to questions such as:

(a) *How can we accelerate energy transition?*

(b) *How can we stimulate consumers to take action?; and*

(c) *How can we ensure that the new energy system will be sustainable, affordable and reliable?*

Its aim was to give the transition to a sustainable energy system the best chance of success by actively involving consumers and letting them contribute to the transition. The project team was convinced that once participants have experienced how to live sustainably at home, they will use this knowledge in their work as well, and this could accelerate the desired energy transition considerably.

2.2 Implementation

PowerMatching City is a living lab demonstration of the future energy system, located in Groningen in The Netherlands. In PowerMatching City the connected households have smart appliances that match their energy use in real time, depending on the available (renewable) generation.

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[39] Power supply–demand balance in a Smart Grid: An information sharing model for a market mechanism", Applied Mathematical Modelling 38, 2014.

[40] Ensure access to affordable, reliable, sustainable and modern energy for all

[41] Power supply–demand balance in a Smart Grid: An information sharing model for a market mechanism", Applied Mathematical Modelling 38, 2014.

The participants were mainly early adopters, with high educational levels and income and were recruited through the network contacts of the project partners, as well as calls for participation in a local newspaper. The average monthly income of households in PowerMatching City ranged between € 3000 and € 4000. Households in PowerMatching City have a 19% higher monthly disposable income, compared to average families in the Netherlands that have a monthly average disposable income of € 2900. Households in PowerMatching City were made up of an average of three persons, with children between the ages of 10 and 14.

This pilot started in 2007 and deployed a number of implemented technologies which included hybrid heat pumps, in-home energy displays, PowerMatcher energy matching software, photovoltaic systems, smart meters and smart appliances, smart thermostats, micro-combined heat and power (CHP) systems and mini gas turbines. At a distance, electric vehicles and a wind turbine were connected as well. The project focused on attaining optimum capacity management in a smart grid, and matching energy services with the demands and wishes of end users. Phase 1 of the project started in 2007 with the realization of a local smart grid with 22 homes and was concluded in 2011. It focused mainly on the demonstration of technical feasibility of the smart energy system. In this phase the Power Matcher software was introduced to ensure that supply and demand of a wide variety of energy resources can be fine-tuned automatically. The aim is to use the PowerMatcher for much more energy traffic points. Appliances are equipped with sensors which enable households to turn them on – or off – depending on energy supply and present-day tariffs. Buying and selling of both heat and electricity occurs automatically and at an optimum. Released data are stored on an external server so that households are controlling their energy behaviour. Aggregated results of PowerMatching City insights are available in the public domain (open source). This creates possibilities for market parties to develop and introduce new household appliances and business models.

Phase 2 (2011–2014) explored ways to involve the residential end users and identify market mechanisms under a smart grid regime. An additional 18 homes were added in 2011, bringing the total number of participating homes to 40. This phase has become incorporated into the Dutch state programme IPIN (Innovation Programme Smart Grids). Consequently, the second phase of PowerMatching City led to the first business models to calculate flexible prices for both heat and electricity for each situation during the day. In the course of time, start-up companies will grow, having the right knowledge of smart grids on the one hand, and/or expertise to use, operate and maintain appliances and related IT systems on the other.

2.3 Results

The project first showed that the implementation of smart energy grids in the consumer market is worth between 1 and 3.5 billion euros.

PowerMatching City demonstrated that smart energy systems are technically feasible and offer energy flexibility and are also economically valuable. In fact, the net gains from the consumer market could reach 3.5 billion euros. These benefits are based in part due to the savings derived by the three involved stakeholders. Grid operators avoided costs for investments and maintenance of the grids; energy providers could manage their customers' energy consumption more effectively so that they could purchase energy more competitively and also were able to use locally generated energy to match local supply and demand; and finally consumers took control of their electricity behaviour and could save money.

Two energy services jointly established by partners and residents facilitated flexibility: the “smart cost savings” enabled the residents to keep the costs of energy consumption and generation as low as possible, and “Sustainable together” supported them to become a sustainable community.

The project also demonstrated that if this smart and flexible energy system is to be implemented in the consumer market on a large scale then it will need to be standardized, in order to reduce costs, and energy purchasing will need to take place on the basis of actually measured energy consumption or generation.

3 Conclusion

PowerMatching City proved that an integral approach offers undeniable societal advantages, especially with reference to SDG 7 on "Affordable and Clean Energy". This project has been so successful that PowerMatching City has been incorporated into the UN 'Sustainia 100'[42] in autumn 2012.

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[42] 'Sustainia100' is a prestigious list of over a hundred examples worldwide that provide viable solutions for a more sustainable future.

SMART SOLUTIONS FOR CITIES

PRODUCTION
- ORGANIC FOOD
- SAFE PRODUCTS
- REDUCE THE COST OF DELIVERY

ENERGY
- RENEWABLE ENERGY
- ENERGY INDEPENDENCE
- SMART BUILDINGS

SERVICES
- MOBILE PAYMENTS
- REMOTE OUTAGE NOTIFICATION
- ONLINE ORDERING

TRANSIT
- FLEET MANAGEMENT
- ASSET TRACKING
- MOBILE PAYMENTS
- SMART ROADS

SAFETY
- VIDEO SURVEILLANCE
- REMOTE SECURITY MONITORING
- MASS NOTIFICATIONS

Goal 8:

Decent Work and Economic Growth – E-banking services: The Case of Pakistan

8 DECENT WORK AND ECONOMIC GROWTH

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1 Introduction

1.1 Background

Information and communication technologies have penetrated nearly every aspect of urban human life. Similarly, the global banking systems have also undergone a major metamorphosis given the technological advancements. In general, foreign banks are credited with introducing "e-banking" in Pakistan between the late 1980s to the mid-1990s. In the late 1990s, domestic banks in Pakistan also started following a similar trajectory to adopt the technologies and e-banking services like automatic teller machine (ATM) cards and debit cards. Since then, the e-banking system in Pakistan has transitioned from ATM to telebanking, electronic fund transfer and the revolutionary online banking.

1.2 Challenge and response

Despite the adoption of e-banking in Pakistan, several private banks still rely on traditional banking systems. Even in banks with the provisions for e-banking, these services are not fully functional. Several banks still have no website, ATM machines or the facility for online payments. Customers of such banks have to deposit their bills and cheques in person.

Apart from the limited use of e-banking in Pakistan, there other issues which mar the widespread adoption of this technology.

These challenges include:

(a) Security issues: The major challenge for the banking sector in Pakistan are e-security, cyber-attacks, unauthorized access to accounts and frauds. This coupled with the limited training on ICTs given to non-technical staff, exposes the accounts of customers to various privacy and security threats.

(b) Improper management and regulation: Falsifying reports on cash-inflow and other transactions along with corruption issues increases people's mistrust in Pakistan's e-banking system.

(c) There is a lack of an effective regulatory mechanism to thwart security risks.

(d) There is limited knowledge among the public on e-banking.

2 The project

2.1 Vision

Realizing the imminent risks associated with e-banking, the Government of Pakistan has been striving to make electronic banking a pleasant experience for its citizens by including the Electronic Transaction Ordinance 2002. This Ordinance provides the legal structure for payments made through electronic transactions. Furthermore, the Payment System and Electronic Funds Transfer Act, 2007 was also implemented to provide a regulatory framework for e-banking. The overall responsibility of overseeing the e-banking scenario in Pakistan has been taken over by the State Bank of Pakistan, which supervises and monitors the payment transactions within the country, as well as overseas.

The recently approved Prevention of Electronic Crimes Bill, is also expected to supplement the existing laws in this domain to protect and improve the security associated with online transactions.

3 Conclusions

Throughout Pakistan's stint with e-banking techniques, the Government has consistently tried to render support for its expanding banking sector. As such the cybercrimes associated with banking fraud still remain relatively high in Pakistan. Assessing this situation, the Government of Pakistan has regularly introduced appropriate laws and regulations which are bound to facilitate the growth of the banking sector and improve its security in the coming decades.

With the increase in use of social media among the urban populations in Pakistan, the concept of online services including banking is gaining momentum again.

Given Pakistan's consistent efforts in the area, other developing countries in the South-Asian region should take a leaf out of Pakistan's book not only to endorse the ease of e-banking systems but also to ensure the widespread adoption of such technologies across communities as envisioned by Sustainable Development Goal 8.

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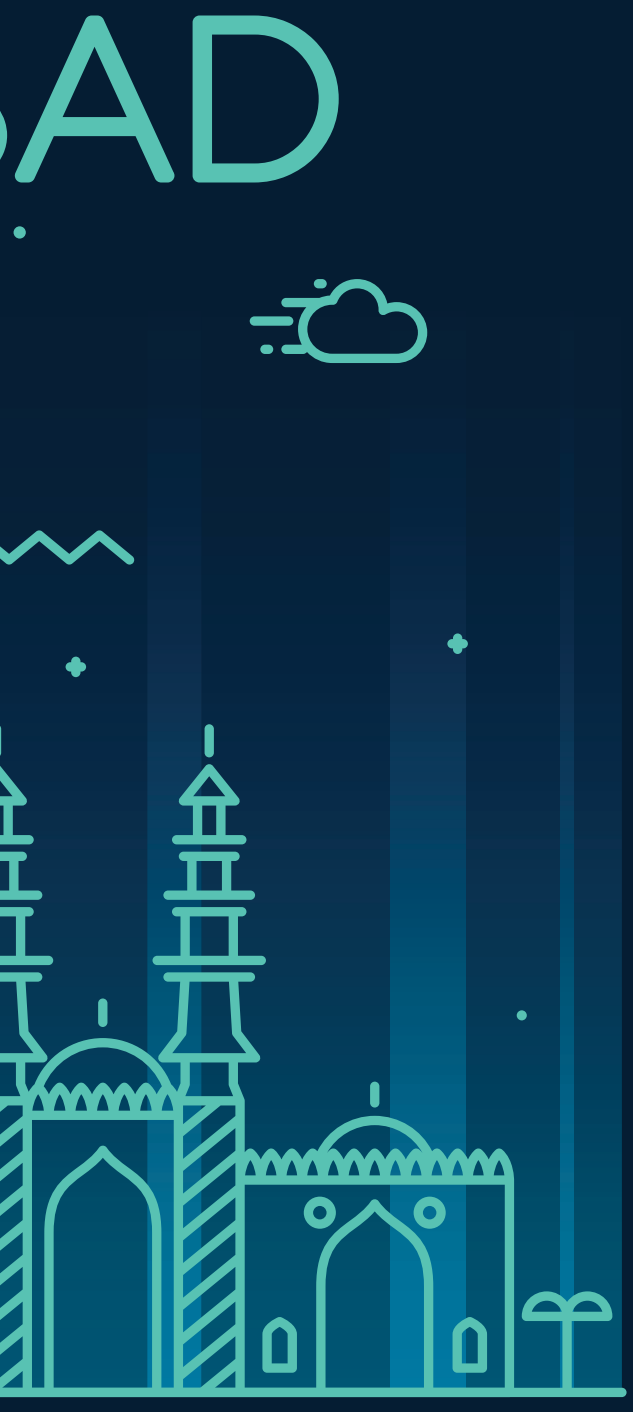
AHMEDAB



Goal 9:

Industry, Innovation and Infrastructure – Smart Mobility: The Case of Ahmedabad

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

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1 Introduction

1.1 Background

Founded in 1411 AD as a walled city on the banks of the river Sabarmati, the city of Ahmedabad is now the seventh largest metropolis in India. The textile industry revolution in the 19th century brought a lot of prosperity to the city, and in the 20th century marquee education institutions such as Indian Institute of Management, National Institute of Design, Centre for Environmental Planning and Technology brought in the knowledge capital to propel the city to greater heights in the 21st century. The city attracted modern masters of architecture such as Le Corbusier and Louis Kahn, who gave the city a unique identity. The entrepreneurial nature of the locals coupled with able leadership has made the city an economic powerhouse, with the city contributing about 14% of the total investments in all stock exchanges in India and 60% of the total productivity of the state. Foreign and domestic investment in sectors such as pharmaceuticals, textiles, automobiles and information technology have been driving the engine of growth in the last decade, which is reflected in Forbes' world raking of #3 for fastest growing cities of the decade. The development of the city and the influx of people have only accelerated over the last three decades, with the decadal population growth rising from 29% (in 1981) to 40% (in 2011), and the metropolis accommodating over 6.3 million people.

1.2 Challenge and response

The growing population in the city of Ahmedabad along with a relatively (compared to other Indian cities) sparsely populated urban core has resulted in rapid urban sprawl. The administration, taking cognizance of the issue, has developed multiple ring roads to enhance connectivity and regulate traffic. The city was among the first in India to adopt a bus rapid transit system (BRTS) and has thus far implemented a BRTS corridor of 130 km, which boasts of daily ridership of 0.12 million passengers and a fleet of 235 buses. The city bus network, which serves as a feeder system for the BRTS, has a network on over 700 km. This huge network of transit system was managed by discrete IT systems which were nearing end of life, and were not well equipped to address the challenges of operating a large fleet of buses to ensure operational efficiency. Moreover, the fare collection systems across modes of transit lacked integration, resulting in revenue leakages. The net result of revenue leakages and sub-optimal operations were: operating losses for the entities running the city bus network, lack of predictability of bus journeys, scarce availability of real-time data to plan for journeys, and a lack of integration with informal public transit (shared cabs and auto-rickshaws) resulting in reduced ridership emanating from a lack of last mile connectivity.

The city administrators recognized the challenges faced by citizens and operating companies responsible for public transit and constituted a "Smart Mobility" project to modernize the transit operations and provide the means for seamless fare payments. An integrated transit management system (ITMS) was envisaged to enable the gathering of transit data and intelligence in order to provide timely feedback to traffic managers and commuters. The ITMS system was built for real-time monitoring of the fleet of public transport buses and hence enhance commuter satisfaction, reliability and punctuality of bus operations. An automated fare collection system (AFCS) aimed to automate its fare collection mechanism and remove leakages and ease operations. Further fare collection mechanisms (AFCS) of the transport ecosystem are envisaged to be integrated with an open loop common card payment system (CCPS) to enable cashless transactions. A single open loop card is proposed for mobility systems, municipal services, and any other government transactions within the city. Further, open loop cards can be used across any store or seller within the city that has a point of sale terminal accepting cards. Administrators further acknowledged the need for IT connectivity to enhance physical connectivity across the city, and weaved in a programme to lay fibre optic cables along the BRTS corridor to develop a digital highway which will be leveraged by ITMS, AFCS and CCPS systems. This project is directed to achieving SDG 9[43].

[43] Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

2 The project(s)

2.1 Vision and content

The city administration of Ahmedabad has set out its vision to "Provide efficient, affordable, equitable and customized governance for citizens of Ahmedabad" and the project conceived under smart mobility is a reflection of the vision. The open loop payment system along with automatic fare collection is envisaged to offer seamless transit facilities such as journey planning and payments across public transit systems (bus rapid transit system, city buses and metro which will be launched in 2017) and informal public transit systems (shared taxis and auto-rickshaws). A seamless experience across the mobility systems along with adequate planning and scheduling has the potential to decongest public transport and reduce the end–to–end transit times for citizens, thereby allowing the city to use the existing transit capacities to the maximum extent possible rather than investing in new urban mobility infrastructure. This approach that the city has taken to use technology to maximize infrastructure facilities will enable the city to free up capital budget for funding other social development initiatives.

The features being developed in an integrated fashion across the three initiatives (ITMS, AFCS and CCPS) include:

- real-time tracking of city buses, in-bus surveillance systems, and bus station surveillance systems to monitor the buses and driver behaviour;
- data-driven bus scheduling and depot management to optimize the operation of a fleet of buses;
- real-time calculation of 'Estimated Time of Arrival' based on ambient traffic conditions in the city;
- unified payment mechanism through open loop cards across various modes of formal and informal public transit to reduce the revenue leakage;
- city-wide open loop payment card to facilitate digital cashless transactions across services offered by the government and private sector;
- area-based connectivity infrastructure to facilitate digital inclusion and connectivity to field devices.

The city has developed these system on a bedrock of innovation, by utilizing technologies such as data analytics (to schedule buses and display an estimated time of arrival), Internet of Things (to gather field-level data), open loop cards (as an alternative mode of payment), and open APIs (to integrate with informal public transit systems).

2.2 Implementation and perceived outcomes

The implementation of the "Smart Mobility" programme for the city of Ahmedabad is being done under the Government of India's "Smart City Mission" whereby the central government offers a seed capital of USD 73.5 million to each of the selected cities and the state government matches the funding offered by Central Government, thus allocating an aggregate of USD 147 million to each of the selected cities. The programme execution is performed at a city level by a newly created city-specific 'Special Purpose Vehicle' (SPV) which has an equal equity stake of local government (resulting from grants received from Central Government) and state government. This independent SPV is headed by a Chief Executive Officer (CEO), who is responsible for the overall strategy and day-to-day execution of various projects envisaged under the "Smart City Mission". A new institution structure created at city level has offered urban local bodies the required agility to execute large scale technology transformation projects. The institution also engages with citizens through an extensive consultation process over digital and physical channels and projects are prioritized based on aspirations of citizens. For the city of Ahmedabad, public transport was identified as a major issue by the citizens and hence the SPV came forward with the "Smart Mobility" programme.

The overall implementation approach was customized for each of the subsystems based on commercial models, and the risk appetite of city administration and the private sector. For instance, the technology components were developed on an Engineering, Procurement and Construction (EPC) model coupled with

operations support for a period of five years, whereas the open loop card system was developed on a public-private partnership (PPP) model with no upfront capital investment from the city administration.

The execution is orchestrated by the SPV which is supported by project management consultants (PMC). The PMC is tasked with developing the technology solution, defining integration touchpoints, and ensuring the overall financial sustainability of the project. The implementation vendors, technology providers, in the case of optic fibre connectivity, ITMS and AFCS, and banks in the case of CCPS, work with the SPV and PMC in order to deliver the unified solution for citizens.

The overall programme, which has many firsts from an Indian perspective, started in September 2015, and the first three months were spent on citizen consultations and eliciting the appetite of the private sector in taking up urban transformation projects. The projects were then phased out so that interdependencies of various components (developed by different vendors) were mapped, and infrastructure-heavy initiatives were commenced first, followed by the deployment of ICT street infrastructure and software development. The implementation is currently underway and the systems are expected to go live in April 2017.

The project selected effective technology suitable to Indian conditions. The provision of some services through a PPP results in reduced financial dependence in an already constrained urban funding scenario. Furthermore, financial support from the central government enhanced the project's attractiveness for the components of projects which did not have a viable PPP alternative.

3 Conclusions

Ahmedabad's pioneering PPP model for the CCPS system has helped in reducing upfront investments and increasing alternative revenues in capital-intensive ICT projects. The model is worth emulating across other transit systems in the developing world.

The key lessons learnt from this initiative are:

- Ensuring financial sustainability and proper risk segregation are critical and are an essential feature of ICT based capital-intensive projects.
- The dissemination of information and citizen consultation builds the legitimacy required for such large scale projects.

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MOBILITY


Reduced
inequalities

Goal 10:

Reduced Inequalities – Pan Africa e-Network Program

10 REDUCED INEQUALITIES

Table of Contents

1 Introduction

1.1 Background

Pan-African e-Network is a unique programme, which has been involved in mitigating the challenges of health and education in 48 African countries. The Former President of India, Dr. APJ Abdul Kalam, offered this platform to the African Parliament in Johannesburg in late 2004. The African Union Commission (AUC) accepted the Indian proposal and signed an umbrella MoU with the Government of India, through the Ministry of External Affairs .This was translated into a practical project by TCIL, a Government of India enterprise, which has a presence in Africa.

The main objectives of capacity building and technology flow have been achieved by virtue of this programme being in 48 nations of Africa. The programme is an outstanding example of South-South cooperation, India and Africa both being developing territories. This case study forms an excellent example of striving to attain the Sustainable Development Goal (SDG) SDG 10 to "reduce inequality within and among countries".

1.2 Challenge and response

In any society, city or country, people play an important role. How 'smart' a city or country is depends upon the smartness of its people. For people to be smart, the most important aspect is good quality education. While educated people are a prerequisite for the development of any nation, limited educational infrastructure poses a big challenge. With a large number of developing countries spread across Africa and Asia, resources to bring education to the desired standards pose a big challenge.

The solution is about enabling people to obtain formal education in terms of graduate and postgraduate programmes which help people to meet their aspirations, and make them smart. Also, it is about providing support and expertise for handling the Super Specialty healthcare facilities to the local citizens at the international level.

2 The project(s)

2.1 Vision and content

The vision behind this project was to connect all 53 African Union Commission member countries with Indian institutions to share India's expertise in the fields of education and healthcare, with the objective of accelerated socioeconomic development and equal access to these services in Africa.

When the people of a major city are able to get themselves educated, overcoming the challenges of having to leave their city/ country and also invest resources beyond their means, more and more young citizens would be able to contribute to the development of the city and towards its competitiveness.

Key features and design

- Scope of this project:
  - tele-education
  - tele-medicine
  - VVIP connectivity

    (Video-conferencing and VoIP among the Heads of African states).

A pictorial depiction of the same

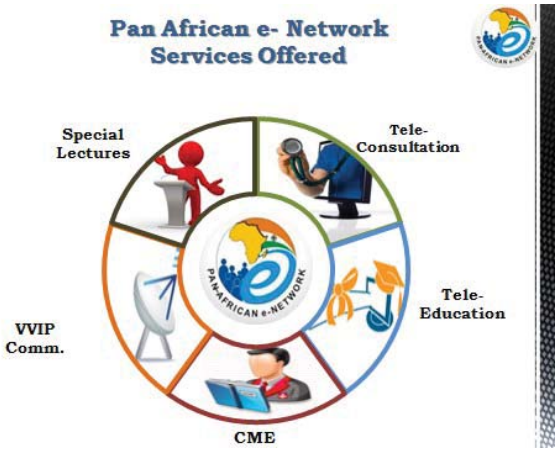

Figure 10-1 – Pan African e-Network services offered

Features of the telemedicine services

Stakeholders in the process include:

- 12 Super Specialty hospitals of India
- 5 regional Super Specialty hospitals of Africa
- 48 patient end locations in Africa.

Components of the solution

- software for patient EMRs (Electronic Medical Records)
- direct capture of patients' vital information from medical equipment
- easy follow-up through tele-consultations
- regular continued medical education (**CME)** sessions; live interaction through video conferencing
    - more than 20 medical disciplines offered
    - 72 sessions take place in English/24 in French, every month
    - session schedules are circulated in advance based on the demand from the African doctors.

Features of tele-education services

The stakeholders in the process include:

- 5 universities of India
- 5 regional universities of Africa
- 48 learning centres in Africa.

Programmes running:

- 6 postgraduate programmes
- 5 undergraduate programmes
- 6 diploma courses
- 10 certificate programmes.

VVIP communication

- This ensures communication among the heads of African nations,
- a dedicated and secured network in Mesh Topology via satellite, and
- audio, video and data communication through video conferencing systems.

Architecture of the network

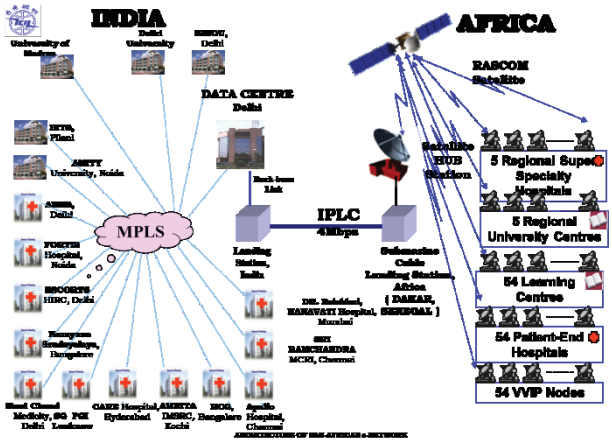

Figure 10-2 – Architecture of the network

- IPLC (International Private Leased circuit) – 4/8 Mbps;
- Internet connectivity: 2 Mbps initially, scalable up to 4 Mbps for offline access to tele-education lectures;
- space segment: half transponder initially, one and a half transponder later;
- customization of tele-education and tele-medicine application software in French, Arabic & Portuguese;
- digital library and content generation support two conferences;
- special lectures from an expert guest faculty from various fields from the TCIL studio in New Delhi.

Innovation involved

This programme involves virtual classroom learning in a point-to-multipoint mode. One professor based in one of the leading universities of India is able to interact in real time with students in 48 countries simultaneously. These students can ask their questions and get their doubts clarified on a real-time basis. All the lectures are recorded so that the students can access them at their leisure.

From a healthcare perspective and unique to this programme is that doctors in 48 hospitals across Africa can be helped with capacity building in terms of special cases and continued medical education.

The programme also provides an opportunity for the heads of 48 African nation states to interact with one another with the aid of an audio-visual medium, in a completely secure environment.

Role of ICT in enabling this project

A major portion of this project involves the use of ICTs in a big way, including state of the art education and healthcare software. Included are:

- satellite hub station
- VSATs in 169 locations in Africa
- data centre and studio setup in TCIL HQ
- data centre at the satellite hub station
- ICT equipment
    - computer hardware

  - system software
  - application software
  - networking
  - studio equipment
  - UPS
- medical equipment at 53 patient-end hospitals
  - 10 numbers each
- tele-education and tele-medicine application software.

2.2 Implementation

The project was implemented by TCIL, a Government of India enterprise on a turn-key basis. The parameters of the programme were dynamically altered based on the inputs from the African nations.

Policies/ strategies that made its implementation possible:

- a master agreement between the African Union Commission and the Ministry of External Affairs, India, to help in the process of implementing this programme;
- country-level agreement between individual African nations and TCIL, enabling the implementation of this project;
- agreements between the 48 universities of Africa with each of the five universities of India, recognising the Indian graduate and postgraduate degrees;
- agreements between the 48 Super Specialty hospitals of Africa, with each of the 12 Super Specialty hospitals of India.

The various stakeholders involved in this project are:

- African Union Commission
- Ministry of External Affairs, Government of India
- Doctors of Super Specialty hospitals of 48 countries in Africa
- Doctors of five designated regional Super Specialty hospitals of Africa
- Professors in state universities of 48 countries in Africa
- Professors of five designated regional universities of Africa
- Professors of five leading universities of India
- Doctors of 12 leading Super Specialty hospitals of India
- Digital content developers in India
- Tele-education/Telemedicine software companies of India
- ICT equipment manufactures
- RASCOM satellite – Africa's own satellite
- MPLS/bandwidth connectivity provider
- TCIL – implementing agency.

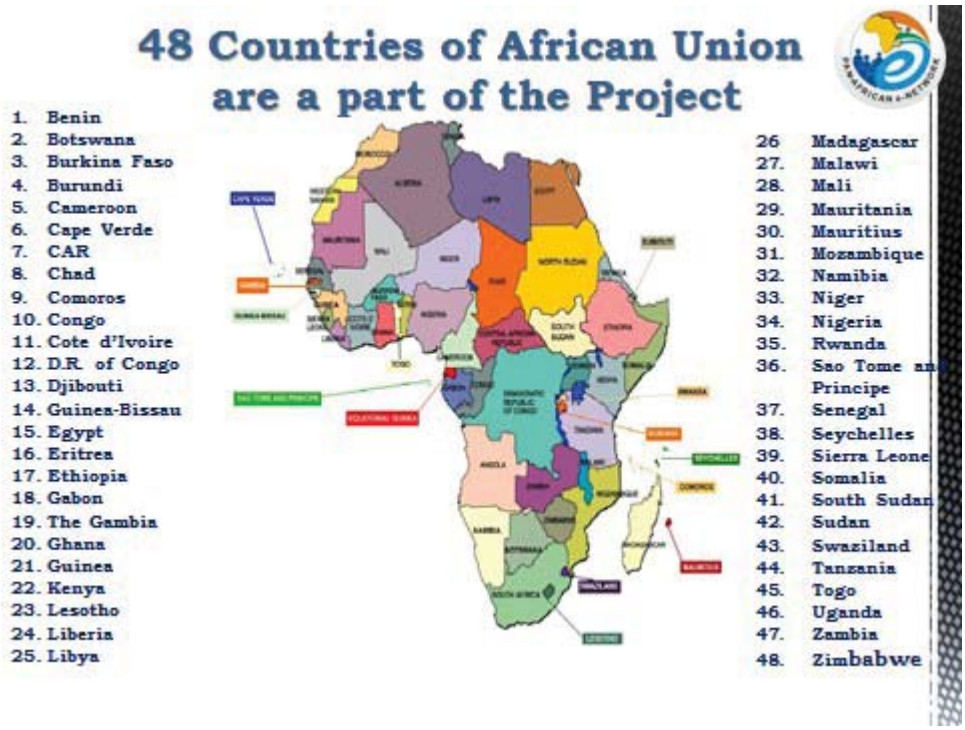

Figure 10-3 – Participants of Pan-African e-Network programme

Enablers that "made it happen":

- *Leadership*

Dr. APJ Abdul Kalam took a personal interest in the implementation of the programme. It became a flagship project of the Government of India. The African Union Commission took a leadership role from the African side to remove all obstacles and promote the project.

- *Governance (within the city and across levels of government)*

All the participating African nations took a keen interest in its implementation.

- *Financial (e.g. PPP, risk management)*

The project was fully funded by the Government of India.

- *Organizational (partnership, private involvement, citizen involvement, project management)*

The individual stakeholders, such as doctors, professors, went out of their way to ensure the success of this programme.

- *Communication (internal and external, branding)*

The institutions on the African side gave due publicity to this programme in their respective countries.

2.3 Results

Intended benefits for the people of Africa included:

- capacity building by way of imparting education to
  - 10 000 African students over a 5-year period (2009-14):
    - 2000 in postgraduate programmes,
    - 3000 in undergraduate programmes, and
    - 5000 in skill-enabling certificate, diploma and post graduate programmes
- tele-medicine components:
  - online medical consultation for one hour every day to each country for five years
  - offline advice for five patients per day to each country for five years
  - CME for practicing doctors and working nurses/physicians' assistants, in order to update their medical knowledge and upgrade their clinical skills.

Results achieved:

- More than 21 000 students from African nations are pursuing undergraduate/postgraduate programmes from Indian universities.
- By October 2016, nearly 5 700 learning sessions were held.
- CME sessions from Indian hospitals started for all countries on a regular basis on 22 April 2009.
- By October 2016, about 5 650 CME sessions in English and around 750 CME sessions in French were conducted.
  - At times 20 to 50 doctors attended the live CME sessions.
- By October 2016, 750 online medical consultations had taken place.

Sustainability of the programme

An important feature of this programme is that five leading hospitals and five leading universities of Africa, one from each region, are also a part of this programme. The objective being that there would be a capacity- building process throughout the duration of the programme, so that after some time these institutions would be able to fully take over the programme, without the support of India. This makes this programme unique in the world.

Figure 10-4 – Recognition of the project

3 Conclusions

Main lessons learnt from this case study

It is possible to implement complex projects, which involve making *people smarter* with limited resources, even across continents, provided there is a will to do so. It is also possible to implement projects and programmes as a South-South cooperation.

There were also some unintended benefits accrued from the implementation of this project, which were not initially thought of. One such key advantage observed was that people no longer had to return to India for a follow-up with their doctors and hospitals as they could make use of the benefits bestowed by India's position as a major tourist destination through the Pan-African e-Network. Hence, as most of the leading hospitals of India are a part of the Pan-African e-Network, the patients can now directly follow up with these doctors from their home countries without spending their precious resources and time for travelling.

Critical success factors

Similar projects, on a smaller scale that had been previously started elsewhere for smaller nations did not succeed. The critical success factors in this case, apart from the commitment of various stakeholders, has been the knowledge of the mutual difficulties and challenges which developing nations on both sides were able to understand.

Challenges ahead

The project is under expansion to reach larger sections of the populations in these countries. The Government of India has committed another USD 160 million for this programme over the next five years. Involving private stakeholders and also the other cities from the African side is imperative. Success of this programme will depend upon how much the governments in these nations are willing to commit.

Transferability to other cities

So far in most of the 48 countries of Africa, it is the capital cities that have benefitted. It is possible to transfer this concept to the other cities in Africa, where a majority of the people reside, and that would be the real success of this programme in Africa.

Scalability of the project

The programme is scalable, both upwards and downwards. It was implemented on a smaller scale in the SAARC nations as well. With ICT being at the core of this project, it is easily possible to scale it up for extending it to other cities of these nations in Africa, with a substantial increase in the cost of the project, which some of the African nations are willing to bear themselves.

Based on the success of this programme, and at the request of the African Union Commission, the Government of India has decided to extend the services under this programme by another five years to July 2021, at an additional cost of USD 160 million.

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Offline
social data
DATA MANAGEMENT
PLATFORM
CRM
3rd party
1st party
2nd party
01

Goal 11:

Sustainable Cities and Communities – Smart Dubai Platform and Dubai Data Initiative

11 SUSTAINABLE CITIES AND COMMUNITIES

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1 Introduction

1.1 Background

The United Arab Emirates, and Dubai in particular, have taken major strides in the digitization of services, processes and assets, and have emerged as a regional leader. The Smart Dubai initiative was born out of the visionary approach of His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and The Ruler of Dubai, to focus the city's unified efforts towards its most valued asset – its people. The vision of Smart Dubai is to become the happiest city in the world (by embracing technology as an enabler). The Smart Dubai initiative plays a pivotal role in guiding and enabling the city's ongoing digital transformation across all sectors. Since the Smart Dubai initiative was founded in March of 2014, the city has witnessed exceptional growth in the availability and quality of digital services contributing to more efficient and improved city experiences for the government, private sector and individuals. Dubai embarked on its smart and sustainable city transformation through several tracks including legal, governance, infrastructure and services, among others.

During the past two decades, the numerous digital transformation initiatives in the city drove public acceptance and adoption of ICTs in all aspects of life. In 2017, Dubai, a city of 2.5 million inhabitants and one of seven emirates of the UAE, has one of the highest levels of ICT adoption in the region, both by the public and the government. Dubai has historically pioneered an exceptional quality of life and an unparalleled business environment. Outlined in His Highness' vision, technology, as the platform for solutions, is simply to play the role of an enabler, rather than the principal goal. The Smart Dubai initiative fulfils the vision of His Highness to make Dubai the happiest city on earth. The impact the city can create with the goal to drive happiness is enormous, and is growing tremendously each year. Numerous implementations ranging from massive "Internet of Things" (IoT) systems, data analytics, pioneering blockchain, hyperloop projects, innovative 3D printing initiatives, autonomous vehicles and drone experiments, robotics and artificial intelligence applications were developed and trialled as part of the initiative. These initiatives serve the attainment of the Sustainable Development Goal (SDG) SDG 11[44].

1.2 Challenge and response

In this context, Smart Dubai launched two major and complementary initiatives called the Smart Dubai Platform (SDP) and Dubai Data which unite various aspects of Dubai's smart and sustainable city transformation at the data, and selective ICT infrastructure and service levels. SDP forms the new digital backbone of Dubai in its citywide digital transformation whereas the Dubai Data initiative aims to achieve a seamless, efficient, impactful and safe data governance and data sharing at the city level contributing to Dubai's smart transformation.

Smart Dubai Platform: Prior to SDP, various entities were working independently to deliver their smart-city initiatives with commonly needed data, IoT and related ICT infrastructure requirements. The city potentially risked inefficiencies stemming from replication of ICT investments, resources and services.

Hence, Smart Dubai launched the SDP initiative to unify the common collective smart-city needs of public sector entities by identifying various inherent synergies (to be extended to private sector entities in due course based on demand). SDP is a large-scale, complex initiative consisting of infrastructure, data and services which will be delivered in multiple phases. SDP entailed significant capital and operational expenditure, spread over time and associated with its implementation and roll-out phases. Additionally, it posed challenges in terms of sophisticated smart ICT and data management skills, platform development and provisioning at the city level, as well as platform and related services commercialization.

The financing challenge of the SDP initiative was to formulate a smart mechanism for this citywide initiative in a creative and commercially viable manner without necessarily relying purely on traditional public sector funding. After a careful feasibility analysis and extensive consultations with stakeholders, a public-private

[44] Make cities and human settlements inclusive, safe, resilient and sustainable

partnership (PPP) model was adopted for implementation. The partnership also addressed financing, skills, platform development and commercialization issues jointly through the selection of an appropriate private sector partner. Hence, SDP was an innovative initiative both in terms of its scope and also in terms of its financing.

Dubai Data initiative: Data in Dubai, as in every city around the world, has not necessarily been managed as a strategic asset for the city in its own right, but has:

- existed as an 'afterthought', often in an ad-hoc manner as a result of each entity's activities;
- been locked away within individual entities, limiting the ability for collaboration and innovation with external stakeholders and organizations;
- been limited in terms of value created directly from it, and the restricted value created was confined in most cases to a single entity.

This traditional operating model rendered it challenging to join up data and services around city needs, and limited the innovation potential to drive citywide change at speed. And it became clear that it would hamper sustaining city needs in the future, as Dubai embraced its citywide digital transformation and adopted the Internet of Things (IoT), among others. As city assets and infrastructures such as buildings, roads, places and a huge range of things and devices are becoming smart and Internet-connected, the number of Dubai data sources is also multiplying exponentially, as will the potential for inefficiency, duplication and lack of "citizen-centricity" if that data is not effectively managed.

Dubai therefore needed to establish a radically different operating model for its data. Hence, Smart Dubai has launched the Dubai Data initiative to address and mitigate these impediments. Drawing on the "transformational operating model for Smart Cities" recommended in the relevant international standards[45], the Dubai Data initiative established a new Modus Operandi based on:

- *clear governance frameworks to ensure data is managed as a strategic asset,* with clear accountabilities for maintaining and exploiting data sets, supported by clear, principle-based rules for promoting reuse and innovation with data sets;
- *use of open standards* to ensure that data sets can easily be leveraged by various city constituents inside and, where appropriate, outside the Dubai Government;
- *nurturing the development of a flourishing 'data market place' in Dubai*, in which city entities, public and private sector organizations, voluntary sector and community organizations and individual citizens are enabled to use Dubai Data to create new sorts of social and economic value.

2 The smart project(s)

2.1 Vision and content

Smart Dubai has embarked on implementing a comprehensive citywide digital platform, namely the Smart Dubai Platform (SDP), to unite all layers of the city's ICT architecture, from connected infrastructure, to data orchestration, to enabling services such as Digital IDs and payments, IoT and data management, to personal dashboards and applications. SDP is one of the key enablers for the smart-city transformation of Dubai and smart leading edge ICT technologies were embedded in SDP as key enablers.

SDP is the digital backbone fuelling the smart and sustainable city transformation of Dubai. This innovative platform represents a shift away from models where city infrastructures are built independently, operating in parallel silos with providers merely supplying point solutions. Instead, this unique platform applies a horizontal and collaborative approach that integrates the city's information technology and services.

[45] See Section 2.3 and Footnote 1 on the OASIS Transformational Government Framework and BSI Smart City Framework.

The SDP is unique in several ways, principally in the breadth of city solutions that it will empower and in its employment of innovative leading edge technologies.

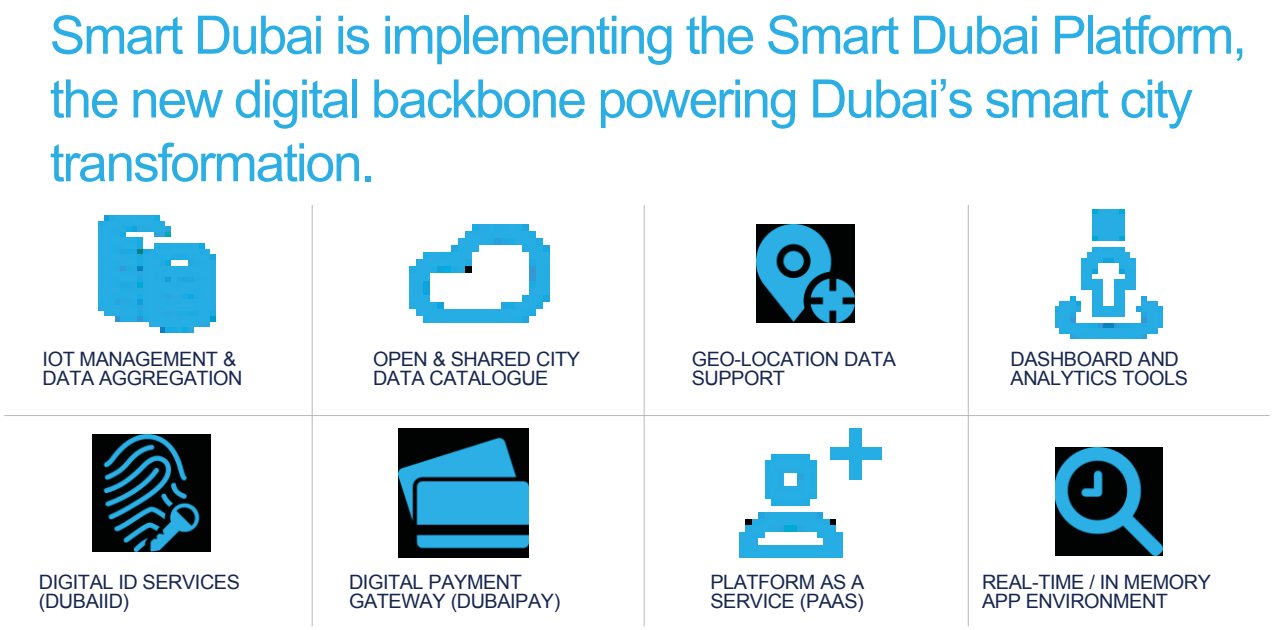

Figure 11-1 – SDP Platform initial services

The principal role of the SDP will be as technical enabler for the interconnection of data throughout the city and as technical incubator to new, seamless citywide services.

Dubai targets the SDP to be one of the globally competitive platforms operating in the world today. Built through a collaborative and interactive process with all city stakeholders, SDP is an embodiment of Smart Dubai's efforts to reshape the way government services are structured to meet the needs of the customer. To deliver the SDP, Smart Dubai has pioneered a public-private partnership (PPP) with its strategic private sector partner, namely du (a major integrated telecommunications services provider in UAE). du contributed their expertise to build a collaboratively designed platform that brings the most advanced technology innovations on the market to support smart-city experiences for all Dubai residents, visitors, business owners and city decision makers.

This new and integrated approach depends on interoperability and from the very outset it became apparent that no single vendor would have the capability to entirely provide such a holistic and technologically sophisticated digital platform. As a result, this demanded not only new budget models, but new thinking from vendors whereby they would not be just service providers but instead strategic partners working in harmony with shared vision and goals.

The adoption of a unique public-private partnership (PPP) model was therefore the most expedient and efficient alternative of harnessing the potential of the public and private sectors in meeting the goals of this groundbreaking smart-city initiative. The risks and the rewards were jointly shared by partners in a well-defined framework agreement.

Private sector partner brought extensive experience and skills in operating citywide platforms and infrastructure. It also provides requisite sophisticated ICT skills to implement and manage the large-scale SDP platform and provide leading-edge services (e.g. IoT, data, etc.).

Smart Dubai Platform complemented by Dubai Data initiative: Dubai's vision is contingent upon the free flow of information. Data and information will be the "new currency" by which its citizens, residents, businesses and Government will exchange value and develop new and innovative ways to live, learn and do business in a culture of data sharing.

The Dubai Data initiative has set 11 strategic objectives towards creating a culture of data sharing and innovation as indicated below:

1. Enable Dubai to achieve its smart-city vision of becoming the happiest city.
2. Manage data based on clear guidelines aligned with international best practices.
3. Achieve integration and harmony between the services provided by federal government agencies and local government bodies.
4. Optimise the use of data for data providers.
5. Promote transparency and establish governance rules on the dissemination and exchange of data.
6. Increase efficiency of services provided by federal and local government entities, in terms of: level of quality, speed of delivery, simplification of procedures and reduced operational costs.
7. Increase the competitiveness of data providers and raise the standing of Dubai and UAE on international competitiveness indices.
8. Improve decision making at federal and local levels to enable agencies to effectively process data, prepare policies and implement strategic initiatives.
9. Encourage and nurture a culture of innovation that will lead to a better quality of life for residents and visitors.
10. Balance the dissemination and exchange of data with preservation of data confidentiality and privacy.
11. Provide the necessary data for non-governmental actors in order to support the economic and development plans of the emirate.

The overarching goal of the Dubai Data initiative is not to publish the most data for the city; but rather to unleash the greatest value from data to enhance access to opportunities and to improve quality of life in Dubai. The Dubai Data initiative is committed to developing an advanced knowledge ecosystem around data in Dubai, elevating data analysis and data science abilities for the public and private sectors, and unlocking the greatest possible value from Dubai data.

Dubai Data Law, Dubai Data policies, Dubai Data standards and SDP are key building blocks (enablers) addressing various data-related issues to ensure the success of the Dubai Data initiative. ICT is naturally at the heart of the Dubai Data initiative. The Dubai Data Portal, an electronic portal managed by the Dubai Data Establishment and operated on the SDP, will be the city’s gateway as the unified electronic platform to open and share data. This portal is designed to include key enabling tools that allow users to directly benefit from data such as: dashboards and analytical tools, an open and shared city data catalogue and a real-time app environment.

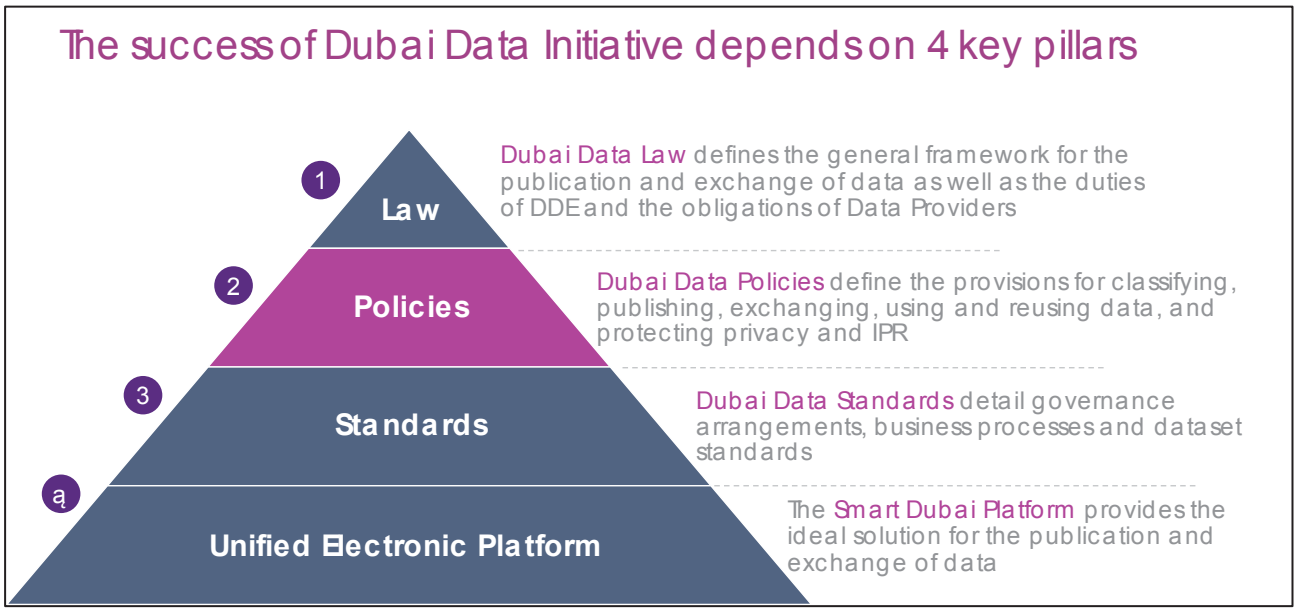

Figure 11-2 – Key pillars of the Dubai Data initiative

A wide range of stakeholders is expected to benefit from the Dubai Data initiative, as shown in the figure below.

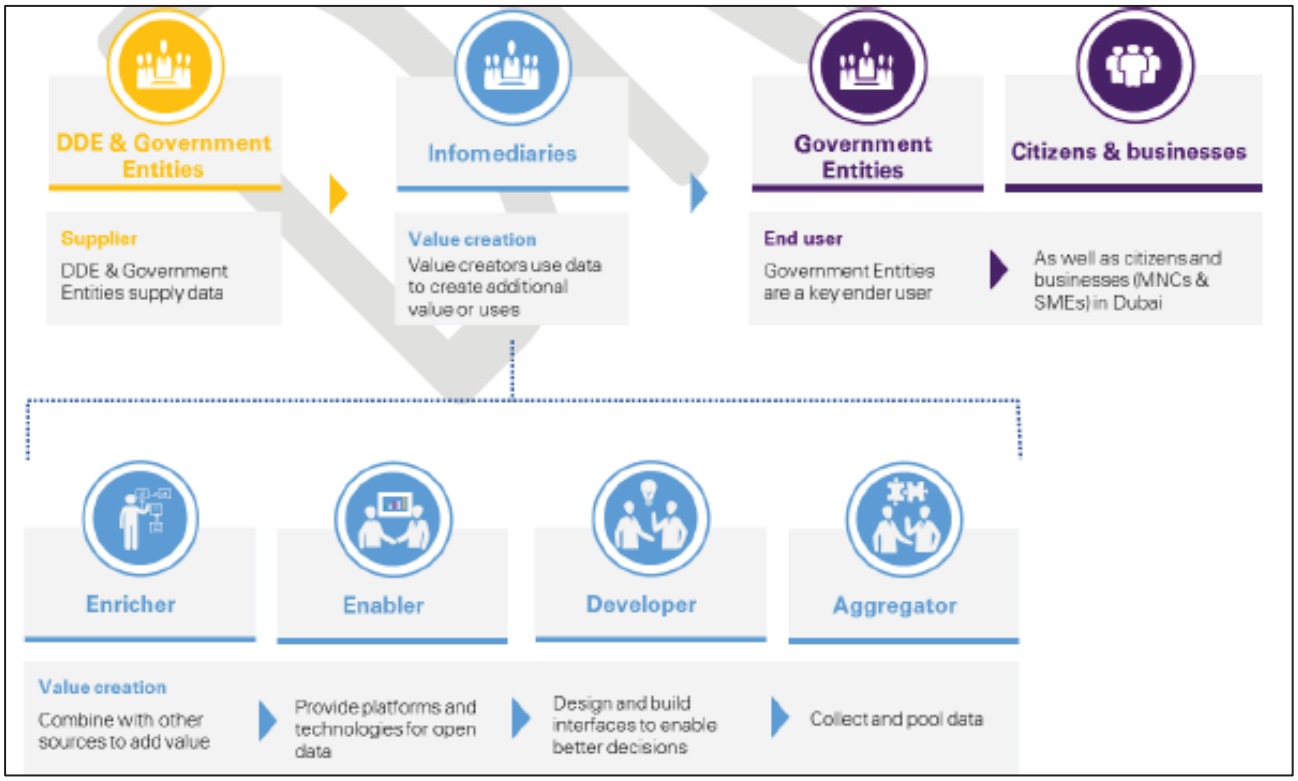

Figure 11-3 – Stakeholders expected to create value from the Dubai Data initiative

2.2 Implementation

Smart Dubai Platform implementation: The SDP project was implemented by going through the following steps:

- visioning and scoping
- current and future state assessment and gap analysis
- identification of detailed ICT/data platform needs and components
- blueprinting of the SDP
- tendering process (several iterations + learning curve) and selection of approach
- awarding of the best partner (Consortium) that fit the city requirements
- contractual phase (PPP agreement)
- implementation phase.

Figure 11-4 – SDP Implementation Options Considered

Smart Dubai went through a rigorous exercise to select the right approach for building the SDP. Three main options were considered (as shown in the above figure) and they were evaluated with respect to several criteria. Consequently, the PPP approach was opted due to the several advantages it posed. Smart Dubai's public mission was combined and integrated with the predominantly commercial mission of the private sector partner du. A joint value proposition was created for SDP.

The PPP agreement was implemented by going through the following steps. For building and signing the PPP agreement in an effective and accelerated manner Smart Dubai has obtained assistance from the Legal Affairs Department and Department of Finance to play an active role (both entities are central government entities responsible for legal and financing issues in the Dubai Government).

Dubai Data initiative implementation: Smart Dubai launched the Dubai Data initiative in 2014 and formed the cross-governmental Open Data Committee in November 2014 to suggest a data strategy, roadmap and law for opening data in the Emirate of Dubai. Subsequently, Law No. (26) of 2015 Regulating Data Dissemination and Exchange in the Emirate of Dubai, henceforth referred to as the Dubai Data Law, was issued in October 2015 and Dubai Data Establishment was instituted in March 2016 to oversee its implementation.

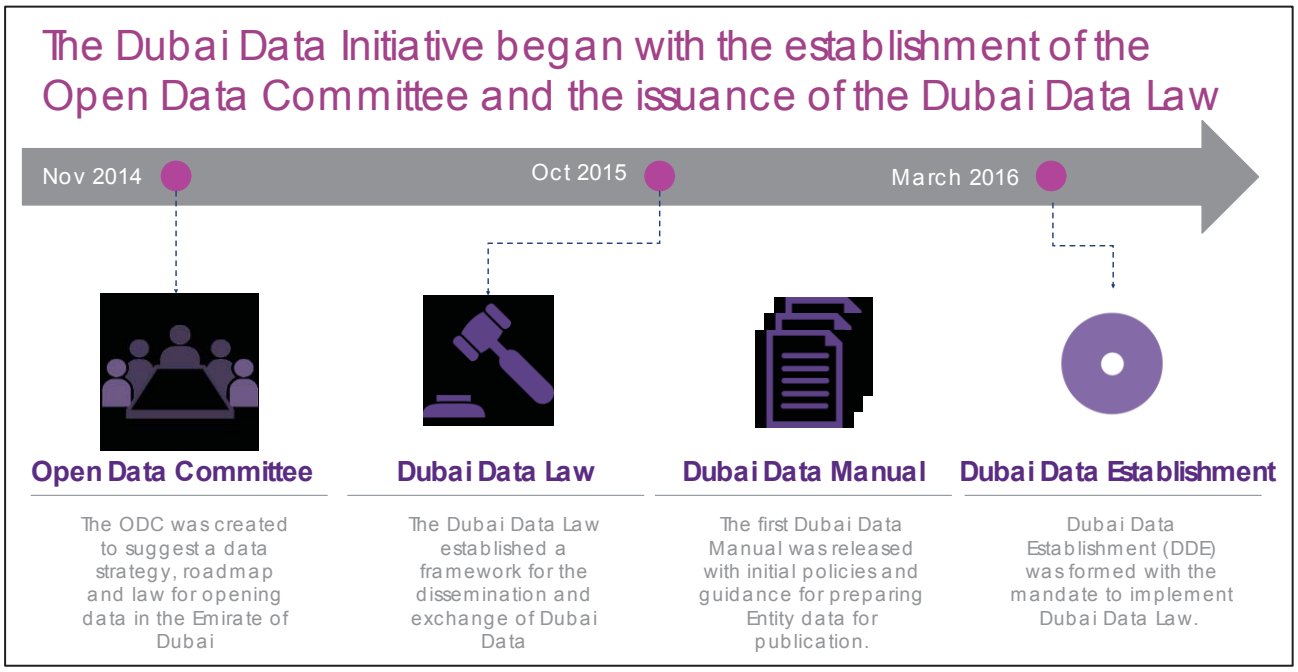

Figure 11-5 – Brief Chronology of Dubai Data initiative

The Dubai Data initiative has been built on collaboration and promoting cooperation and co-creation in both the implementation and the outcomes of the initiative. As an inclusive process from inception, a large number of city stakeholders were engaged throughout the strategy and implementation process, with the aim to cultivate a culture of cross-sector sharing.

The implementation of the Dubai Data initiative is staged into two distinct phases, in which the first will span only government sectors, as well as collaborative outreach into non-government sectors. Based on this dialogue the Dubai Data initiative will then be extended to the non-government sector in the second phase.

A detailed implementation roadmap, with clear roles and responsibilities for Dubai Government entities, was developed and communicated with entities. Compliance with this roadmap will drive the data maturity of the city from monopolizing data to driving more insightful and impactful data collaboratively for everyone.

Key implementation strategies for the Dubai Data initiative include:

1. Developing Dubai Data policies

In accordance with Dubai Data Law, the Dubai Data Establishment developed a number of policies to govern the opening and sharing of city data. The Dubai Data Establishment is specifically required to propose and approve: the policy for Dubai data classification, the policy for the protection of confidential data in possession of data providers, such as data related to individuals, establishments and companies; the policy for intellectual property rights associated with data; dissemination and exchange; the policy for data use and reuse; and the technical standards policy for Dubai data dissemination and exchange via the SDP.

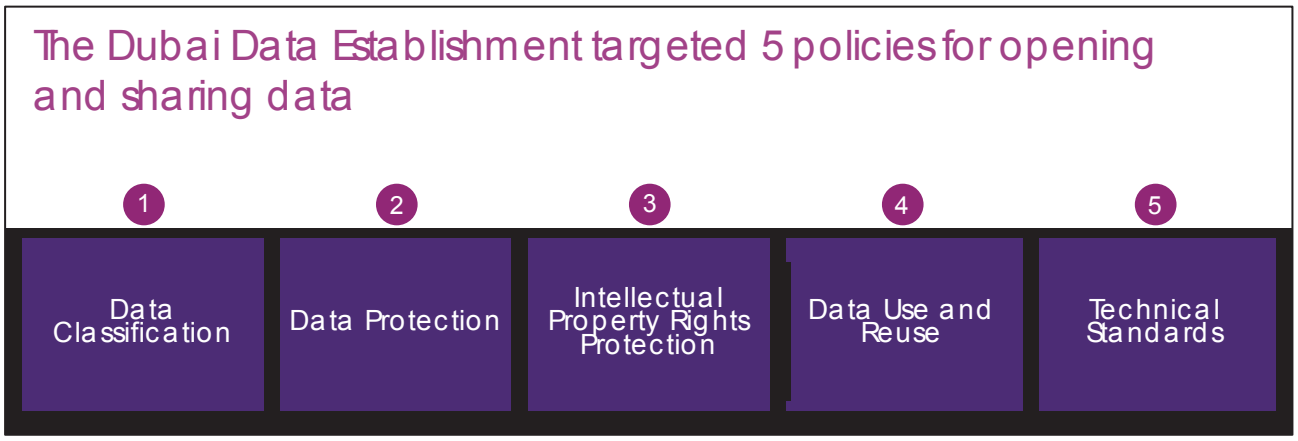

Figure 11-6 –Dubai Data initiative policies

2. Developing Dubai Data standards:

Dubai Data Establishment developed a number of common standards to unify data management processes across data providers and to enable easy data publication and exchange in the city. These standards include:

1. Standards architecture and roadmap
2. Data governance principles
3. Entity level implementation plans
4. Data governance roles and processes
5. Dubai Data Competency Framework
6. Prioritization criteria and process
7. Data cataloguing process (incl. primary registry)
8. Data inventories
9. Data ingestion process
10. Data Classification Framework
11. Data formats
12. Data quality standards
13. Metadata standards
14. Open Data License
15. Permissions management rules
16. Smart Dubai Platform acceptance criteria and quality assurance process.

Figure 11-7 –Dubai Data standards

3. Designating a data team within each data providing entity:

Dubai Data initiative requires data providers to designate data teams within their entities. These data teams, referred to collectively as the Dubai Data Champions, are a closed community of government data peers who will lead the implementation of the Dubai Data initiative. Dubai Data Champions have been appointed to represent their entity on all matters related to Dubai Data, including: data inventory, data compliance and data-driven decision making.

The Dubai Data Champions have been nominated by their leadership to guide each entity through the process of classifying, readying, opening and sharing data through the Dubai Data Portal, in accordance with the Dubai Data Law. To date, more than 180 data champions have been nominated from 31 government entities.

To support the Dubai Data Champions, the Dubai Data Establishment has suggested detailed roles and responsibilities for data team members along with streamlined processes for publishing and sharing data within each entity.

4. Training and upskilling Dubai Data teams

To upskill government employees, the Dubai Data initiative designed the Dubai Data Masterclass and the Dubai Data Curriculum.

Dubai Data Masterclass

To prepare the city to implement the Dubai Data Initiative, the Dubai Data Establishment, in partnership with the leading academic institution for public administration in Dubai, namely Mohammed bin Rashid School of Government, hosted a series of workshops with government partners to introduce the objectives of the Dubai Data initiative; define the role of the Dubai Data Establishment; explain the entity's obligations to open and share data in line with the initiative; and share the initiative roadmap for collaboration and contribution from each entity to achieve the mandates of the Dubai Data Law. Three Dubai Data masterclasses were held between June and September 2016. Over 150 government officials attended the educational sessions.

Dubai Data Curriculum:

To enhance the knowledge around data, the Dubai Data Establishment developed a data compliance curriculum. The Dubai Data Curriculum is a series of courses offered to prepare the Dubai Data Champions from government entities to ready data sets for opening and sharing, in line with the Dubai Data Law. It is the first in a series of practical and hands-on training opportunities to equip government employees with the data skills required to deliver the benefits of data to make the city more efficient, seamless, safe and impactful.

5. Guiding data-providing entities in developing their data release plans

The Dubai Data initiative provides detailed step-by-step guidance to entities through its standards to prepare them for publishing and exchanging their data. Entities are required to complete a self-assessment tool to determine their data maturity as well as inventory, and to classify their data before developing a detailed data release plan.

6. Uploading data to a centralized electronic platform (Smart Dubai Platform)

Dynamic opening and sharing of Dubai Data is enabled by the SDP. Having open data on one platform will help in making data more discoverable and reliable to data users. Furthermore, the seamless exchange of shared data will be enabled through this centralized platform and governed through access permission management. Data providers will be able to request access to new data sets available on the Dubai Data catalogue on the SDP. They will be able to determine the authorizations to each data set and inspect the access audit trails of data users. This will help data providers increase their data sharing while maintaining a high level of protection for shared data.

Results and benefits

Smart Dubai Platform (SDP) and Dubai Data initiatives are both major contributors to a smart-city initiative in Dubai. It turns the entire city into an enabling platform with carefully designed services, data and infrastructure components.

- The SDP will be fully enabled with geolocation data support, enabling advanced responsiveness in many citywide applications, from emergency medical response to event planning and transportation logistics. The data residing in the platform will be provided through the meticulous governance of the Dubai Data initiative.
- The SDP will store the complete catalogue of open and shared city data, enabling efficient and secure data sharing and secure data-cloud services for the city. The SDP will be the source for open city data for entrepreneurs, city planners and business owners seeking to learn and benefit from city data, produced as part of the Dubai Data initiative.
- Personalized dashboards and analytics tools for individuals, business owners, government departments and city leaders will be provided.
- A unified, single sign-on digital ID that will permit individuals to access hundreds of city services with one secure username and password that is also linked to their Emirates ID, so that city services can be completed quicker and more easily for all parties.
- A secure digital payment gateway protects both individuals and organizations with reliable and timely digital payments. With secure digital payments powered by the SDP, individuals will be able to transfer and receive payments with comfort and peace of mind.
- The SDP will be available as a “Platform as a Service” to government entities or the private sector to be able to benefit from the full suite of services provided by the platform including data services.
- All users of the SDP will benefit from its real-time app environment, powering live dashboards and other time-dependent operations such as traffic monitoring; and smart grids connected through the Internet of Things.

On the data side, Dubai Data Establishment has achieved considerable success in engaging data providers and raising their awareness about the Dubai Data Initiative during the past year. A total of 31 data providers, from government, semi-government and private sector entities, currently have data teams with a total of more than 180 data champions. Three masterclasses, a training course and several data team meetings have been arranged to drive and monitor compliance with the Dubai Data Law. The Dubai Data Establishment also works on actively engaging data providers in the development of standards and policies through focus groups, formal consultations and roadshows to top-level leadership. For example, in the development of the Dubai Data policies, focus groups were conducted with private and public sector data providers to understand their needs and concerns, and rounds of consultation were held with 13 government data

providers through working groups, formal consultations and roadshows to the top leadership of these entities to showcase the key decisions in the policies and obtain feedback.

Triple bottom-line for Smart Dubai Platform and Dubai Data initiatives

Both initiatives were designed to deliver a triple bottom line for the city with well-conceived economic, social and environmental impacts.

Economic impact

- Dubai strongly believes in the potential of data for value creation as a strategic asset. Data is emerging as a significant economic force across the globe, as the exchange of information becomes more critical to a sustained global competitive positioning across sectors, spanning economic, social and environmental ones.
- The Dubai Data initiative has commissioned a comprehensive study for estimating economic and social impacts of formal data management in Dubai. Preliminary estimates indicate that the potential annual economic impact, direct and indirect in gross value added, will be between 1.7 and 2.7 billion US dollars for 2021. These estimates are conservative as they do not take into account the benefits that will be realized through seamless exchange of data between Dubai Government data providers, or the fact that Dubai has the potential for a more exponential impact given that it is an emerging market for value-added data services and as such much of its value creation is yet to be realized.
- It circumvents the replication of ICT investments by the public sector, as well as some private sector organizations. SDP and data services will be provided as shared services enabling operational efficiencies achieved through significant cost savings.
- PPP has enabled the utilization of private capital to supplement public sector investment in Dubai. This has freed up additional capital for Smart Dubai to use for other city projects in Dubai.
- SDP and Dubai Data are expected to contribute to Dubai's economy by enabling innovation through new products / services and even new ICT-related sectors (e.g. mobile apps, open data utilization, IoT, data-driven services and economy, etc.).
- SDP and Dubai Data both encourage entrepreneurship by providing a one-stop shop enabling services for digital businesses in an easy to use and highly accessible manner. Digital businesses are expected to contribute in a positive way towards Dubai's GDP.
- Entrepreneurs and businesses will be able to easily access and use citywide open data to assist in planning their businesses and in managing them.
- The PPP model has been devised through a comprehensive framework jointly developed by partners. Smart Dubai as the public partner in the PPP has avoided significant upfront investments and has been able to negotiate a smoother (highly uniform) financing scheme over the years balancing out investments. The risks and the rewards are shared by the partners in a well-defined manner reducing risk from each party's own perspective.
- Partners have incorporated financing mechanisms to flexibly accommodate innovation in the future for the platform and various data services on it. Either partner or both partners can undertake future innovations and invest depending on their risk appetite and rewards potential. Joint investment by partners takes priority; however, the PPP agreement for SDP allows for each partner's individual investment if the other one refutes. So it benefits both parties and leaves sufficient room for innovation. The partners of SDP have committed to a long-term collaboration and ensured medium-term financing as part of the agreement, and have iterated their long term financing commitment to further innovate in the face of increased demand for smart-city services. This has enabled the financial sustainability of SDP.

Social impact

- SDP and Dubai Data initiatives are both designed to touch the lives of people impacting them throughout their daily lives in Dubai. Below are some examples where data and the platform will be beneficial directly and/or indirectly for city residents:

  - ffr a mother, checking health data from her child's school to determine if a flu vaccination is required;
  - for a father, reviewing household energy consumption to conserve resources and save money for a family vacation;
  - for a tourist, utilizing the live public transportation data to make the most out of time spent in the city;
  - for all commuters, enjoying reduced traffic congestion as more services are provided online;
  - for an urban planner and developer, achieving operational cost savings into data-driven research and development about Dubai through the data available in SDP.
- Several social services in Dubai will be made available enabling the public to benefit from it immensely.

Environmental impact

- SDP is designed to collect citywide environmental data from various points across Dubai. SDP will contain air quality, noise, pollution, energy, water and land-related data, among others.
- SDP will contain enablers to achieve city resources efficiencies and related consumption reduction tools which will positively impact the environment; these efficiencies will be captured by using city-related data.
- Digital adoption of various SDP-related economic and social services in Dubai will circumvent the need for conducting city services through traditional means by physically visiting service providers. Hence, a significant number of road trips will be avoided which in turn reduces GHG (greenhouse gas) emissions and will also reduce the stress on city infrastructure such as roads.
- Urban planning will be significantly enhanced by utilizing citywide data available from different public sector organizations.

Hence, Smart Dubai through its flagship Smart Dubai Platform and Dubai Data initiatives, is bringing about radical enhancements to city-leadership decision making, operational efficiencies and the daily quality of life.

3 Conclusions

Some of the critical success factors and lessons learnt for Smart Dubai Platform and Dubai Data initiative include:

- **Leadership**

  The ambitious vision and strong drive for the achievement of the goals of the Smart Dubai initiative comes from the very top of Government with H.H. Sheikh Mohammed Bin Rashid Al Maktoum UAE's Vice President, Prime Minister and Ruler of Dubai leading the way. Publishing and exchanging data on a shared platform is seen by top leadership as the key to creating seamless city experiences, enhancing the happiness of residents and building the innovation economy. Eager to speed up the process of opening and sharing data, a central entity, the Dubai Data Establishment, was created under the umbrella of the Smart Dubai Office to drive this initiative and work hand in hand with data providers to ensure its success. Top level leadership of strategic data providers are actively engaged in developing policies, standards and data release plans to ensure their buy-in, support and implementation of these policies and plans. In addition, Smart Dubai leadership has played a key role in formulating and overseeing the implementation of the SDP as well as the PPP building process (leaders of partners and their senior management teams were highly engaged, in addition to the leadership of various stakeholders involved in this citywide project).

- **Governance**

  SDP governance and strategic monitoring were put in place early on and have been instrumental in overseeing different aspects of SDP implementation. On the other hand, the Dubai Data Law defines

clear roles and responsibilities for data providers and for the Dubai Data Establishment. The Dubai Data policies and standards further define internal governance arrangements for managing the publication and exchange of data within data providing entities. With clear accountabilities, data teams, and data providers at large, are highly likely to succeed in implementing the Dubai Data Initiative.

- **Clear policies:**

  Detailed policies on protecting privacy, intellectual property rights, use and reuse of data, data classification and technical standards were devised by the Dubai Data Establishment to assist data providers in opening and sharing data. Previously, the absence of a clear framework that governs how data should be handled has hampered data publishing and sharing between data providers. With the clear definitions of rights, roles and responsibilities, those barriers to publishing and sharing data are eradicated and this added clarity should result in the robust opening and sharing of data in the future.

- **Adoption of common standards**

  Having common standards and processes enable well-defined interactions with the SDP and also ensure that Dubai Data is accessible, trusted, consumable and interoperable and that all data sets have appropriate access controls with proper authorizations. With common definitions and processes, data providers and platform operators can apply the same principles and reach an agreement regarding what data sets to publish as open data and what data sets to exchange between themselves and how to operate the citywide platform. Absence of common standards was a major challenge in the past.

- **Amplifying data value by opening up and sharing**

  Even though some opening and sharing practices currently exist in the Emirate of Dubai, the environment prior to the SDP and Dubai Data initiatives was generally characterized by monopolization and bartering of data and locking data within entities in closed platforms. By bringing the city data on one platform and engaging users and data scientists in mining this data, Smart Dubai expands the benefits of data to all stakeholders from students and researchers, to city planners, government officials, business owners and individuals.

- **Partnership building and smart financing**

  SDP has been implemented and financed through a PPP based approach. Building a PPP based partnership is a relatively novel capability compared to traditional public procurement. It requires sophisticated planning, contract negotiation and accounting and budgeting for contingent liabilities. It also requires a sound understanding and modelling of risks and rewards with clear accountability mechanisms.

  Public and private sector organizations' missions and raison d'etre tend to differ. Unifying a common mission and purpose for partners involved in a PPP which leads to a common vision for the partnership is quite critical. Leadership in partners play a crucial role during this visioning and alignment phase and sets the scene for a successful implementation.

  A unique well-defined framework and accounting standard does not exist for PPPs since they tend to vary in terms of arrangements based on project (e.g. short-to-medium term management contracts, outsourcing arrangements, Build-Operate-Transfer arrangements, joint ventures, etc.). The degree of ownership of assets and expenditures by partners also varies significantly depending on the type of PPP. Hence, it is important to agree on a viable PPP model early on by partners and to address issues around it.

  Consensus by partners on a business case and business model (cost benefit analysis, etc.), risk allocation, transparency on fiscal issues, and ensuring alignment on a public sector partner's delivery of its mission are essential for sustainable success. Technology and customer (demand) uncertainty are inherent in sophisticated citywide technology projects such as the SDP and need to be flexibly incorporated and addressed as part of the PPP agreement.

On the other hand, PPPs provide significant advantages by bringing together the best of both worlds (public and private sector) with each contributing significantly to the partnership. Different perspectives between public and private sector partners can be reconciled, leveraged and further capitalized as an advantage by a successful partnership. Innovative ideas can be jointly developed by partners to enhance the value for the ultimate customers by splitting the investments, revenues and risks.

Technology and demand uncertainty pose great opportunities, as well as challenges for the future. In the case of the SDP, there is ample opportunity for incorporating new services and functionality in the platform through innovation, albeit with certain risks. Hence, it will be quite important to balance rewards and risks in the future while innovating new services and functionality. Additionally, establishing and adopting an appropriate governance model will be key for sustaining the success of SDP.

- **Focus on knowledge and skills building**

  Ongoing training, workshops and awareness events are held to enhance platform services and data-related skills of government employees. Additional citywide awareness sessions, educational programmes and hackathons drive data usage and enhance the insights unlocked from data.

- **Recognize and award success**

  Awarding success and recognizing efforts are important for ensuring participants' continuous contribution and active involvement in these transformative initiatives. Data providers that contribute to the Dubai Data use cases, for example, are recognized and their efforts are highlighted at the highest levels of leadership in the Dubai Government. Compliance is driven by awarding the entities that engage with these initiatives and reporting high achievers to top leadership in the Emirate. Additionally, key performance indicators were infused in the Dubai Government level programmes and awards, to drive up participation of local government data providers in the initiative and to utilize citywide platform services.

- **Active communication, engagement and inclusiveness**

  Smart Dubai promotes extensive participation in both initiatives and the usage of Dubai Data by focusing on real use cases and policy problems in the city and demonstrating visual analytical findings to government entities. By showcasing how the platform and data publication and exchange can help solve real-life challenges that city planners face, city entities are more eager than ever to take part in these initiatives. Furthermore, there is ongoing communication about the progress of these initiatives and the activities conducted through direct and indirect channels.

- **Facilitating demand and supply**

  The value of the platform and the data in Dubai will be realized based on the quality of the supply of platform services and the open and shared data on it, and the demand from users. Without use and reuse of data, the value derived from opening and sharing data will be minimum. Smart Dubai and Dubai Data Establishment play a facilitation role in determining the priority list of platform services and data sets to be opened and shared with data providers. Needless investment in generating, opening and sharing data that are not conducive to value creation is avoided through a robust, collaborative, needs-based prioritization approach**.** Furthermore, efforts are taken to enhance the quality of platform services and the data supply making it reliable, discoverable and interoperable.

- **Innovation potential**

  Reliable platform services and rich city data are catalysts for innovation, opening new insights to government and business leaders to enhance existing operations and service delivery, identifying new areas of opportunity for growth from all sectors, and establishing a level playing field for entrepreneurs to discover, design and deliver new products and services addressing areas of unmet needs across the city. The Dubai Data Initiative has made efforts to enhance innovation through putting minimum restrictions on the use and reuse of open data through the open data license.

Additionally, to encourage the full exploitation of the value of open data, efforts are also taken to address concerns about quality, reliability and the lack thereof ongoing support through Dubai Data standards. The combined impact of insights unlocked by open and shared data, and the development of skill-sets to orchestrate and analyse data, will propel Dubai from a knowledge economy to an innovation economy, as individuals and entities take the leap from generating data to applying data for the benefit of all through the Smart Dubai Platform.

- **Measurement of impact:**

  From the inception of the Smart Dubai initiative, there was a strong drive to estimate and start measuring impact. Efforts are currently underway to estimate the social and economic impact of the SDP and opening and sharing of data, to develop logical models to determine the levers to achieve intended impacts, set a baseline and put appropriate measures in the future to rigorously measure and track the economic and social impacts of both initiatives. Robust methods and tracking mechanisms are being put in place to determine just how much value Dubai has generated from both initiatives.

  The sustainable growth and a steady momentum of the SDP and Dubai Data initiatives will be maintained in the next five years with plans to implement new services, and to release new data sets on the SDP and through active engagement with stakeholders. Both initiatives are sustainable in the long run since the innovation potential multiplies as more services and data become available. Both the public and private sectors will reap substantial benefits in planning, designing and developing new products, services and processes.

- **Transferability:**

  This unique experience of how Dubai is driving its smart and sustainable city initiatives, through establishing a citywide platform, data teams, unifying standards, collaborating with data providers, incentivising participation and tracking the impact, can be transferred to other cities. The particulars of some of those may vary based on each city context (e.g. specific policies and related direction setting statements, implementation specifics, etc.). However, the overall framework, processes and the issues identified in the SDP and Dubai Data initiative in terms of law, policies and standards, and skills building aspects are very much applicable to other cities which intend to undertake similar initiatives.

  The SDP as a concept and the PPP agreement as a framework are both transferable to other cities. Particular aspects of Dubai have determined the actual scope of services in the SDP; however, a good majority of these services would be applicable to other cities since they entail commonly needed aspects of IoT, data management, digital transformation needs, etc.

  The smart financing aspect of SDP is also easily expandable and transferable to other cities. The smart financing model through PPP identified various issues around the partnership model and incorporated a flexible framework addressing innovation in terms of platform and services expansion in the future with well-defined contributions from partners, as well as undertaking risks transparently. Hence, the particular context of Dubai played a relatively minor role, rendering transferability viable to other cities.

- **Scalability:**

  SDP and Dubai Data initiatives have both been defined and designed upfront to be scalable for future expansion both from a scope and also from a financing perspective. Technical flexibility has been incorporated into the design to accommodate future expansion and innovation at the city level. Similarly, various clauses have been incorporated by partners to scale up financing aspects of the platform in the face of increased demand from city entities and participants to address future sustainability. SDP has been designed to incorporate the projected massive growth in terms of city data from various providers. Similarly, the legal framework in terms of law, policies and standards also accommodate future concerns and growth of citywide data.

A References

Smart Dubai Platform Partnership Framework

Smart Dubai Platform Legal Agreement

Smart Dubai Platform Architecture and Blueprint

Smart Dubai Platform Scope of Work and Business Requirements

Smart Dubai Achievement Report 2014-2016

Dubai Data Strategy and Roadmap

Dubai Data Manual v 3.0 (December 2016)

Dubai Open and Shared Data Economic and Social Impact Study by KPMG and CS Transform (December 2016)

Dubai Data Compliance Framework

Dubai Data Access Permission Management Framework

Dubai Data Competency Framework

Dubai Data Primary Registries

B List of discussion partners/interviews

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Goal 12:
Responsible Consumption and Production – Smart Tourism

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Table of Contents

1 Introduction

1.1 Background

On the face of it, Sustainable Development Goal (SDG) 12 only seems to refer to ensuring sustainable consumption and production patterns. However, delving into its associated targets, one realizes that the concept of sustainable tourism to promote local culture and support sustainable development also forms an integral part of this global goal.

The term "smart" has been affixed to several concepts including smart cities and smart buildings. In recent years, information and communication technology (ICT) related tourism services and platforms have made their way into the tourism sector and paved the way for easier travel in terms of the planning and management of trips along with monitoring the local environment. This integration of ICT for tourism purposes has led to the creation of "smart tourism", which relies on human-computer interactions that aid in decision making for tourists and information processing for smooth service delivery within the sector.

Globally, there have been efforts to drive the smart tourism agenda forward. Countries like China and South Korea are heavily funding initiatives on building the technological infrastructure to support smart tourism. In several European countries, the respective smart tourism initiatives evolved out of smart-city projects. As a result of this, the idea of smart destinations (based on smart tourism) is gaining ground and popularity in the global tourism landscape.

1.2 Challenge and response

While some smart tourism initiatives focus on driving innovation and competitiveness and developing smart end-user applications that enrich tourism experiences for travellers, others focus on the transformative power of ICTs in improving the economic potential and environmental conservation dimensions for the tourism and hospitality sectors. Given the different approaches to the concept of smart tourism, there is no universal or standardized definition for this term.

For a general concept of tourism, the United Nations World Tourism Organization has provided a definition. This definition refers to tourism as a "cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes".

With the incorporation of ICTs into various tourism-related activities, smart tourism has been regarded as a logical progression from traditional tourism concepts in keeping with the technological evolution. The smart tourism technologies (STTs) implemented are able to collect and harness data from physical infrastructures and portable devices to transform travel experiences by providing an effective feedback mechanism and promoting destinations via different channels including social media.

The most commonly used STTs are smartphone applications and websites of travel agencies and destinations. These STTs are able to assist with the planning process by providing relevant information on the destination in an interactive manner and therefore help with the decision-making process. Armed with adequate information on the culture, terrain and recreational activities at their desired destination, users will be able make an informed decision which will allow for a better experience. Users can also estimate the overall travel and sightseeing costs using STTs, which will reduce the chances of incurring unforeseen additional expenses when at the destination.

One example of a successful online tourism portal is for the state of Kerala in India. The government of Kerala struck gold with the launch of its tourism website, Kerala Tourism.org.

This official website has the largest database on Kerala, which contains detailed information on the places to visit and highlights the cultural practices in each region. It also provides a list of centres for recreational activities, hotels and restaurants which reduces the scope for fraud and improves security. This site boasts of nearly 3 million visits per annum and has significantly boosted Kerala's tourism. The number of tourists in

Kerala rose to 13.6 million in 2016, which has significantly boosted employment in the tourism sector and has facilitated the expansion and increased use of STTs for Kerala bookings.

Other cities like Barcelona offer more "on the go conveniences" for travellers like interactive bus shelters that not only provide touristic information and bus arrival times but also have USB charging stations for mobile devices. Other examples include the city of Amsterdam, which uses beacons to let tourist signs translate themselves into different languages and Seoul which provides free Wi-Fi, as well as smart phones to tourists.

Despite such success stories, there are still no concerted efforts to develop a global framework for smart tourism. While it is understandable that different cities, regions and countries may have varying requirements, considering the differing perspectives on this concept, it is essential to develop a generic framework, as well as an internationally accepted definition, for smart tourism which will help derive an in-depth understanding of the concept and also help cater to regional requirements in this area.

2 Vision

With smart tourism, the tourism sector has entered the digital playing field. Keeping in mind the various perspectives on smart tourism, this concept is found to have three components which are supported by ICTs (See Figure 12-1):

- Smart experience: refers to the technology mediated/propelled tourism experiences.
- Smart destinations: refer mostly to aspiring smart cities which not only take into consideration the requirements of its inhabitants but also strive to assist with mobility, resource availability and allocation, sustainability and quality of life for tourists during their stay.
- Smart business: refers to the socio-economic ecosystem that generates and supports the exchange of touristic resources for an enhanced tourism experience, based on dynamically interconnected stakeholders, who have digitalized their core business processes.

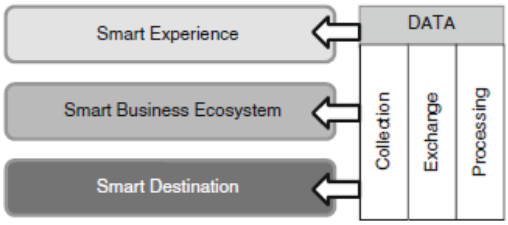

Figure 12-1 – Components of smart tourism
(from Smart tourism: foundations and developments, June 2015)

3 Conclusions

Based on the three components; smart experience, smart destination and smart business, it is feasible to develop a definition for smart tourism which will be acceptable globally. Standards developing organizations (SDOs) like ITU, which have expertise in this field, can be called upon to explore this term further, through their ITU-T Study Group 20 on Internet of Things and Smart Cities and Communities.

As mentioned, several smart tourism initiatives are already underway. Most of these initiatives are aimed at socio-economic convenience and benefits for the tourism industry and tourists themselves; however, not many of these initiatives include limiting the habitat destruction induced by tourism-related activities. This important aspect of environmental conservation should not be omitted from the concept of smart tourism. It is important to understand that without environmental conservation, there may be no place for tourism at all. Adequate incorporation of the environmental dimension (along with the other three components) into

smart tourism, will allow for this concept to have far-reaching positive consequences on the attainment of SDG 12 (with reference to its sustainable tourism target).

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Goal 13:

Climate Action – Creating Climate Smart Cities: The Case of Scotland

13 CLIMATE ACTION

Table of Contents

1 Introduction

1.1 Background

As Sustainable Development Goal (SDG) 13, urges all concerned to "take urgent action to combat climate change and its impacts", urban areas are increasingly being deemed the battleground locations for tackling climate change. Climate change is without a doubt one of the major environmental concerns for cities, since more than half of the world's population live in cities. Additionally, cities are also responsible for nearly 70% of the global energy consumption and greenhouse gas (GHG) emissions, which are the main factors causing climate change.

Realizing this, countries are progressing towards adopting urban governance strategies which address climate change. Efforts to institutionalize climate-change governance in urban areas indicate that cities have gained traction in climate policies. With cities being hubs of innovation and technological revolution, there has been significant debate on the use of information and communication technologies (ICTs) for dealing with the grave issue of climate change.

1.2 Response

Whilst cities are not perfectly functioning machines, they cannot also be considered a mixture of several random ecosystems driven by human actions either. It is important to understand that cities are capable of polluting as much as they have the ability to conserve and develop.

While it has been acknowledged that cities can play a pivotal role in tackling climate change, the actual pathway for such change is still to be effectively determined. Several countries and cities have taken a leap forward and incorporated legislation and guidelines which support these activities. These guidelines and legislation are based on the role of cities as drivers of technological innovation. Urban stakeholders will collectively bring about the practical implementation of these technological innovations, scale, recognize gaps and aim to reduce carbon emissions overall.

In line with the above, this case study will explore the initiatives adopted in Scotland to deal with climate change and reduce the carbon footprint.

2 Vision and implementation

Scotland has adopted the "Public Sector Green ICT Strategy" and "Low Carbon Economic Strategy" to support ICTs deployment in their public organizations in an energy efficient manner, with the overall aim of reducing the carbon footprint of these organizations. The term "Green ICTs" in this case is used with refer to ICTs which are utilized for climate change adaptation and/or. Accordingly, these Green ICTs aim to reduce emissions, improve energy efficiency and other waste produce throughout the ICT lifecycle.

Within Scotland's public sector, the services offered are exclusively underpinned by ICTs. Keeping in mind the potential of Green ICTs, this extensive usage of ICTs in Scotland offers potential to contribute to a greener environment by reducing waste and emissions.

Scotland's Green ICT strategy also recognizes that ICTs can be a double-edged sword when it comes to environmental issues. On the one hand, ICTs could generate significant greenhouse gas emissions and on the other hand it can function as a key enabler for the generation of renewable energy, provision of urban services and monitoring of greenhouse gas emissions.

In addition to the Green ICT strategy, Scotland, through the Smart Cities Strategic Intervention has been allocated 10 million pounds to make the cities in the region more energy efficient and environmentally friendly, using innovative technologies. Glasgow City Council is the leading partner in this smart-city intervention. The Scottish Government and Glasgow City Council will be working together with the Scottish Cities Alliance with the support of other cities including Aberdeen, Dundee, Edinburgh, Inverness, Perth and Stirling, to further the Scottish smart-city agenda. Within this agenda, Scotland aims to:

- become smart with sustainable economies;
- be hailed as a healthy, innovative and resourceful place to live and work;
- utilize innovative ICTs to reduce the carbon dioxide (and other greenhouse gas) emissions;
- introduce smart mobility planning within Scotland to reduce traffic congestion within Scottish cities;
- facilitate civic engagement through ICTs and social media platforms;
- implement smart metering and smart grids to improve energy efficiency;
- devize frameworks to boost investment and funding to create opportunities to test and implement smart-city solutions within Scottish cities;
- transition to a circular economy to effectively manage the flow of resources between partner cities and promote recycling;
- introduce e-health technology services.

The main national programmes associated with the delivery of these objectives are referred to as "Pathfinder Programmes" which serve as the foundation for collaborative efforts between the Scottish cities.

Some of the pathfinder programmes are given in Table 13-1.

Table 13-1 – Pathfinder programmes to achieve the smart-city goals in Scotland

Pathfinder Programme	Function(s)
Code for Scotland	This pathfinder programme will help to transition from the generic passive provision of data to platforms for active engagement, which can identify and create feasible smart-city solutions. Collaboration of Scottish cities within this programme will enable the standardization and interoperability between smart-city solutions.
MaaS Scotland	This pathfinder programme aims to offer tailor-made mobility solutions based on innovative technologies for the benefits of consumers. This entails delivering affordable transport options to residents.
Circular Economy	This pathfinder programme aims to decouple economic growth for resource consumption and transition to a low carbon economy.
Sharing & Learning Platform	The development of a "Sharing & Learning Platform" is suggested to enable knowledge sharing and information exchange between Scottish cities to share smart-city experiences and explore funding and best practices.
Smart and Healthy Living	This pathfinder programme aims to establish a nationwide test-bed for implementing innovations in the area of health and overall wellbeing of their citizens. This includes the deployment of remote monitoring systems, introducing assistive technologies and supporting independent living along with community cohesion.

Working together and in keeping with the overall smart-city agenda, the Scottish cities aim to create a smart ecosystem and deliver services to meet the needs of their citizens and enhance their overall quality of life. Scotland's smart-city agenda will help overcome the major socio-economic challenges and help the region transition into a smart and sustainable entity, keeping in mind the importance of the environment in the urban ecosystem. These activities will also help set the benchmark for such future endeavours.

3 Conclusions

Scotland has adopted a unique region-wide network model for smart and sustainable cities, which when coupled with their Green ICT strategy, caters to both the concepts of 'low-carbon cities' and 'smart cities'. This model is essentially co-designed with Scottish residents, to support the scale-up, commercialization and export of feasible and successful smart city and green ICT solutions implemented in Scotland.

Overall Scotland's smart-city agenda and Green ICT strategy is expected to boost the global profile of cities in the region, attract investments, foster environmental protection against climate change, facilitate knowledge transfer and protect vulnerable sections of society.

This has paved the way for a new form of urban development, which will present the urban ecosystem with a certain regenerative capacity and policies to mitigate the effects of climate change and progress towards SDG 13.

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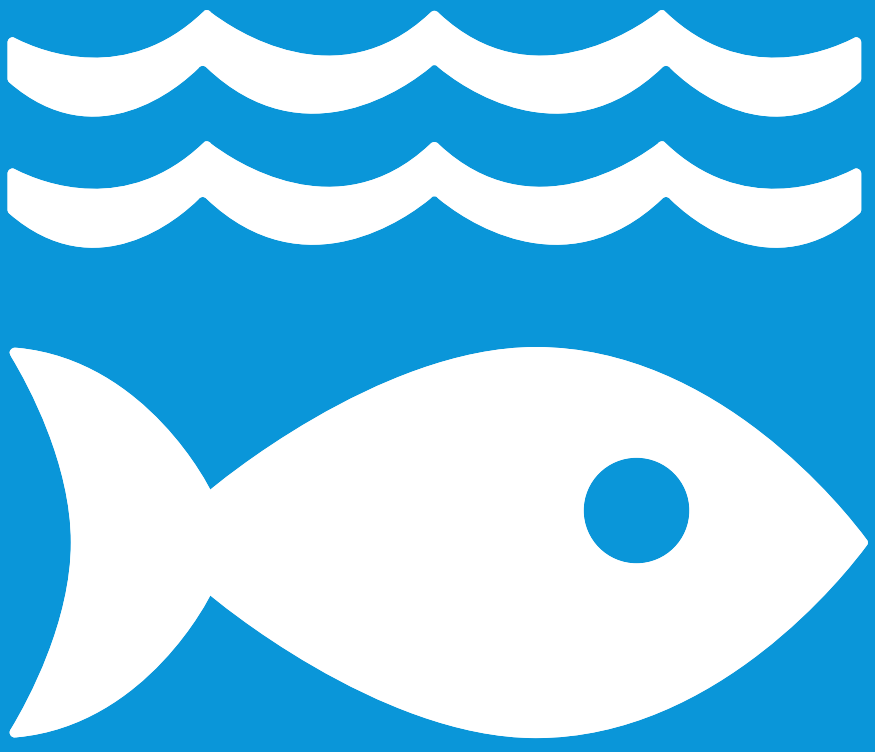
CO2

Goal 14:

Life Below Water - Protecting Life Below Water: The Global Fishing Watch Platform

14 LIFE BELOW WATER



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1 Introduction

1.1 Background

More than 70% of the Earth's surface is covered by oceans. These oceans are rich in biodiversity and also are a treasure trove of minerals. It has been estimated that phytoplankton in the oceans produce over half the oxygen that land animals, including humans, breathe. Therefore, these oceans along with forests serve as oxygen producers and reservoirs for the world[46]. Millions of people also heavily depend on oceans for their livelihoods and engage in activities like fishing. Oceans also function as carbon sinks and can currently take up about 25 % of annual anthropogenic carbon emissions released into the atmosphere.[47]

The significant increase in human activities impacting oceans over the past few decades has diminished their potential to compensate for the increased emissions. Water bodies are now faced with a number of challenges including the endangering of marine biodiversity, habitat destruction, coral reef depletion, overfishing and pollution.

In line with the above, the United Nations Member States adopted the new Sustainable Development Goal (SDG) 14 on "Life below water"[48]. Introduction of this goal is known to be a major turning point for marine conservation as it was distinctly brought to the global centre stage for the first time. Thus, incorporation of this goal has generated visibility and reaffirmed political commitment for the protection of the oceans.

Following the adoption of SDG 14, humans are moving towards a more sustainable use of the oceans and significant progress has already being made in this regard.

As with the conservation and monitoring of biodiversity on land, information and communication technologies (ICTs) can also assist in oceanic conservation and promote sustainability in this area. In this regard, satellite monitoring, sensors and wave instrumentation are known to have the ability to collect accurate data for oceans, which can then be used to analyse aquatic biodiversity and pollution and help to tackle problems like overfishing.

1.2 Challenge and response

It is important to recognize that as with most resources on Earth, biodiversity in the oceans is also finite. This implies that it is essential to identify and acknowledge oceanic boundaries and factor them into human activities.

Humans continue to threaten the oceans through overfishing, conducting illegal fishing which in turn can affect foods chains and even cause habitat destruction. Maintaining marine sustainability heavily depends on the monitoring of fisheries and further actions taken by relevant international and national stakeholders along with the fishing industry.

It was in response to the need for a monitoring system for aquatic life that the Global Fishing Watch platform was launched.

2 The project

2.1 Vision

The Global Fishing Watch platform was launched by Google, Oceana and Skytruth. This online technological platform allows anyone with an Internet connection to track and monitor commercial fishing activities in near-real time.

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[46] Sustainable Use of Our Oceans –Making Ideas Work, 2015.

[47] The ocean carbon sink – impacts, vulnerabilities and challenges. Earth System Dynamics, June 2015.

[48] "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

Thus, the Global Fishing Watch platform covers an area which had been hitherto untapped, by providing regulators with an effective monitoring tool that can help curb overfishing, rebuild fish stocks and protect aquatic life.

2.2 Possible outcomes of wide-scale utilization

The Global Fishing Watch platform is programmed to use public broadcast data from the Automatic Identification System (AIS) collected by satellite and terrestrial receivers. This enables the tracking of the actions of commercial vessels as it occurs. Global Fishing Watch uses the information collected to monitor vessel movement and classify activities as "fishing" or "non-fishing".

Currently, the Global Fishing Watch is able to depict the fishing activity of approximately 35 000 commercial fishing vessels functioning throughout the world's oceans. This platform is the first of its kind to bring such information into the public limelight, which in turn will allow regulators to hold the fishing industry accountable for any overfishing lapses. This platform is also expected to help the fishing industry understand the impact of their activities and conduct sustainable fishing operations, and also to assist relevant enforcement agencies to phase out illegal fishing in due course.

3 Conclusions

The Global Fishing Watch platform is expected to reform commercial fishing norms, while helping to identify irregularities, track dubious fishing activities and reduce seafood fraud.

Countries like Indonesia have already committed to registering their fishing vessels with trackers to make them visible through the platform. This is expected to improve transparency of the Indonesian fishing industry and will allow customers to ascertain whether their seafood had been legally harvested.

Global Fishing Watch is touted to be a game-changer not only for the fishing industry but also for governments, international agencies and other stakeholders, who are responsible for setting the guidelines and regulatory frameworks for fisheries. This technology is also expected to assist the international communities in the achievement of SDG 14 by providing a transparent and innovative tool for effective surveillance on fishing activities and thereby protecting precious life below water.

A References

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Goal 15:
Life on Land – Monitoring of Animals

15 LIFE ON LAND

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1 Introduction

1.1 Background

The vulnerability faced by animals and other terrestrial species is unquestionable. The expanding urban terrain has highlighted the need for the protection of all species living in cities, as well as for those at the brink of bearing the effects of human civilization.

As humans are further encroaching on many forest areas, many species find themselves to be at the mercy of human activities. This has resulted in the fragmentation of natural habitats and put animals in the danger of road accidents, poaching and other mishaps.

The rise in these incidences goes against Sustainable Development Goal (SDG) 15 which strives to ensure the conservation and sustainable use of terrestrial land and forests along with the prevention of loss of biodiversity.

This case study presents an overview of a study on wildlife monitoring conducted by the China Academy of Transportation Sciences and Changbai Mountain Academy of Sciences. This case study will also examine other technologies which can be used for animal protection and nature conservation.

1.2 Challenge and response

The Changbai Mountain National Nature Reserve is located in the Jilin province of north-east China. More than 1225 fauna species are found in this region. Nearly 4% of the species in this region have been declared protected species including the sable, Siberian roe deer, and Siberian weasel. Amur tigers are also found here.

There is a fenced four-way expressway called JiYan expressway. This expressway bisects two national nature reserves, namely the Changbai Mountain Nature Reserve and the Wangqing Nature Reserve. Between these reserves and along the expressway, certain wildlife-crossing structures have been built to allow for the movement of wildlife.

The study in China on which this document is based, is the first of its kind to monitor wildlife movements through a tunnel along the expressway using infrared camera surveillance technology in China.

Given the evident encroachment into wildlife areas, this case study based on the findings of the pilot project in the Changbai Mountain National reserve, aims to analyse the plausible deterrents for animals not using the crossing structures and will highlight other technologies which can be used to safeguard animals.

2 Implementation

For this pilot project, infrared cameras were set at equal distances apart along the tunnel and other crossing structures.

These cameras were put up from between the following time periods:

(i) 16 September to 15 December, 2011

(ii) 10 May to 26 July, 2012

(iii) 30 April to 11 December, 2013

In order to increase the chances of detecting wildlife, the cameras were installed at the known locations of animal sightings. Some cameras were put on trees at a height of 0.5m to be able to gather high resolution photos of both medium and large wildlife species. Appropriate changes to camera angles were made based on weather changes including snow and other foreseen obstructions.

The data from this project was collected and recorded in a Microsoft Excel spreadsheet for later reference.

2.1 Results

From the results of the pilot project, it was noted that the tunnels and other crossing structures are utilized by wildlife. These structures were initially built for water drainage and for the benefit of residents in the area. The incidence of species was deciphered based on its relative abundance index (RAI). The Siberian roe deer and wild boar were found to have the highest RAI crossing structures fitted with cameras.

2.2 Other technologies

TRACKING PET ANIMALS IN ASPIRING SMART CITIES

While wildlife monitoring and regulation remains to be a matter of concern under SDG15, the scenario for pet animals in aspiring is not very promising. It is noted that traditional animal identification in many cases do not provide the adequate security and regulatory system for tracking. To date, there is no official database or identification systems in place for tracking pet animals in cities which are in the process of transitioning to a smart city.

As such, methods like ear-tagging, freeze-branding, ear-tattoos, ear-tipping, embedding microchips in the body of pet animals (for identification purposes) do exist. However, these methods do not provide a very high assurance of protection against theft or loss as these microchips, ear-tags, tattoos can be easily replicated.

In keeping with these shortcomings, the Indian Institute of Technology (IIT) Varanasi has proposed a low-cost system (with no extra hardware) for monitoring of dogs based on their primary animal biometric identifiers. This recognition system is able to identify dogs based on their biometric facial features. This system if implemented will be non-invasive and humane and can help monitor pet animals in urban areas in real time. This system is expected to have a 96.87% recognition rate among the dogs whose biometric details were fed into the system.

One drawback of this system, as also acknowledged by the researchers at IIT-Varanasi, is that this system has not been tested on the real data of dogs captured from the surveillance cameras, which can eventually help detect loss or theft.

Future research in this area in IIT-Varanasi is expected to entail identification and verification of individual pet animals in real time scenario, along with development of mobile apps and intelligent pet care and verification systems based on IoT.

If this path-breaking system kicks-off and is successfully implemented in urban areas, it could also pave the way for similar systems to be put into place for wildlife species too which can help control problems including land encroachment and hunting.

Source: Kumar.S, Kumar Singh. S. Monitoring of pet animal in smart cities using animal biometrics. Department of Computer Science & Engineering, Indian Institute of Technology. Future Generation Computer Systems. 2016

WILDLIFE ENFORCEMENT MONITORING SYSTEM

Wildlife Enforcement Monitoring Systems (WEMS), developed by the United Nations University (UNU), is a web-based model for the collection, compilation, and analysis of data linked to wildlife monitoring and protection. This system is intended to serve as a common mechanism to ensure prevention of wildlife crimes and promote regulation of wildlife at the national, regional and global levels. One of the key aims of WEMS is to monitor compliance with international legislations on wildlife conservation.

WEMS facilitates sharing information on enforcement and compliance to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It is also known to assist with the implementation of other multilateral environmental agreements (MEAs) for trans-boundary information sharing is required.

If effectively implemented, WEMS can curb hunting and illegal trafficking of endangered species of both flora and fauna and thereby dismantle the growing black-market for wildlife goods and protect the wildlife ecosystem.

Source: Wildlife Enforcement Monitoring System. Retrieved 16 February 2017 from http://www.wems-initiative.org/ .

3 Conclusion

As these structures are used seamlessly by certain species, it is advisable to build more such passages for this purpose. More consistent monitoring of all crossing structures may help provide further insight into species' movements between the reserves.

Additionally, given the increasing traffic in these areas, it is advised to build fences surround the bridges and culverts which will help guide species and prevent them from becoming victims of road accidents.

Similar pilot projects in other places, as well as Changbai areas, can be conducted to monitor wildlife populations and also help reduce the illegal hunting of endangered species. These pilot projects can be exclusively linked to WEMS to ensure global awareness on the situation.

It is acknowledged that as the number of multilateral environmental agreements is on the increase, national governments are finding it difficult to keep track of and implement even the basic guidelines in the MEAs. This makes information collection and flow to international environmental repositories inconvenient. To overcome such challenges, countries should strive to enforce the MEAs to which they are party and promote the international adoption of WEMS, with the support of concerned international agencies involved in the monitoring of enforcement and compliance to MEAs.

A References

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Goal 16:

Peace, Justice and Strong Institutions – Improving Participation and Accountability in India: MyGov Platform

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

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1 Introduction

1.1 Background

India has launched its 100 smart city mission in 2015. This initiative strives to make 100 cities across the country more sustainable using technology. Within this initiative, India also plans to make their cities more citizen-centric. The MyGov (https://www.mygov.in/) portal was created for this purpose. This portal has proved to be a very effective tool in people's participation in governance. For a country of the size of India, with 1.25 billion people, with diverse backgrounds, this portal is quite a success as can be seen from the number of engagements on the site itself. In this sense, this portal assists with the achievement of Sustainable Development Goal (SDG) 16[49].

India has a large number of cities with a population above 1 million. Ensuring that the government involves people in the process of governance in a democratic setup, this type of portal seems to be quite an effective way forward. This model can be replicated at the city level for local governance for smart sustainable cities.

In a city like New Delhi, which happens to be the capital of the largest democracy in the world, an influx from other parts of the country is imperative. As New Delhi has been expanding due to its increasing population, the infrastructure has come under tremendous pressure. Designation of the National Capital Region, allows for adjoining cities to share the population burden of the capital. However, with the passage of time, even these adjoining cities have come to face similar challenges vis-à-vis population growth.

1.2 Challenge and response

The challenge in a developing economy like India is to meet the aspirations of the 1.25 billion people with a population of more than 800 million people below the age of 35. Being a democracy, getting feedback from the stakeholders, improving accountability and taking corrective or preventive action, as needed, is essential.

More than 400 million people live in cities, and the number of cities in India with a population of more than 5 million is more than 100. Getting citizens' participation in the governance of the cities would make the cities more accountable and easy to receive feedback on services through portals of this kind. As such the MyGov portal is able to ensure that the genuine suggestions are honoured and implemented. The feedback mechanism on this portal is also able to foster reliability within the urban governance structure.

2 The project(s)

2.1 Vision and content

The vision behind the setting up of this portal is to translate the aspirations of the majority of citizens in a city into implementable projects and programmes, and to also obtain feedback from citizens about the projects and programmes since their implementation, as envisioned in SDG 17[50].

The portal has got more than 50 open groups for facilitating discussions including:

- Smart Cities
- Consumer Protection
- Human Resource Development
- Disaster Management
- Skill Development

[49] Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

[50] Strengthen the means of implementation and revitalize the global partnership for sustainable development

- Digital India
- Energy Conservation
- Education
- Health
- Watershed Management

There is a provision for

- activities under the 'Do' tab
- discussions
- polls and surveys
- blogs
- talks.

The portal also has a provision for creating polls and surveys for gathering opinions and data on relevant issues.

The MyGov portal can be accessed via the Internet and through apps specifically launched by the government.

2.2 Implementation

The portal was put up by the Government of India, and the various stakeholders have adopted the policy of openness for future decision-making processes for the activities under the MyGov umbrella.

A number of stakeholders are involved in the functioning and maintenance of the portal, including various government departments, the residents welfare associations, and the citizens.

The key factors behind the success of this initiative are:

- **Leadership**

The Prime Minister, Mr. Narendra Modi himself is involved with the MyGov portal, which improves the credibility of this portal and motivates the citizens to also post their views with the expectation that their feedback will be taken into account.

- **Dedicated involvement** (within the city and across levels of government)

Many of the ministries of the government involved in governance and providing various amenities to the citizens are proactively involved in the activities highlighted in the portal and therefore, these ministries consistently receive feedback from the MyGov portal.

- **Increased participation** (partnership; private involvement; citizen involvement; project management)

Citizens are encouraged to join the MyGov portal in order to be fully involved in the governance process of their city. This includes the involvement in the activities of the residents welfare associations of various parts of the city.

- **Improved communication** (internal and external, branding)

Citizens are provided the option of registering themselves on the MyGov portal. These registered citizens receive regular queries on various issues pertaining to urban services etc. Citizens are encouraged to put forth their views; this facilitates an effective and self-sustaining feedback loop.

- **Use of ICTs**

The MyGov platform is well engaged. This indicates the widespread use of the Internet and other ICT-based services and devices to access this site.

2.3 Results

The Government of India's solution to launch the MyGov portal turned out to be a path-breaking move for a developing country like India.

The MyGov portal is certainly *sustainable*. This portal is expected to become a benchmark for future governance systems, wherein the government can receive direct feedback from their citizens. It is still early days for the MyGov portal and it is not possible to deem this portal a major success. Given the large-scale involvement of citizens in this portal, a transparent system needs to be put into place to ensure that the feedback received is adequately taken into account and acted upon within a defined time frame to prevent delays.

In the coming years, if this portal is able increase the current rate of engagement on the site, a similar model could be implemented in other developing countries to improve accountability and action, in view of SDG 17.

3 Conclusions

Based on the positive response to the MyGov portal, it is acknowledged that citizens can be actively involved in the decision-making process for making cities dynamically respond to the needs of the citizens and aim for sustainability. As can be deduced from the results of this case study, it is possible to get citizens more involved in governance.

The critical success factors have been the leadership at the government level, along with the involvement of the youth in the process of interacting with the various stakeholders in the government.

The challenges are that in developing nations like India, there is a good section of the population, who are not literate could have a problem in making use of this portal, though there is a feature for audio contribution in the regional languages.

It is easily possible to replicate this concept at the city level and import it to other countries which are looking to improve participatory governance.

Given the amount of frugal resources required for implementation at the city level, this project is easily scalable.

A References

MyGov Portal. https://**mygov.in** (accessed 10 January 2017)


GOVERNANCE


U4SSC

Goal 17:
Partnerships for the Goals – United for Smart Sustainable Cities

17 PARTNERSHIPS FOR THE GOALS

Table of Contents

1 Introduction

1.1 Challenge and response

Since the end of the last decade, nearly 50 percent of the world's population has been living in urban areas. Urban populations have been projected to constitute 66 percent of the global population by 2050. With its increasing populations, cities are being recognized as growth hubs, which can unlock economic potential and empower citizens with the capability to drive sustainable urbanization.

Recent urbanization trends revolve around making cities energy efficient and eco-friendly. Many cities are also climbing on the smart-city bandwagon to facilitate the adoption of technologies such as smart grids and Internet of Things (IoT).

Despite such efforts for smart and sustainable urban transitions, there was no global platform to facilitate discussions on successful smart sustainable city ventures and support their replication. The United for Smart Sustainable Cities (U4SSC) initiative was created by the ITU and UNECE to fill this void and provide international visibility to successful smart and sustainable city measures and highlight best practices and guidelines which can be adopted across the world.

Keeping in mind the catalytic role of ICTs in enabling the transition to smart sustainable cities, this initiative will also assist with the attainment of Sustainable Development Goal (SDG) 11 to "Make cities and human settlements inclusive, safe, resilient and sustainable". Given the large-scale cooperation for smart sustainable cities within U4SSC, this initiative also caters to SDG 17 to "strengthen the means of implementation and revitalize the global partnership for sustainable development".

Within the umbrella of the U4SSC, ITU and UNECE have also created an Advisory Board for Smart Sustainable Cities. This Advisory bBoard is tasked with the responsibility of refining the existing key performance indicators (KPIs) for smart sustainable cities developed by ITU and UNECE. Members of the aAdvisory Board comprise city representatives, United Nations officials, associates from NGOs, ministry officials, as well as participants from academia. Following the revision of the KPIs, the Advisory Board will develop a Global Smart Sustainable City Index, based on pilot projects conducted by its member organizations. The refined KPIs will also be submitted to ITU-T Study Group 20 on IoT and Smart Cities and Communities for facilitating its approval as an international standard.

The U4SSC is supported by 16 United Nations agencies and programmes including ITU, UNECE, United Nations Industrial Development Organization (UNIDO), Economic Commission for Latin America and the Caribbean (ECLAC), Food and Agriculture Organization (FAO), Secretariat of United Nations Framework Convention on Climate Change (UNFCCC), World Meteorological Organization (WMO), UN Women, United Nations Environment Programme (UNEP), UNEP Finance Initiative (UNEP-FI), World Trade Organization (WTO), Secretariat of United Nations Convention to Combat Desertification (UNCCD), United Nations University-Institute for the Advanced Study of Sustainability (UNU-IAS), UN-Habitat, United Nations Economic Commission for Africa and the Secretariat of Convention on Biological Diversity.

2 Implementation

The U4SSC management team includes two co-chairs and two vice-chairs. The work of the U4SSC is carried out by designated leaders who are given charge of specific areas of work and deliverables. The leaders are appointed by the two vice-chairs who are responsible for the overall development and implementation of the U4SSC Action Plan.

The first U4SSC meeting was held on 21-22 July 2016 in Geneva, Switzerland. This meeting was attended by over 150 global smart-city experts.

During this meeting, the terms of reference and the vision of the U4SSC were approved. Participants to this meeting also helped to define the future action plan for the first phase of U4SSC.

The first year of work of the U4SSC lasted from May 2016 to March 2017 and concluded with the development of a number of deliverables.

The second U4SSC meeting was held in Manizales, Colombia on 5 April, during the Green Standards Week 2017. This meeting set the new U4SSC vision and action plan for the upcoming year.

U4SSC is working on the following deliverables:

1. Guidelines on tools and mechanisms to finance SSC project
2. Guidelines on strategies for circular cities
3. City science application framework
4. Guiding principles for artificial intelligence in cities
5. Blockchain 4 cities
6. Toolkit for Smart Sustainable Cities

Each deliverable is expected to be prepared in one year. E-meetings to discuss progress on each deliverable will be held regularly.

2.1 Results

During the first year of activity, several output documents were developed based on existing smart city and sustainable development activities. Given the rising importance of the SDGs, some of these documents were produced in view of one specific SDG. The deliverables generated by U4SSC in the first year of its existence, have been collected in three different publications.

3 Conclusion

The U4SSC members have done commendable work in identifying and presenting feasible policies, measures and guidelines for smart and sustainable city transitions. The flipbooks developed by the U4SSC will be used as the basis to derive the best practices for establishing smart cities and submitting new contributions to ITU-T SG20 on Internet of Things and Smart Cities and Communities, with the expectation that they will eventually be approved as international standards by ITU[51].

A References

United for Smart Sustainable Cities.
https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx (accessed on 18 February 2017)

[51] In addition to its role as the UN agency for ICTs, ITU also serves as an international standards developing organization


U4SSC

MAPPING U4SSC PRODUCTS TO THE SDGS

3

This section presents the preliminary mapping scheme of the SDGs to the current U4SSC products and case studies. Table 1 provides an overview of some of the SDGs touched upon by the U4SSC case studies.[52] Based on this mapping, U4SSC will derive the best practices and policies to propel the transition to smart cities and achieve the SDGs during its second year.

Table 1 – Mapping the U4SSC products to the Sustainable Development Goals

Product/ Case study title	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Green bonds for cities	√								√				√				
Aquaponics as innovative urban agriculture: The case of the GrowUp Box		√	√			√			√			√					
Managing HIV in children: The case of Kenya			√						√	√						√	√
Mohammed Bin Rashid Smart Learning Program				√					√								√
Digital Literacy Campaign	√				√				√	√	√						√
Smart water management: SmartH2O project						√					√						√
Smart grid solutions: The case of PowerMatching City							√		√		√						√
E-banking services: The case of Pakistan								√	√	√						√	√
Smart mobility: The case of Ahmedabad							√		√		√	√					√
Pan-African e-Network Programme			√						√	√	√						√
Smart Dubai Platform and Dubai Data initiative					√				√	√	√					√	√
Smart tourism								√	√		√	√	√	√	√	√	√
Creating climate smart cities: The case of Scotland			√						√		√		√		√		√
Protecting life below water: The Global Fishing Watch platform									√			√		√		√	√
Monitoring of animals using ICTs									√		√				√	√	√
Improving participation and accountability: MyGov Portal									√		√					√	√
United for Smart Sustainable Cities	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

[52] Please note that this table is not exhaustive and is meant for informational purposes only. This table intends to provide an understanding that the case studies included in this flipbook need not address just one SDG and could also cover various other areas and targets stipulated within other SDGs.

MAPPING U4SSC PRODUCTS TO OTHER RELEVANT INTERNATIONAL AGREEMENTS AND CONVENTIONS

4

This section presents a preliminary mapping of the U4SSC products and case studies to the existing international conventions, agreements, resolutions and targets. Specific case studies highlighting the implementation of the existing international instruments shown in Table 2 are expected to be expanded on during the second year of U4SSC.

Table 2 – Mapping the U4SSC products to existing international agreements and conventions

Product/ Case study title	Connect 2020 Agenda	New Urban Agenda	Paris Agreement	WTSA
Green bonds for cities		√	√	
Aquaponics as innovative urban agriculture: The case of the GrowUp Box			√	
Managing HIV in children: The case of Kenya	√	√		√
Mohammed Bin Rashid Smart Learning Program	√	√		√
Digital Literacy Campaign	√	√		√
Smart water management: SmartH2O project	√		√	
Smart grid solutions: The case of PowerMatching City	√			√
E-banking services: The case of Pakistan	√	√		√
Smart mobility: The case of Ahmedabad	√	√		√
Pan-African e-Network Programme	√			√
Smart Dubai Platform and Dubai Data initiative	√			√
Smart tourism	√	√	√	√
Creating climate smart cities: The case of Scotland	√	√	√	√
Protecting life below water: The Global Fishing Watch platform	√			√
Monitoring of animals using ICTs	√			
Improving participation and accountability in India: MyGov Portal	√			√
United for Smart Sustainable Cities	√	√	√	√

5 CONCLUSIONS

Conclusions

The large-scale involvement within the U4SSC has helped this initiative to fulfil its promise of being an effective platform to promote smart-city best practices and support smart-city transitions.

As a result of its successful year of work, U4SSC has collected 17 case studies, which have been included in this flipbook. In keeping with the importance of the SDGs and the rising concerns of countries regarding whether they may be able to attain these through urban governance measures, this flipbook has provided examples that are relevant for each goal within the SDG framework.

Global smart-city leaders all over the world are being encouraged to favourably support the work of the U4SSC and contribute at all levels to this important effort aimed at a better future.

Teamwork
30%

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ISBN: 978-92-61-25371-4

Published in Switzerland
Geneva, 2017