COMMUNITIES OF PRACTICE (CoP)

Sustainable Urban Development – Smart Cities II

Digital Transformation

International ‘Good Practice’ examples

Mysuru, 16 November ‘23

Luigi Cipolla, Neelabh Singh, Florian Bemmerlein-Lux,

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

INTEGRATION

It is not what you have, it is what you do with it.

- Good examples with sufficient detailed information can be BLUEPRINTS providing mechanical / technical plans for digital adaptation.

- However, for functioning systems RECIPES are required which give instructions about the process of building and functioning.

Content

Selected themes

1. **Urban Observatory**
2. **Urban planning and design - Sponge City - Green and blue infrastructure**
3. **Municipal solid waste management**
4. **Municipal urban freshwater management and wastewater management**

1 Urban Observatory

There is potential for a **central data repository** (urban observatory) in cities (i.e., Kochi) for information-based decision-making (ad hoc and long-term planning). Such a repository can be used i**n conjunction with and complement the existing IC4**.

- The Urban Observatory has the **potential to play a central role for data-based decision making and for and long-term planning**
- Potential to **pool data** of public concerns, public and private observations, climate and disaster risk data etc. and
- **analyse, and evaluate** them and
- make the **advisory service** available to the respective urban actors

1 Urban Observatory

What is the challenge for an Urban Observatory?

- Need of a clear purpose and strategy for the urban observatory and its complementarity with the IC4.
- The geographical scope of the Urban Observatory must be defined and should be agreed upon by all the actors/stakeholders
- The aspect of data quality and quantity and its integration with the Urban Observatory is critical.
- This requires analytical competencies and intersectoral expertise, plus a clear mandate = strong political commitment needed.

1. Urban Observatory Recommendations

Data Collection

a. From various public and private sources incl. IC4 and live operations

Data Governance, Management, and Integration

a. Covers processes, policies, standards, and controls for all assets
b. Handles and integrates large volumes of diverse data sets

Big Data Analytics

a. Process and analyse large data
b. Apply data mining algorithms to discover patterns and trends
c. Conduct predictive analytics (challenges & resource allocation)
d. Data validation

Visualization and Reporting

a. Develop interactive and user friendly, dashboards and maps
b. Create real-time visualizations and generate reports and insights

Citizen Engagement and Open Data

a. Involve citizens in data collection and establish open data platforms

Security and Privacy

a. Implement cybersecurity measures, comply with privacy regulations

Collaboration and Partnerships

a. Academia, industry, local bodies, urban planners, and policymakers

2.Sponge Cities - Urban planning and design: Green and blue infrastructure

Critical Challenges

- **Integration with other city elements:** to create a city's blue-green urban infrastructure to address flood risk while enhancing livability. A series of primary, secondary, and connected spaces will be built and created to link the green areas with the city context.
- **The Natural Tools:** Green open spaces, Green roofs, and porous design interventions across the City.
- **Water Efficiency:** Water conservation and recycling measures include expanding greywater recycling at the building block level, encouraging water conservation among users, launching awareness campaigns, and enhancing smart monitoring systems to spot leaks and inefficient water use.
- **Green and Blue Infrastructure:** creating or improving parks, improving water retaining capacity and biodiversity, improving the connectivity of the urban water system and urban green spaces, and creating corridors for wildlife.

2.Sponge Cities - Urban planning and design: Green and blue infrastructure

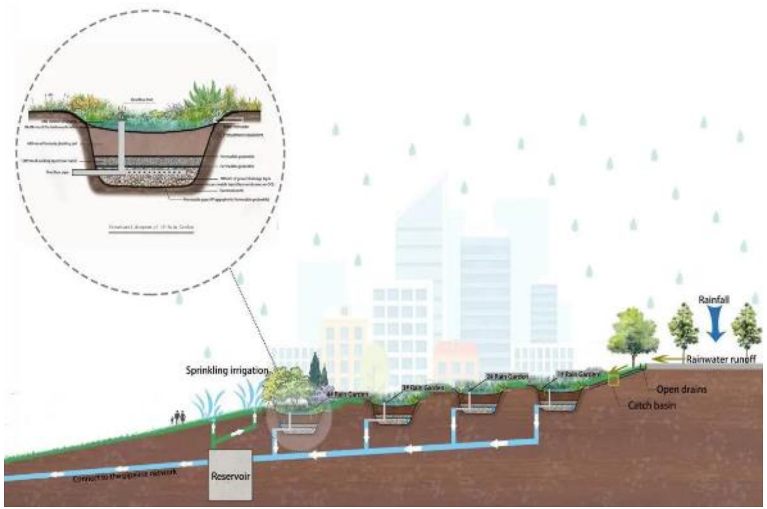
- Sponge City is a new concept of urban rain flood management, which allows cities to adapt to environmental changes and ecological natural disasters with the integration of Natural Tools.
- The emphasis is on developing a network of natural measures and green infrastructure in urban areas.
- Digital and artificial intelligence and the current green technology bring more convenience and optimization to urban management to form a sponge city intelligent management mode.

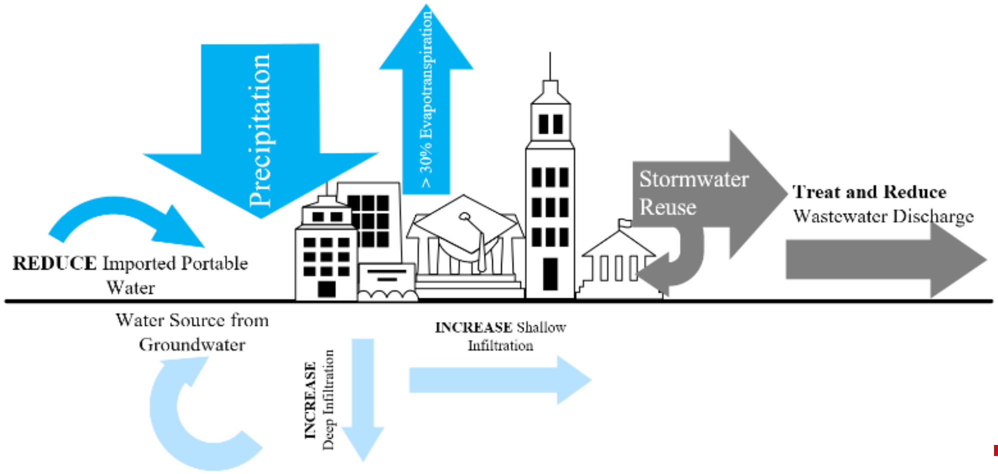
2.Sponge Cities - Urban planning and design: Green and blue infrastructure

Sponge City is a new concept of urban rain flood management,

The sponge city’s underlying concept is to view rainwater as a valuable resource and to leave it in its natural cycle for the most part. Which entails the following benefits:

- Local evaporation and infiltration of the rainwater puts less pressure on the sewers.
- Flood damage is decreased through delayed and reduced runoff.
- The natural water cycle is encouraged.
- Evaporation of the rainwater benefits the urban climate and binds dust.
- During dry periods, any rainwater stored can be used for local irrigation of urban green spaces instead of drinking water.
- Groundwater recharge is encouraged and rainwater is purified via the soil through infiltration





A sponge city is one that acts like a sponge, soaking up and retaining water during rain and storms and releasing it slowly.

Sustainable Urban Drainage (SUDs)

Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:

- Storing runoff and releasing it slowly (attenuation)
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

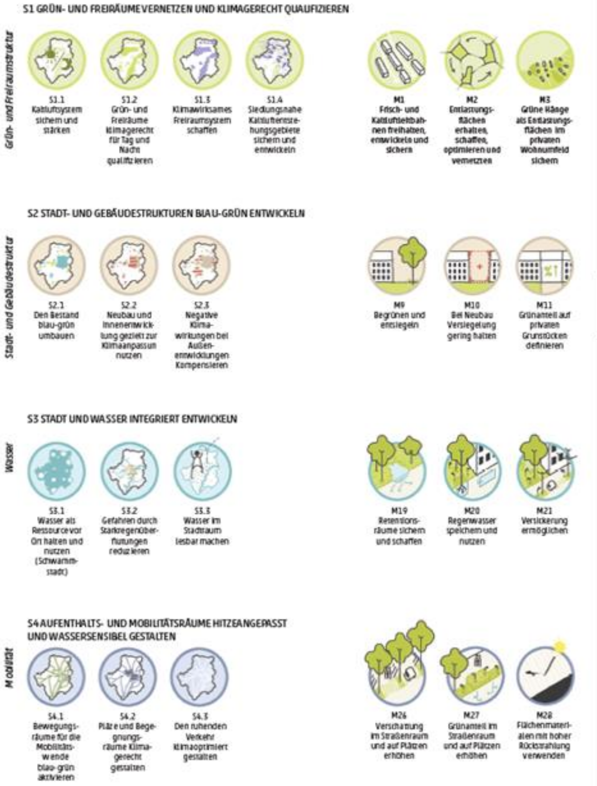
Nature Based Solutions (NbS)

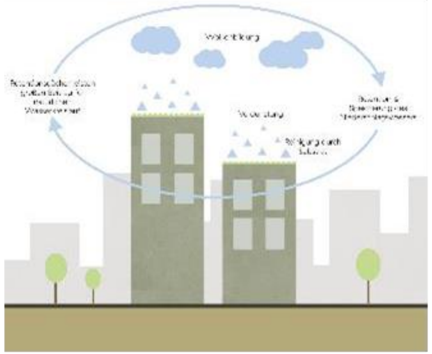
Nature-based Solutions could deliver emission reductions

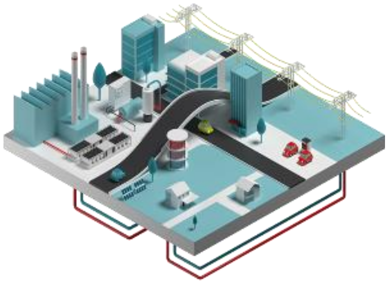
and removals of at least 5 GtCO2e per year by 2030 (of a maximum estimate of 11.7 GtCO2e per year).

2.Sponge Cities - Urban planning and design: Green and blue infrastructure

Green&Blue Infrastructure + Digital Solutions = Digital Sponge Cities







2.Sponge Cities - Urban planning and design: Green and blue infrastructure

The Digital Transformation: Smart Digital Sponge Cities

Construction of Intelligent Sponge City

Urban Infrastructure
Wastewater Infrastructure Management
Water Supply Management
Green-Blue Infrastructure

Green Infrastructure
Water system, green space system, drainage system construction, rainwater resource utilization, and urban land classification sponge construction.

Real-time Monitoring Management System

Digital System Function
To guide decision-making
To guide planning and design, optimization of the construction management process, real-time data monitoring, achievement evaluation, and system alert.

Digital System Structure
IoT Tolls, digital infrastructure, transmission, data layer, business network infrastructure.

Intelligent management measures
Integrated monitoring command control center
Online application and approval
Automatic evaluation of Sponge City construction achievements
Operation&Maintenance

Case: Evaluate the Greenness and Soil Permeability

Main objective
The main objective of the new service is to provide cities with effective tools for understanding, managing and planning the city's vegetation which leads to optimizing the use of resources and more effective Sponge Digital Tool.

Target group:
City’s Communication Department, Public authorities, Private Sector

- **Main functions**:
  - **Geotagged image dataset.** Users must fly a UAV about 30 m above ground level to obtain the image of the terrain to be analyzed.
  - **Natural Network.** Based on previous historical data the system will classify each image according to the eight classes.
  - **Visualization and retraining.** In this stage, the users are able to visualize the classification results and, if desired, re-train the pre-loaded DNN with a new dataset.

giz

2.Sponge Cities - Urban planning and design: Green and blue infrastructure

Recommendations considering the power of digital transformation

- **'Hard engineering' is frequently used in traditional urban management strategies**. Although these methods may be technically effective, they provide minimal additional benefits **for the environment and the economy**. While NbS provide a variety of co-benefits, including biodiversity improvement, improved water quality, reduced heat stress, improved aesthetics, improved community welfare, and connectivity.

- **Digital and technical innovations for enhancing resilience need to be embedded in appropriate governance structures** and procedures as cross-sectoral coordination, data exchange, and financial and technical capacities.

- **Robust data gathering is needed to tailor the design to local conditions and regional potential** and to carefully examine and address unique city issues by utilizing local and regional resources (such as soil permeability, climate conditions, hydrology, and water catchment area).

- To operate, three aspects of intelligence management measures are necessary: **real-time monitoring, program simulation, and information feedback for the system during the operations.**

- Raise the national minimum standards for the total area of new developments that need to be permeable (e.g., WHO establish a minimum of 9 m2 of green space per individual with an ideal urban green space value of 50 m2 per capita).

3.Municipal Solid Waste Management
Smart cities for the future

Digital Solutions to SWM

- Waste Technologies contains robotics, artificial intelligence, the Internet of Things (IoT), cloud computing, and data analysis.
- More smart solutions for sustainable garbage collection and treatment approaches increase towards an environmentally friendly economy.

Challenge

- Generation of accurate, reliable, and timely information about the entire solid waste chain.

3.Municipal Solid Waste Management: Smart cities for the future

Critical Challenges

- **Data Gap and Management System:** The lack of precise and reliable data on waste generation, collection, transportation, processing, and disposal poses a significant challenge. The absence of a robust data management system hampers progress monitoring and evaluation, leading to suboptimal planning and decision-making.

- **Low Community Awareness:** The community awareness campaign is a pivotal challenge in City's waste management.

- **Enhancing Technical Capacities:** The City's waste management workforce, encompassing sanitary waste pickers and operational staff, with reduced technical capacity building.

- **Lack of Integrated Approach:** City's waste management operations lack a comprehensive, integrated approach encompassing scientific, sustainable, and holistic practices.

3.Municipal Solid Waste Management: Smart cities for the future

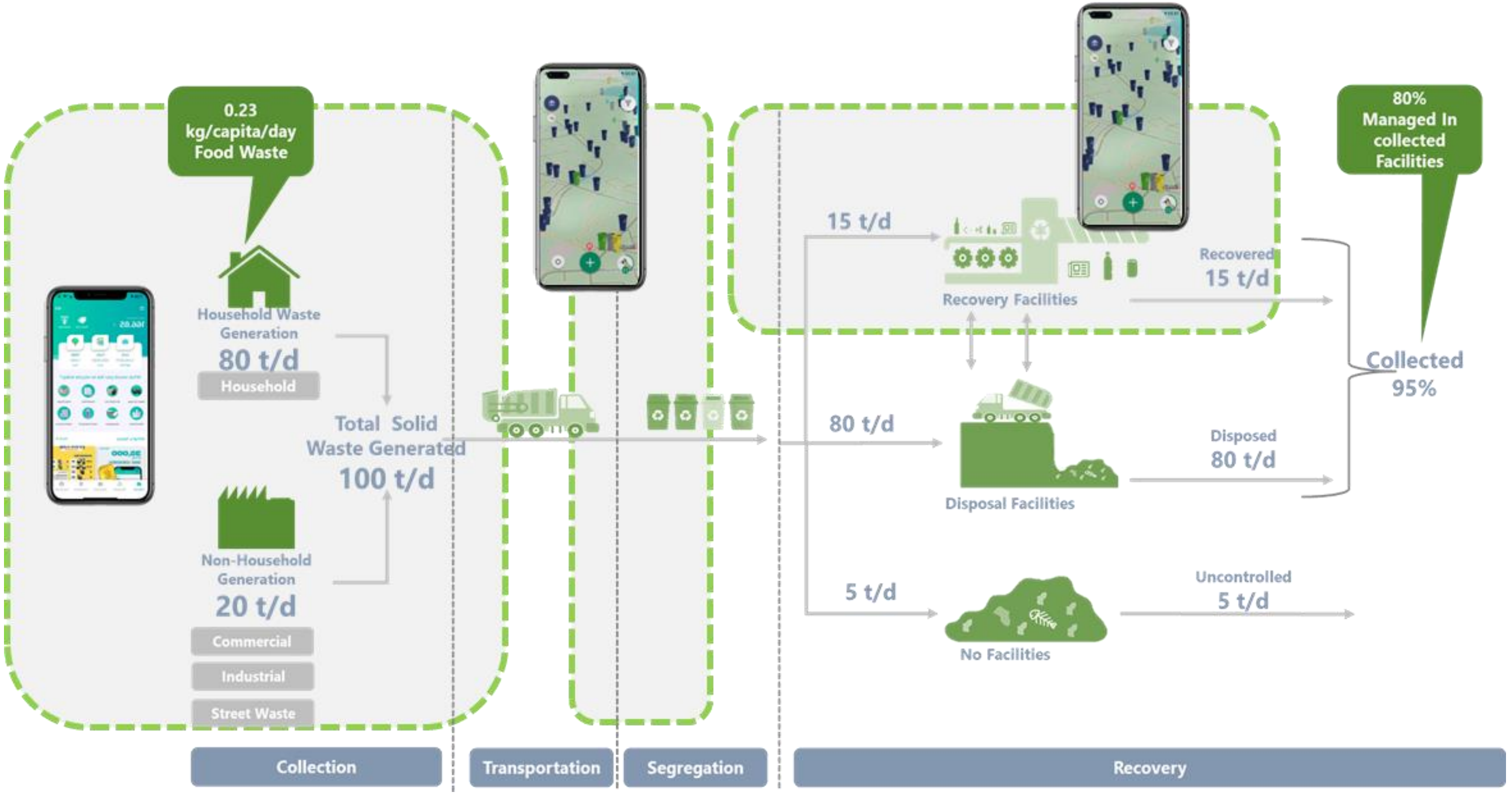
Solid Waste Management Strategy

- The strategy is based on reducing the waste going to landfills or incinerators from all Industrial processes.
- To expand the by-product program for residents and reuse the "technical products" as by-products for other industries.
- To develop education and enforcement programs to keep recyclables out of the waste stream.
- To organize the Industrial system in order to reach the maximum number of symbiosis

Introducing a digital solution (e.g., App or Dashboard) facilitates the municipality's decision-making, monitoring the daily activities and achieving finance sustainability.

3.Municipal Solid Waste Management: Smart cities for the future

The combination of a circular approach with smart tools can re-use at least **65% of municipal waste** while the amount of **municipal waste landfilling can be reduced to 30% and over.**



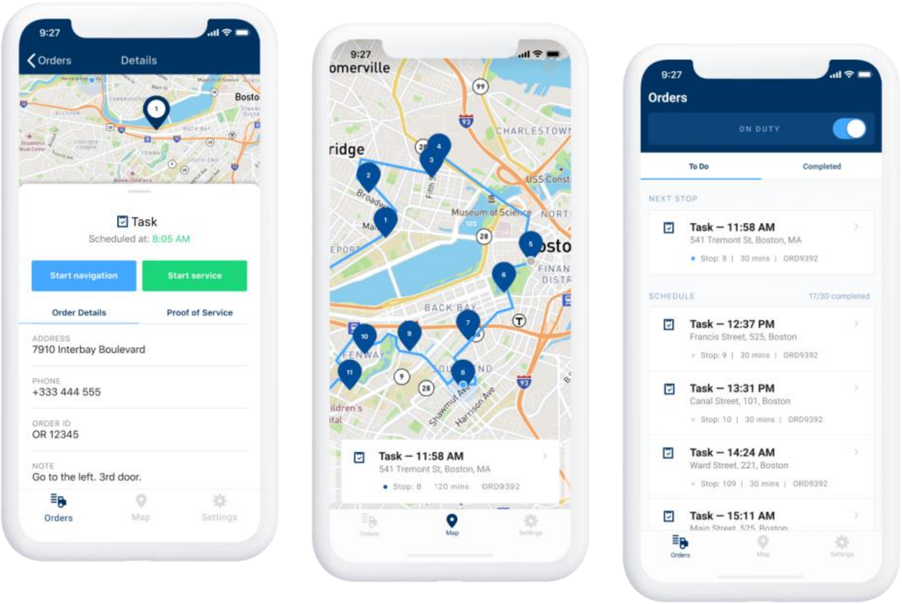
giz

Case: Smart Waste Collection and Truck Monitoring

Main functions of the solution:
Optimization of the waste collection, considering
- the spatial and demographic conditions,
- the available vehicles,
- the pre-defined data regarding waste collection vehicles, depots, and landfills/ incineration side

Data availability and data quality:
- Time (Real-time vs. Historic, Frequency of Updates)
- Geography (Public space, Building, Street, Post-code, Demographic Data)
- Data delivery (Raw data, Excel files, API access, GIS maps, Dashboards)

Innovation and Adaptation:
- Combining dynamic route planning and real-time optimization, the platform can help you excel in a competitive market, increasing efficiency.



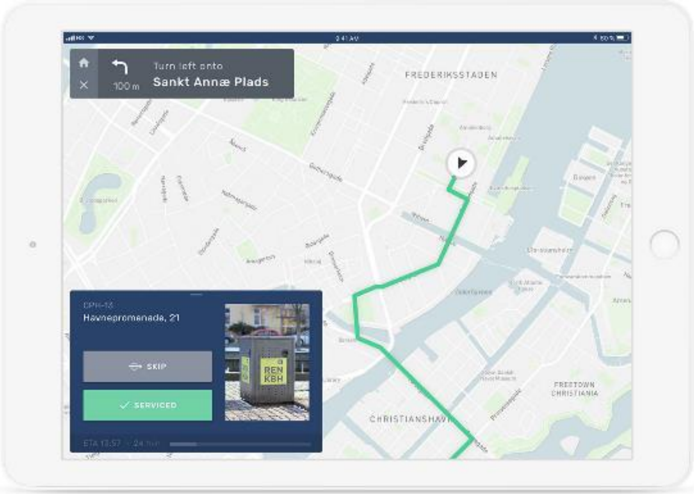
giz

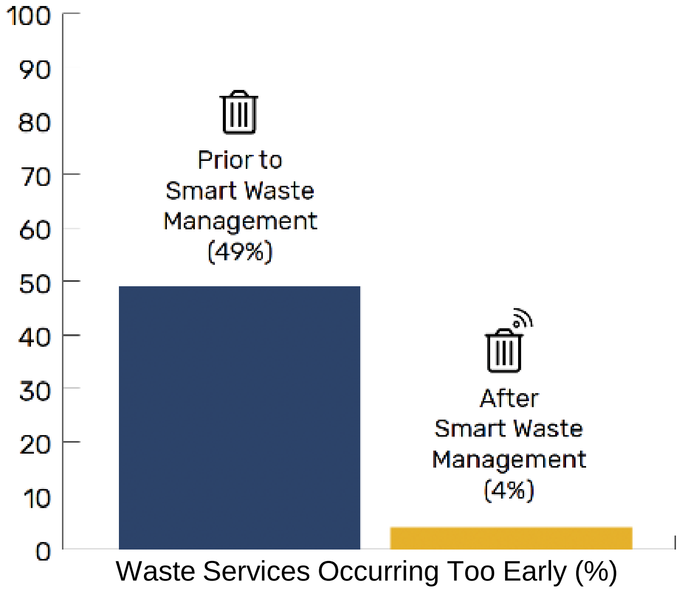
Case: Smart Waste Collection and Truck Monitoring

Results: Reducing Collection Services by 30%

Real-time data on fill levels and dynamic routing has enabled the Municipality to optimize its processes and reduce collection services by 30% on average

- Optimized and cost-efficient collection routes
- Cleaner streets and less overflowing waste
- Data insights on trip durations and cost estimations
- Faster and more efficient daily work for drivers and waste collectors





3.Municipal Solid Waste Management: Smart cities for the future

Recommendations considering the power of digital transformation

- **Waste Collection and Transportation:** Track data on waste collection routes, frequencies, and efficiency. This includes monitoring the number of collection points, collection vehicles, and collection times. Analysing this data can optimize collection routes, reduce costs, and improve resource allocation.
- **Waste Treatment and Recycling:** Gather data on waste treatment facilities, recycling rates, and the types of materials being recycled.
- **Landfill Management:** Record data on landfill operations, including landfill capacity, waste deposition rates, and environmental parameters.
- **Economic Aspects:** Collect data on the costs associated with waste management activities, such as collection, treatment, and disposal. Analysing this data helps evaluate the financial viability of different waste management strategies, assess cost-effectiveness, and allocate resources efficiently

4.Smart Cities: Municipal urban freshwater management

Critical Challenges

- Water stress is one of the major concerns worldwide, due to the high population density in cities, expanding urbanization, economic development and other factors, urban water supply is particularly vulnerable. United Nations estimated that by 2050, a decline in urban water availability in of at least 10%, due to climate change.

Digital transformation, urban water governance, and partnerships

- Digitalization of urban water management increases transparency innovation and optimize its processes and operational efficiency.
- Intelligent data analysis allows water entities to classify different types of consumers, water end users, and businesses and to identify water consumption anomalies, which could mean a leak or the water distribution system.

giz

4.Smart Cities: Municipal urban freshwater management

Recommendations considering the power of digital transformation

- **Smart Meter:** is another IoT-enabled solution for controlling water treatment plants. Leaks can be eliminated by lowering the water pressure in leak-prone areas.
- **Water Demand and Consumption:** Monitor historical data on water demand patterns, and consumption rates to forecast demand, optimize water supply infrastructure, and develop conservation strategies.
- **Water Quality and Treatment:** Collect data on water quality parameters, including chemical, physical, and microbiological characteristics.
- **Infrastructure and Distribution:** Maintain data on water supply infrastructure, including pipes, pumps, storage tanks, and distribution networks.
- **Non-Revenue Water:** Track data on non-revenue water, which includes losses due to leaks, unauthorized consumption, and meter inaccuracies.
- **Climate and Hydrological Data:** Incorporate climate and hydrological data into water supply management.

Thank You

Q/A