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Smart City | Smart Nation
Client stories in action

Amman

Data-driven approach to waste management in Amman

Between 2004 and 2015, Amman's population more than doubled from approximately 2 to over 4 million[i], thus putting pressure on outdated urban infrastructure and overburdened public services. Driven largely by the Syrian refugee crisis, Amman has also absorbed 1 million new residents over the past three years[ii]. Greater Amman Municipality (GAM) is directly responsible for delivering a number of services to this growing and evolving population, from waste management to road maintenance to licensure.

One of the biggest challenges such cities face is effectively managing solid waste in light of this kind of rapid growth. In the case of Amman, improving solid waste management presented a unique challenge due to its particular spatial limitations, as well as infrastructure, human and financial resource constraints. Poor solid waste management at every stage—from street sweeping, household pickup, to disposal in landfills can undermine citizen confidence in government and has the potential to disrupt economic growth. In some cases, the inability to deliver basic waste services can trigger economic or political instability, as seen recently in Beirut, Lebanon[iii]. Many cities are facing similar challenges.

"Between 2004 and 2015, Amman's population more than doubled from approximately 2 to over 4 million, thus putting pressure on outdated urban infrastructure and overburdened public services."

"The next three decades will see a rapid change in urban demographics with the emergence of "megacities" and the rise of secondary cities, which are facing even greater challenges with population growth, combined with poor infrastructure, lack of investment and insufficient capacity"

The next three decades will see a rapid change in urban demographics with the emergence of "megacities" and the rise of secondary cities, which are facing even greater challenges with population growth, combined with poor infrastructure, lack of investment and insufficient capacity[iv]. The United Nations (UN) estimates that 66 percent of the world population will live in urban areas by 2050[v]. How Amman is using a Smart City approach to address this problem can be a guide for other urban centers struggling with booming populations.

Amman produces nearly 900,000 tons of solid waste annually. The GAM manages this service for residents throughout its entire lifecycle across 22 administrative districts. Prior to implementing its Smart City solution, waste management operations were inefficient, with trucks not completely filled while others skipped stops due to volume limits. There was also little direct oversight of service provision, and GAM lacked a rigorous system for using data to identify problem areas in delivery and adjust with varying demand[vi].

To tackle this challenge, the Mayor's office launched a pilot program called CityPerform in 2015, which drew inspiration from Baltimore's municipal management innovation, CitiStat. The aim of the CitiStat model is to gather data on an array of performance indicators, including response times for things like pothole abatement, trash collection, and snow removal, as well as the prevalence of problems such as illegal dumping, vacant buildings, and sewage overflows. Once collected, this data can be analyzed with the assistance of computerized databases and geographic mapping to target areas of underperformance[vii].

GAM's CityPerform was implemented in multiple phases. Phase one focused on an overall understanding of the institutional, financial, and technical aspects of solid waste services under the GAM's responsibility. Phase Two involved refining a performance management framework, with defined indicators and targets with a focus on usability. GAM already had large number of datasets, but many were disorganized, unreliable, and not available in a shareable format[viii].

In subsequent phases, a process was established so that the mayor could meet with the heads of the various departments periodically, discuss progress against performance indicators, and resolve to take action to address problem areas. Executive management dashboards using data and visual graphics helped in tracking areas such as route optimization, wait time, customer feedback, collection efficiency and staff utilization on a real-time basis. For instance, the dashboards gave a breakup of waste tonnage by district, distribution of the number of complaints resolved, and a graphical depiction of the efficiency of the workforce. These meetings were a great way to promote internal accountability, and redirect resources to improve performance in underperforming areas[ix].

The CityPerform pilot in solid waste management resulted in a practical, adaptable, and locally sustainable process that made best use of available data in improving efficiency in solid waste services. A new fleet tracking system and updated maps helped to meet operational needs more efficiently. The daily field reporting of tonnage collected helped to identify collection issues before they became critical. A data driven management model, combined with enhanced technological capabilities, has been driving positive results for Amman[x].

"Through this model, the city hopes to realize results in improved and more efficient solid waste services, and apply the same model to other sectors gradually, for the sake of continued development and improvement of services provided to citizens."

Amman's Mayor - Aqel Biltaji

"Through this model, the city hopes to realize results in improved and more efficient solid waste services, and apply the same model to other sectors gradually, for the sake of continued development and improvement of services provided to citizens," states Amman's Mayor Aqel Biltaji.

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Amsterdam

Ecosystem approach leads to innovative solutions in Amsterdam

Amsterdam, the capital of the Netherlands, wanted to become more innovative. But like many cities, it faced a challenge: How to drive innovation when most city department heads were focused on day-to-day operations?

City administrators realized that an ecosystem model could bring together various stakeholders to build smart city solutions. To make this ecosystem model effective, the city's ideation and innovation processes were removed from operations and centralized within a new workshop environment. The focus was on developing ideas through co-creation with experts and a broad ecosystem of stakeholders including city agencies, businesses, academia, research organizations, and citizens.[xi]

Adopting this ecosystem innovation process required civil servants to work alongside technology experts, corporate entities, social entrepreneurs and start-ups. It also entailed embracing the rapid prototyping of ideas.

"How to drive innovation when most city department heads were focused on day-to-day operations?"

New and innovative solutions were applied to the city's most sticky problems. The city was able to develop seven ideas initially, which were then filtered down to two most critical areas: mobility and poverty reduction.

"The city was able to develop seven ideas initially, which were then filtered down to two most critical areas: mobility and poverty reduction."

In line with their sustainable mobility goals, the city recently launched a pilot project called Vehicle2grid.[xii] The aim of the pilot is to help residents store their locally produced solar energy to their electric car batteries. The pilot involves several ecosystem partners like Cofely, Alliander, Mitsubishi Motors Corporation, Amsterdam Smart City, Amsterdam University of Applied Sciences and the borough of Nieuw-West. It is a good example of how diverse ecosystem players, in this case car manufacturers, city government, and academia, can come together to test an innovative solution.

Amsterdam's mobility efforts also include a focus on cycling. Cycling is a way of life in Amsterdam, and the city has built infrastructure, bike tracks and bike racks that could support and encourage bicycling.[xiii] Amsterdam is arguably one of the most bicycle-friendly cities in the world.

In the sphere of poverty reduction, an innovative budgeting app has been developed that helps the poor plan and track their financials.[xiv]

Another example of collaboration innovation through an ecosystem approach is the Amsterdam smart citizens' lab. The lab provided a platform for citizens, scientists, engineers and designers to develop low-cost, easy-to-build and maintain sensor kits that can measure temperature, humidity, light, sound, carbon monoxide and nitrogen dioxide.[xv] Citizens were active participants in this effort and were taught both the science behind these measurements as well as their technological application, and also how to upload the data to the online platform. This initiative was developed in association with the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). "It was one more step towards a greatly adaptive and user-centered urban environment", noted Natasha De Sena, programme developer at AMS.6 She also believes that such innovations will transform cities into prosperous, dynamic and adaptive living environments.

"Citizens were active participants in this effort"

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Buenos Aires

Buenos Aires uses technology for more responsive service delivery

With a population of more than 3 million spread over 78 square miles, Buenos Aires owns more than one million pieces of public infrastructure, including 370,000 trees, 120,000 public lights, 56,000 sidewalks, and 28,000 stormwater drains.[xvi] Maintaining such a vast public infrastructure can be a challenge. The city has long allowed citizens to log complaints or service requests through a call center for everything from fixing a pothole to removing graffiti. Unfortunately, the feedback mechanism was largely ineffective since the city was very slow in addressing those complaints, averaging 600 days (almost two years) to resolve a complaint in 2011.[xvii]

In 2010, city hall resolved to fix this problem. Part of the solution was a new IT system that would streamline information flow and improve departmental coordination.[xviii]

The city launched a mobile app citizens could use to register complaints or they could flow in via social media. For instance, when a resident sees a problem like a manhole missing or a broken sidewalk, she can tweet a picture to the ministry along with a short description. The app, using an integrated geographic information system (GIS) technology, sends the

"The city launched a mobile app citizens could use to register complaints or they could flow in via social media."

location of the complaint to the ministry and work is assigned to the nearest vendor to resolve the issue. To close the loop, a city street inspector—using a mobile device—validates the work done by the vendor and uploads a picture through the app showing the issue was resolved.

The ministry also uses dashboards to make sense of the real-time data that flows in. The dashboards provide insights on the status of each complaint, how the ministry is addressing it, and also captures citizen ratings on resolved complaints.

The granular data that Buenos Aires is collecting via sensors and crowdsourcing also enables the city to evolve hyperlocal solutions for certain areas

The granular data that Buenos Aires is collecting via sensors and crowdsourcing also enables the city to evolve hyperlocal solutions for certain areas. For instance, the city is now able to predict floods in certain areas using sensor data. The city frequently faces severe floods due to its location on the shores of the river Río de la Plata. Apart from using data from weather reports, the city's sensor network in sewage drains can now measure the speed, direction and level of water in the sewage drains and feed the data to city IT systems, setting off an alarm if flooding is predicted.[xix]

The responsive system has created tremendous impact on the city's quality of life parameters.

The responsive system has created tremendous impact on the city's quality of life parameters. The average time to resolve a complaint plunged 93% without additional budget, allowing the city to fix more problems in less time. The city has also seen an uptick in almost all satisfaction indices including the green spaces satisfaction index (49 to 76), streets works index (13 to 45), public lighting index (19 to 51), and storm water drains index (19 to 56).[xx]

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London

Congestion charging cuts car usage in Central London

London's congestion charging model, implemented in 2003 in Central London and then later expanded to Western parts of the city, is still more than a decade later the largest implementation of its kind in the world. The objective: reduce congestion by bringing about a modal shift away from single passenger vehicles in central London. The ultimate success of the scheme can be attributed to the presence of a political champion, a detailed implementation strategy, and careful stakeholder management.

"The objective: reduce congestion by bringing about a modal shift away from single passenger vehicles in central London."

The congestion charging area involves a network of over 600 cameras[xxi] at 174 entry / exit points across 21 square kilometers.[xxii] The cameras record images of vehicles entering and exiting the zone. To charge drivers, vehicles are matched with the database of registration via an Automatic Number Plate Recognition (ANPR) system.

The sheer size and complexity of the project meant technological and operational challenges were bound to be there. However, the scheme also encountered some political and social challenges with a huge task of achieving support for the initiative and then managing stakeholders who resisted the scheme. Here, the leadership of Ken Livingstone, then mayor of London, as a political champion was critical. The mayor along with a few

employees of Transport for London (TfL) devised a strategy to gain support from stakeholders by engaging them throughout the design of the scheme.

In July 2000, Livingstone published a discussion paper 'Hearing London's Views' and shared the paper with nearly key 400 key stakeholders including London boroughs, MPs, Members of the European Parliament , business groups and transport operators. In January 2001, the mayor released 'Transport Strategy' for public consultation which received 8,000 responses, most of them favoring the proposed scheme.[xxiii] This approach allowed for a host of modifications to the scheme, many of which are now considered critical to the general acceptance of the congestion charge. For instance, the 90 percent discount given to residents who live within the road charging zone.[xxiv]

"The city deployed proven technologies to reduce the risk of failure."

On the technology front, the city deployed proven technologies to reduce the risk of failure. TfL developed predictive go-live scenarios which were used to test operational and emergency decision-making processes prior to launch day. This approach helped TfL transition from a focus on project and implementation risks towards active contingency planning. On the operational front, the city developed operational processes to be used once the scheme went live.

Ultimately, the scheme went live in February 2003. Since then, the scheme has delivered significant traffic reduction benefits in central London. After the first 12 months of the scheme, measurements of congestion indicated an average reduction in congestion of 30 percent. The traffic flow has reduced in London and is more pronounced in central London, where vehicle kilometers fell by 23 percent between 2000 and 2012.[xxv] Further, car usage in central London fell 53 percent between 2000 and 2014. During the same time, bus and bike commuting usage increased 60 percent and 203 percent, respectively.[xxvi]

The charging scheme underwent many changes since its launch. For instance payments have moved from simple SMS based to a direct Auto Pay option that collates monthly payments and charges the credit or debit card.[xxvii] The scheme has also freed-up space in the congestion charge zones, which TfL has used to prioritize public transport, pedestrian, and bike traffic. However, in recent years, the increase in road works by utilities, general development activity, and a huge construction boom in London have slowed traffic speeds in the congestion charge zone.[xxviii] Further, the emergence of car-hailing and e-commerce companies in London have led to more vehicles on the road, thereby increasing the traffic congestion in the recent year.[xxix]

From 2003 to 2013, about £1.2 billion of net revenue from congestion charging has been invested in developing bus network, road and bridge improvement, walking, and cycling schemes.[xxx] The investments in alternative modes of transportation has greatly increased the quality of life of London residents.

"From 2003 to 2013, about £1.2 billion of net revenue from congestion charging has been invested in developing bus network, road and bridge improvement, walking, and cycling schemes."

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Santander

Sensors and effective governance makes Santander a smart city

The SmartSantander project in the Spanish city of Santander offers a preview of the possibilities: how open data and the role of citizens can transform a city. The city-run project involves 20,000 sensors that measure traffic flow, parking spaces, noise, pollution, temperature, moisture levels, and other metrics from fixed locations such as buildings, parks, streetlights, and bus stops.[xxxi] Santander residents can add to the information flow by downloading the "Pulse of the City" (PoC) app that turns their smartphones into sensors.

"The SmartSantander project in the Spanish city of Santander offers a preview of the possibilities: how open data and the role of citizens can transform a city."

But the city realized that merely installing sensors won't make the city smart. It requires a governance structure and data management process that could effectively use information collected via sensors. The city designed a strategy to identify service areas—economy, finance, energy, environment, water and waste management and mobility—which could be transformed by leveraging data from sensors.

The city council organized workshops with the staff of each identified service area and made them aware of how the data could help improve service delivery, reduce the cost of service delivery, and how and where to

get this data.[xxxii] The data were all stored in a centralized cloud platform for easy access to city officials.[xxxiii]

The city officials analyze data in real-time to adjust the amount of energy they use, the number of trash pickups needed in a given week, and how much water to sprinkle on the lawns of city parks.[xxxiv] The citizens can also tap into that data via the PoC app and use it for their daily needs. They can use real-time traffic information to plan their commute and also use the same data to know when the next bus is due. An asthma patient can plan her day to avoid areas of high pollution, while another citizen can use the app to track the progress on complaint filed for road maintenance.

"An asthma patient can plan her day to avoid areas of high pollution, while another citizen can use the app to track the progress on complaint filed for road maintenance."

They have also made the information available to developers to create consumer services. For example, SmartSantanderRA, an augmented reality mobile application, includes information on more than 2,700 beaches, parks, monuments, tourism offices, and other city sites. The user just points her smartphone to a particular building—say, a concert hall—to get a short description about events taking place there and who is performing. The app also allows real-time access to traffic flows, weather reports and forecasts, public bus information, and bike-rental services.[xxxv]

"Citizens play the role of "prosumers" in the SmartSantander project: contribute to the data stream by turning their smartphones into sensors and also as users of services."

It is not hard to imagine developers eventually using the data to create an app locating the nearest parking spot. To test it, they could roll it out to residents who have opted to turn their smartphones into sensors and fine-tune it based on user feedback. In this way, citizens play the role of "prosumers" in the SmartSantander project: contribute to the data stream by turning their smartphones into sensors and also as users of services.

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