Co-creating Climate Smart Cities: A Practical Guide

Developing digital solutions for and with citizens and public sector organizations

Command and Control Center of Bhubaneshwar. GIZ / Teresa Kerber. 2018.

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Pilot phase of Arbol IoT in Guadalajara, Mexico. GIZ. 2018.

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Introduction

Successful transformational climate action is underpinned by citizens and digitalization. Digital solutions should improve citizens' lives while also strengthening their rights.

Transformational adaptation to climate change requires citizens to be on board and means deep, systemic change requiring the reconfiguration of social and ecological systems for sustainable development[1] Digitalization is a powerful accelerator of processes and offers environmental policy new scope to shape climate action and conserve nature and resources. If it is successfully and sustainably designed, digital transformation can provide strong support for social and environmental restructuring.[2] Over the long term, transformational adaptation to climate change and digital transformation in cities require acceptance from citizens, as both profoundly influence their lives. Digital solutions therefore have to start from the needs of citizens and city officials and be developed in co-creation with them.

By the year 2050, about 2.5 billion more people will be living in urban areas. More than half the world's population currently live in cities; by 2050, this will have risen to two thirds or about 66%.[3] This massive increase in the urban population across the globe is the equivalent of the entire urban population of Africa and Asia in 2015. Cities are also innovation hubs and places where minds and ideas collide and enrich each other. (Climate-)smart cities are livable and lovable, diverse and open, participatory and inclusive, climate-neutral and resource-efficient, competitive and thriving, and responsive and sensitive.[4]

Every year, people lose their lives in dangerous floods and other extreme weather events caused by climate change. It goes without saying that not a single individual should be exposed so defenselessly to such risks. And we now have the knowledge and information and communication technology (ICT) to change the way our cities function and develop. Climate change, urbanization and digital transformation are the megatrends of our time and need to be addressed together.

The Global Program "ICT-based Adaptation to Climate Change in Cities" (ICT-A) has been financed by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) as part of the International Climate Initiative (IKI) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in cooperation with the German Federal Ministry of the Interior, Building and Community (BMI).

In our partner countries, we cooperate with the Ministry of Housing and Urban Affairs (MoHUA) in India, the Agency for International Development Cooperation (AMEXCID) and the Ministry of Environment and Natural Resources (SEMARNAT) in Mexico, and the

Secretary of Digital Government of the Presidency of the Council of Ministers (SEGDI/PCM) and the Ministry of the Environment (MINAM) in Peru.

The global program operates at the intersection of three megatrends – climate change, urbanization and digital transformation – with the mandate of developing digital solutions to support cities and their citizens to better adapt to climate change, to collaborate on achieving their countries' Nationally Determined Contributions (NDCs) and the Sustainable Development Goals (SDGs), and to contribute to sustainable urban development in the partner cities of Bhubaneshwar and Kochi in India, Guadalajara and Zapopan in Mexico, and Chiclayo and Trujillo in Peru.

We would like to express our deep thanks to our commissioning parties and partners in our partner countries and cities for their commitment and creativity and for having the courage to embark on this experimental journey with us. Open innovation means finding new ideas and solutions to both old and new problems but also involves jointly managing risks along the way.

At the time of writing, urban areas account for 90 % of reported coronavirus cases,[5] and our partner countries India, Mexico and Peru are among the countries with the highest number of cases. We and our partners have had to adapt roles and digitalize activities to be able to complete the global program. However, it would have been much more difficult to get through the COVID-19 pandemic without digital tools, and urban density does not inevitably correlate with higher virus transmission rates, so vulnerabilities are largely a result of choices as to how people live, work and travel. Now we have the opportunity to recover better, by building more resilient, inclusive and sustainable cities.[6]

Proactively addressing a changing climate and welcoming the abundance of new technologies opens up pathways towards more livable cities. It is the role of urban policy makers and practitioners to see climate action and digital transformation as interlinked elements of planning better, more resilient cities and empowering individuals with the necessary capacity to understand and use digital solutions while also withstanding the impact of climate change.

In this practical guide, we introduce you to a process called "citizen-centered innovation" and a set of methods to support it. This process is based on agile

methods with a human/user-centered approach. Nevertheless, we define it as citizen-centered because in our understanding, citizens are more than "just" users: they have rights to be strengthened and obligations to be met.

We provide guidance for urban policymakers and practitioners on conducting a collaborative process of developing and implementing digital solutions for gathering and analyzing urban data and integrating it into urban planning to promote evidence-based decision making that will improve climate resilience and inclusion in cities.

This guide addresses especially the challenge of the lack of geo-referenced, geographically bounded local data that is crucial for climate-friendly urban development. Relevant data at household, neighborhood or district scale is often outdated, unusable, inaccessible, non-digital or simply non-existent. Urban policy makers and practitioners face a critical lack of data because traditional methods for collecting planning data are time- and cost-intensive. Digital solutions can support cities and municipalities in these tasks while raising awareness of the importance of climate action.

1 Intergovernmental Panel on Climate Change (IPCC) 2018: Special Report Global Warming of 1.5°C. Summary for Urban Policymakers.
   URL: *https://www.ipcc.ch/site/assets/uploads/sites/2/2018/12/SPM-for-cities.pdf*
2 German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) 2020: Digital Policy Agenda for the
   Environment. URL: *https://www.bmu.de/en/digital-policy-agenda-for-the-environment*/
3 UN-DESA 2014: World Urbanization Prospects: The 2014 Revision. New York.
4 German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) 2017: Smart City Charter:
   Making digital transformation at the local level sustainable. URL: *https://www.bmi.bund.de/SharedDocs/downloads/DE/veroeffentlichungen/*
   themen/bauen/wohnen/smart-city-charta-kurzfassung-de-und-en.pdf?__blob=publicationFile&v=4
5 World Health Organization (WHO) 2020: WHO Coronavirus Disease (COVID-19) Dashboard. URL: *https://covid19.who.int/*
6 United Nations (UN) 2020: Policy Brief: COVID-19 in an Urban World. URL: *https://www.un.org/en/coronavirus/covid-19-urban-world*

Interlinking Megatrends

Climate change, urban development and digital transformation are closely interlinked (Figure 1). Sustainable development of cities is impossible without taking into account (i) the spatial growth, infrastructure needs and resource demands of urban areas with inefficient planning and management systems, (ii) the impacts and required transformational adaptations arising from a changing climate with increasingly frequent and severe weather events, and (iii) the reach and penetration of digital infrastructure, solutions and multi-stakeholder processes in physical, economic and social systems through digital transformation.

Data plays an important role in addressing climate change impacts while also enabling cities to reap the benefits of digital transformation. On one hand, cities lack the specific localized, geo-referenced data that underpins better information about climate change action needs and solutions for climate-proofing infrastructure and increasing their citizens' resilience: most of the current climate models are not fine-grained enough for these tasks. At the same time, digitalization is impacting on every area of people's daily lives and offers numerous opportunities for engaging citizens and businesses in data collection, climate action planning exercises and the co-creation of related actions. Proactive urban development therefore depends on these two facets to arrive at better-informed analysis, decision-making and day-to-day management of resilient cities.

Climate action needs in a city may, for instance, reflect more frequent flooding or heatwaves, requiring a redesign of the urban space to protect infrastructure, people and processes. Before any such redesign can take place, however, urban planning officers need information on the exact situation and feasible solutions in specific locations, both currently and in the future. Predictions based on previous (historic) patterns are, though, unlikely to apply because climate conditions and occurrences are changing. Models can therefore be redesigned and used to test different scenarios and their estimated impact on specific locations. Such work with scenarios in turn requires a range of data whose collection, storage and analysis is facilitated by the digital transformation. With the flow and utilization of information facilitated and improved by digital technologies, a city can become smarter in dealing with a specific flooding scenario or the challenge of increasingly frequent urban heatwaves.

Eventually, a "sensing" city that monitors environmental, physical, and other processes can enable urban planning to achieve two objectives: (i) effective real-time management of urban infrastructure, basic services and resource flows in highly dynamic spaces that reflects extreme weather events, and (ii) well-informed medium- and long-term strategic and action planning for climate action measures and broader spatial interventions to create a more resilient city.

Better sensing of urban environments and processes improves understanding of these environments and processes. And if the right digital solutions are adjusted to specific local contexts, they can facilitate citizens' interaction with data and help them act on improved information about their city.[7]

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7 Ratti, Carlo 2015: The "Sensing" City Is the Future of Urbanism. Metropolis: 8 December 2014. URL: *https://www.metropolismag.com/cities/the-sensing-city-is-the-future-of-urbanism/* Also see: MIT Senseable City Lab 2018. URL. *http://senseable.mit.edu/*

Figure 1: Interlinked Action Areas for Climate Smart Cities
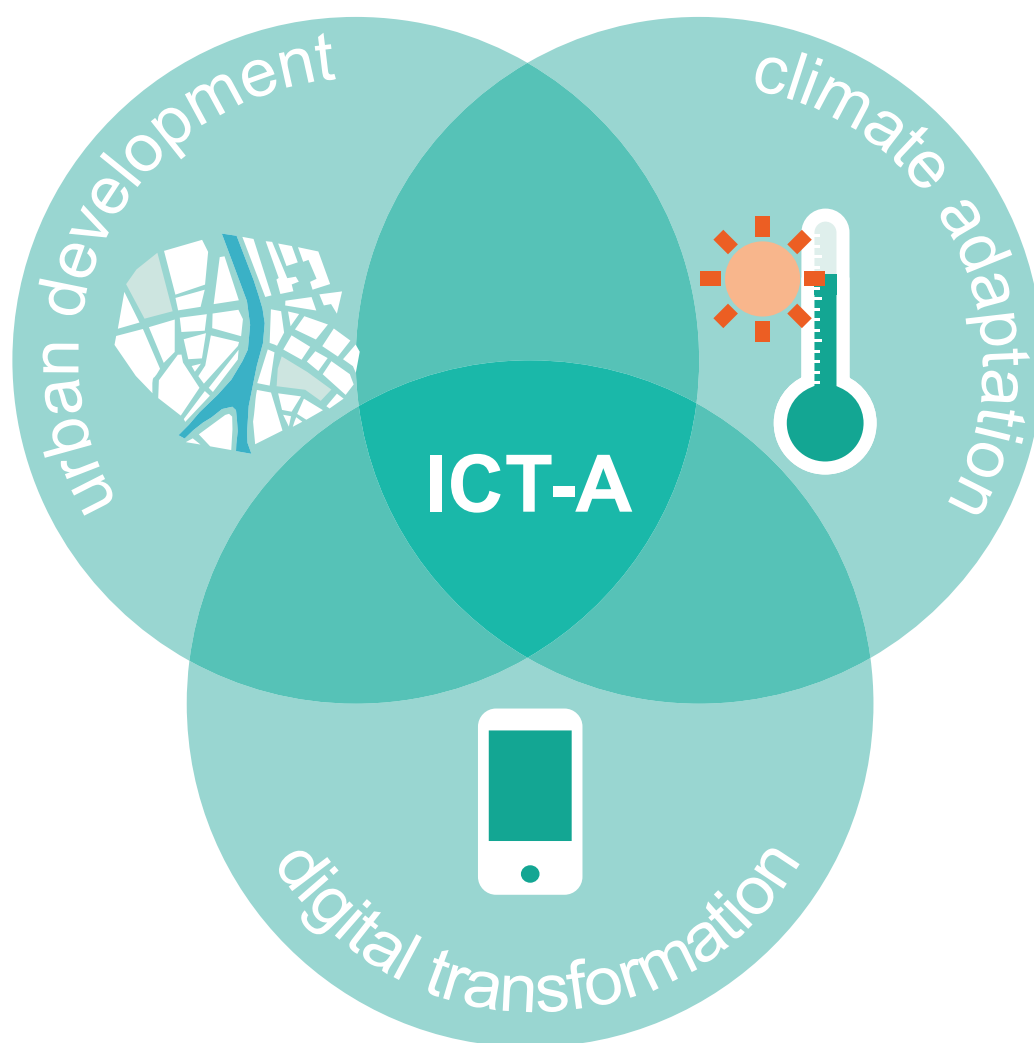
Source: GIZ 2018. Global Program ICT-Based Adaptation to Climate Change in Cities. Project flyer. Bonn/Eschborn.

Strategic Principles for Climate Smart Cities

When carried out correctly, digitalization means taking the Principles for Digital Development into consideration at all stages, such as co-designing with users, understanding the existing ecosystem, designing for scale, using open standards, etc. The Principles for Digital Development were formulated in 2012, when international donor and multilateral organizations brought together existing guidance for institutionalizing the lessons learned from digital development. The Digital Principles have changed over time and may continue changing, as they are a set of living guidelines intended to help practitioners successfully apply digital technologies to development programs.[8]

These Digital Principles are very important, but we wanted more: we needed strategic principles that could support us in implementing our program in the best way possible with and for our partners. We therefore developed eight strategic principles based on the Principles for Digital Development and included specific topics to facilitate the integration of co-created digital solutions into partner systems, such as contributing to existing urban planning processes in our partner countries, addressing local climate challenges and fostering citizen participation and open innovation. Our strategic principles for climate smart cities in detail are as set out below (Figure 2).

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8 Digital Impact Alliance 2020: Principles of Digital Development. URL: *https://digitalprinciples.org/*

Figure 2: Strategic Principles for Climate Smart Cities

Created by Adnen Kadri from the Noun Project

FOSTER CITIZEN ENGAGEMENT
- Carrying out the program for and with citizens;
- Supporting participation of vulnerable groups;
- Allowing a wider range of experiences and knowledge to jointly find solutions to harness collective wisdom.

Created by Creative Mania from the Noun Project

TACKLE LOCAL CLIMATE CHALLENGES
- Focusing on challenges identified by the citizens and that have been shown in climate scenarios, vulnerability assessments, etc.;
- Collecting and collating data and information to develop measures for climate adaptation;
- Providing inputs to guide resilience in urban infrastructure.

Created by Martin Vanco from the Noun Project

CONTRIBUTE TO THE CITY'S PLANNING PROCESS
- Aligning activities to current urban planning processes;
- Identifying missing data needed to increase urban resilience;
- Anchoring collected data to current open data efforts and existing information systems.
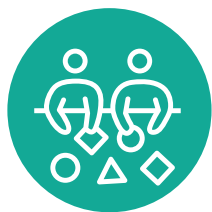
Created by Yu Luck from the Noun Project

PROMOTE LOCAL CO-CREATION
- Drawing upon local innovation ecosystems;
- Supporting involvement and further development of local talent;
- Enabling social appropriation of the jointly developed measures.

PLAN & IMPLEMENT FOR SUSTAINABILITY

- Contribute to the long-term vision of the city, setting short-term actions;
- Involving a wide range of stakeholders and communicating in an easy to understand manner;
- Aligning local, regional and national strategies.

Created by
BomSymbols from the
Noun Project

FACILITATE TRANSFERABILITY & UPSCALING

- Managing knowledge, documenting innovative approaches and good practices in a precise manner;
- Feeding back lessons learned and success factors to improve the process;
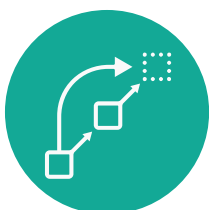- Spreading the knowledge, i.e. tools, results, etc.

Created by
Deivid Sáenz from
the Noun Project

MAKE RESPONSIBLE USE OF DATA

- Complying with international standards as well as national and local norms and regulations;
- Addressing and mitigating risks to data protection and cyber security;
- Strengthening the citizens digital competencies to recognize risks and threads, and protect themselves better.

Created by
Rajakumara from
the Noun Project

PRIORITIZE OPEN SOURCE

- Trying to reduce software and license dependencies for local governments and other stakeholders;
- Fostering collaboration with the local ecosystem and across sectors;
- Customizing existing open source solutions.

Created by Rockicon
from the Noun Project

Source: GIZ 2018. Global Program ICT-based Adaptation to Climate Change in Cities (ICT-A). Project poster. Bonn/Eschborn.

Pilot phase of Mu City Savior in Bhubaneshwar, India. GIZ. 2019.

Guiding Questions for Working with the Strategic Principles

The following are guiding questions used by moderators and trainers on the "ICT-based Adaptation to Climate Change in Cities" (ICT-A) global program and can be used in other workshops and learning activities, to help apply the strategic principles for climate smart cities.

1 **FOSTER CITIZEN ENGAGEMENT**

- Which methodologies and approaches can be used to ensure a targeted intervention in a city with the greatest benefit to its stakeholders?
- What are the specific needs of different stakeholder groups in a city? How can their diversity be reflected in the processes and outcomes of a climate action program? What steps can be taken to focus particularly on the needs of vulnerable groups who are otherwise left out?
- How can stakeholders' active participation be encouraged and how can their different perspectives, ideas and resources be utilized to boost the effectiveness of interventions in a climate action program?

2 **ACKLE LOCAL CLIMATE CHALLENGES**

- What data and information are available for each specific city? How do citizens' own experiences and knowledge compare with such data and information? Which other (potential) partners of a city could be involved and could support the contribution of relevant data and information?
- Which data gaps are most relevant for informing climate actions in a city, and how can these data gaps be addressed through ancillary data from similar contexts or field interventions for data collection?
- What other factors besides data are crucial in establishing a full picture and identifying the most suitable climate action measures in a city? How can these factors be assessed and accounted for in the interventions of a climate action program?

3 **CONTRIBUTE TO THE CITY'S PLANNING PROCESS**

- What is the position with a city's current planning and climate action processes and products, and how can a climate action program advance these through additional inputs?
- What is the most crucial data needed to inform the planning and design of climate action measures in a city? Where can this data be sourced? How do different sourcing efforts fare with regard to cost implications?
- How can data collection allow open access and usage of the data? How can such data collection be integrated into a city's existing processes and systems to avoid overlap and duplication?

4 **PROMOTE LOCAL CO-CREATION**

- What are the key human resource and institutional assets within a city that can be tapped to inform the development of the most creative and locally applicable climate smart solutions? How can specific partner organizations or other actors be engaged in a climate action program?
- What activities, events and related capacity development can be undertaken to enhance local skills and foster local talents?
- Which methodologies and processes are needed to ensure stakeholder involvement at every crucial step of a climate action program? Which (potential) local champions can be identified and encouraged to form an integral part of such a program in a particular city?

5 PLAN AND IMPLEMENT FOR SUSTAINABILITY

- To what extent does a partner city's long-term vision align with its program objectives in the area of climate smart cities? Which realistic targets under specific interventions can be set to help a city become climate smart?
- How can the technical terms around urban development, climate change and digitalization be translated into a language that appeals positively to stakeholders and encourages their engagement and contribution? Which channels are most suitable for such communication?
- How do local, regional, and national strategies for climate change action currently align with each other? How can the interventions in a particular city's climate action program be tailored to complement these strategies effectively?

6 FACILITATE TRANSFERABILITY AND SCALING-UP

- Which processes and methodologies are most suitable for capturing the activities and lessons of a climate action program in a resource-efficient and user-oriented way? What internal (reporting and data management) systems can support such work?
- How can knowledge sharing be facilitated within a climate action program and between partner cities? What timelines have to be taken into account when planning the capturing and feedback loop activities?
- How can the abundance of material from a climate action program be formatted and communicated through different channels to be made widely available to interested actors? Which partnerships and knowledge events can promote related knowledge and learning?

7 MAKE RESPONSIBLE USE OF DATA

- Which data and ICT regulations and laws must be complied with in a climate action program? Which standards are applicable and most effective in achieving the program's objectives and enhancing its guiding principles?
- Which measures can guard a climate action program against data and ICT related risks? How can the partners in such a program contribute knowledge, experience and resources to necessary mitigation actions?
- How can training and other development measures to develop citizens' digital capacity be designed and integrated with other activities in a city? Which national and subnational organizations and other actors can support related activities in this regard?

8 PRIORITIZE OPEN SOURCE

- What current software and hardware is a particular city using? How can new interventions utilize this infrastructure? Which other tools or systems may strengthen a city's planning capacities? Can open, free and less resource-heavy solutions be found that can ensure similar or better performance and outcomes?
- How can open source and open data approaches and platforms be used to activate and further develop local initiatives? How can the interventions of a climate action program be designed in a way that invites local contribution and leadership in the public and private sector or civil society in specific action areas?

Which open source solutions are relevant to a particular city? How can these be used with the resources available? Which partners can support related interventions and also ensure collaboration beyond a climate action program's lifetime?

CHAPT

TER 02

Citizen-centered
innovation process

Pilot phase of AYLLUDAMOS in Chiclayo, Peru. GIZ. 2019.

02

Citizen-centered innovation process

Agile methods start from the needs of users, in our case, the needs of citizens. They support you in determining the needs of users/citizens and designing and building the product around them and in direct response to them. This is why agile methods are the basis of the Citizen-centered innovation process that we developed for the global program ICT-based Adaptation to Climate Change in Cities (ICT A).

Agile methods, such as Design Thinking, Scrum and others, are grounded in theory and are the subject of much debate in this field's community of experts. Without going into detail and arguments here, it is im-

portant to set out the principles and certain conceptual aspects as they influence decisions on how they are used in each case. It is necessary not only to know these principles but also to reflect on how they are valid for us, for our partner and in the context in which they are to be applied. A quick look at your smart phone would probably reveal some digital solutions that have been developed using agile methods.

There follows a description of the Citizen-centered innovation process and the agile methods that it includes, which will be explained in more detail, along with lessons learned, in the next chapter.

Figure 1: Citizen-centered innovation process. GIZ, 2017.

Workshop · Sprint · Sprint · Workshop

CITY SELECTION & MoU — DEFINITION CLIMATE CHALLENGE — CITIZEN-CENTERED INNOVATION PROCESS — DEVELOPMENT DIGITAL SOLUTION — PILOTING — WRAP-UP & TRANSFER

Capacity Development / Continuous Learning
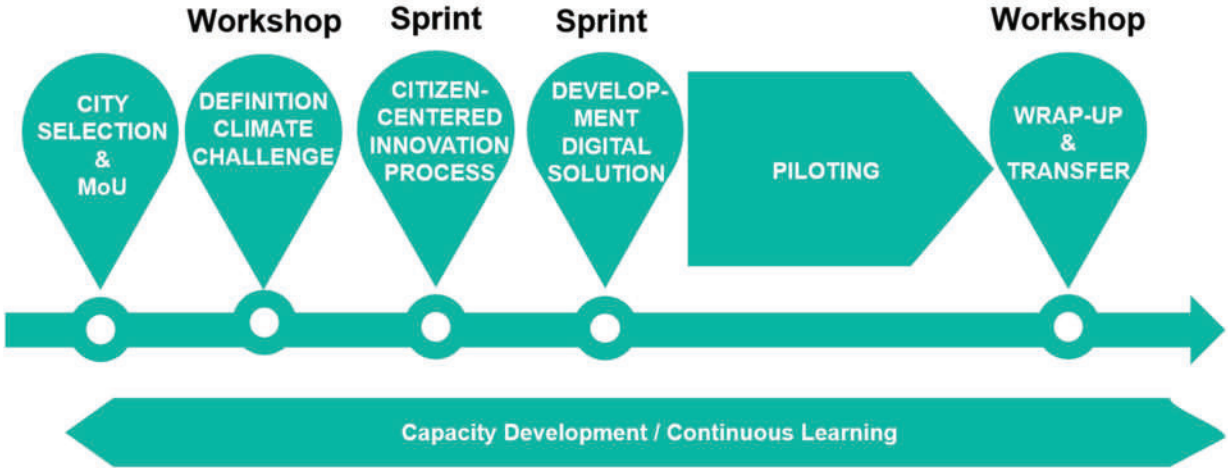
The Citizen-centered innovation process consists of six steps:

1 **Identification and selection of a partner city,** along with political partners at the national level and city representatives. When undertaking research into potential partner cities, we focused on four important aspects, among others:
1. a city's climate challenges and vulnerability;
2. political commitment and/or interest in digitalization approaches;
3. the ability of a municipality to make decisions with a degree of decentralization; and
4. the capacities and resources that a city has to handle and innovate with technology (e.g. maturity of the digital ecosystem). In India, a rapid assessment tool was developed and applied. For further information, please see the detailed description in the next chapter. The selected partner cities then signed a memorandum of understanding.

2 **Definition of the (climate) challenge:** For the purpose of identifying the (climate) challenge, kick-off workshops were carried out with city officials, citizens, academia, non-governmental organizations, etc. The initial discussion for the ICT A global program was centered around local climate challenges and the partner country's Nationally Determined Contributions (NDCs). One of the studies that proved useful during the identification of climate challenges was "Climate Change: Implications for Cities – Key Findings from the Intergovernmental Panel on Climate Change", published by the University of Cambridge and ICLEI.[1]

3 **Citizen-centered innovation process:** The core of the co-creation process is a combination of agile methods selected according to the local context, institutional set-up, intercultural characteristics and digital ecosystem. In order to carry out the different phases, a Citizen-centered innovation process draws upon different formats to bring people together for collective thinking, put together ideas and preliminary models and/or try out solutions under real-life conditions. The following figure shows the methods and formats that were used and customized to the needs and requirements of the different processes in each ICT A partner country. All the methods are explained in detail in the next chapter.

4 **Development of the digital solution:** This step includes the coding of the digital solution based on the prototypes and mock-ups resulting from the last step. Several feedback loops with participants on the formats and methods mentioned above (participants from the kick-off workshops, citizens living in the pilot areas, city officials, etc.) were part of the development.

5 **Piloting:** It involves two stages: internal testing with coders and piloting with citizens/users and city officials. The second stage is the most important because, for the first time, citizens/users and contributors have the possibility to interact with and test a working digital solution, give their feedback and report bugs. Using the initial feedback and responses from citizens and city officials to further improve the product and experience is a key part of the process. The main methods for piloting were:

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1 Intergovernmental Panel on Climate Change (IPCC) 2014: Climate Change: Implications for Cities – Key Findings from the Intergovernmental Panel on Climate Change, Fifth Assessment Report. University of Cambridge and ICLEI. URL: *https://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-climate-science-business-briefings/pdfs/briefings/IPCC_AR5__Implications_for_Cities__Briefing__WEB_EN.pdf*

When we use what?
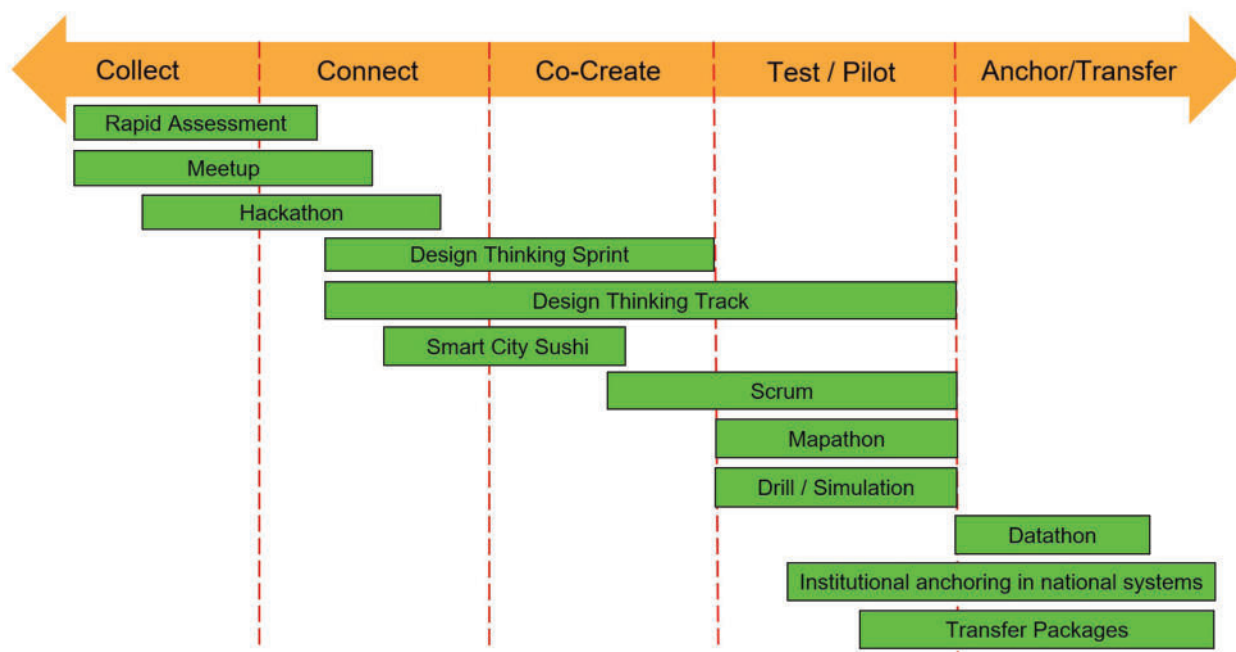
a) Mapathons: They are a versatile format for promoting dissemination of a prototyped solution and act as an initial feedback mechanism. It is important to have a complete and functioning solution since it is going to be tested in real contexts. For further information, please see chapter 3.

b) Drills: They are simulated events carried out in a real context to practice how the digital solution would be used in case of an emergency. Drills respond to the iterative nature of the process and are an important step in the feedback loop. Their purpose is to try out the solution in order to identify areas for improvement. For further information, please see chapter 3.

c) Datathons: They are similar in format to hackathons but with a strong focus on data. Datasets are given to the participants to produce, test and explore solutions and new uses of the data. In the ICT A global program, datathons were envisioned as a way to rethink ideas and to anchor the generated data and information in the cities' platforms. These two-day, on-site events were interrupted by the COVID-19 pandemic and could not therefore be carried out in the partner cities. However, it is important to consider such formats to guarantee the long-term sustainability of digital solutions.

6 **Wrap-up and transfer:** This step included one wrap-up workshop with city officials and citizens in order to discuss lessons learned and further roll-out and another with political national partners to exchange lessons learned, present the transfer packages and discuss possibilities for anchoring the digital solutions in national systems with a view to scaling-up. For further information about a transfer package and its implementation guide, please see annex 5.

Result of the Citizen-centered innovation process are three implemented digital solutions whose brochures can be found here:

▪ Brochure about the digital solution for India "Mu City Savior": *https://www.international-climate-initiative.com/en/infotheque/publications/publication/article/mu_city_savior_preventing_urban_flooding_and_improving_public_services_with_a_co_created_digital_solution*

▪ Brochure about the digital solution for Mexico "Arbol IoT": *https://www.international-climate-initiative.com/en/infotheque/publications/publication/article/arbol_iot_internet_of_trees*

▪ Brochure about the digital solution for Peru "AYLLUDAMOS": *https://www.international-climate-initiative.com/en/infotheque/publications/publication/article/aylludamos_citizen_centered_innovation_for_climate_proofing_urban_infrastructure*

All publications of the ICT A global program can be found on the website of the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU): *https://www.international-climate-initiative.com/en/*

The transfer packages of the three digital solutions of the ICT A global program can be found on the platforms of the partner cities or national partners and here: *https://www.climate-digital-cities.com*

CHAPT

TER 03

Methods

Pilot phase of Arbol IoT in Guadalajara, Mexico. GIZ / Ingrid Cornejo. 2017.

03

Methods

3.1 Rapid Assessment Tool

The Rapid Assessment Tool aims to enable an evidence-based selection of partner cities for the global program by assessing their capacities, resources, suitability and commitment to cooperate in the development, implementation, further use and scaling up of a digital solution for climate action. The tool enables a two-stage city selection process. First, for each city, a rapid assessment is made on the basis of web research and desk analysis. Multiple criteria for the following categories are analyzed:

a. climate risk and data availability,
b. climate adaptation,
c. digital and ICT practices and
d. ICT innovation ecosystems. The rapid assessment prioritizes the selection of cities that are at higher risk due to climate change and have a more mature digital ecosystem by assigning a higher weight to these criteria. As a second stage of the analysis, a verification and scoping trip is carried out to the pre-selected city or cities in order to assess their interest in and commitment to cooperation.

The Case of Bhubaneswar and Kochi, India

In the case of India, three cities were previously shortlisted for selection in agreement with the national partner, the Ministry of Housing and Urban Affairs (MoHUA) of the Government of India, under the national program Smart Cities Mission:

1. Bhubaneswar in the State of Odisha,
2. Coimbatore in the State of Tamil Nadu and
3. Kochi in the State of Kerala. The rapid assessment showed that Bhubaneswar was most suitable for the project, though Kochi and Coimbatore also offered viable options.

All three cities had a history of climate adaptation projects including ones in partnership with international agencies, and have relatively mature digital ecosystems and a conducive state policy environment in terms of climate change and digital projects. However, Bhubaneswar stood out. It was the most prone to climate change, with changing rain patterns, high levels of projected heat stress and cyclonic risk. City planning, including the city's Comprehensive Development Plan, has incorporated these climate adaptation goals into the city's objectives. In conversation, the city government also stressed the related risks of waterlogging and flooding. The city also highlighted that it had a 'Local Resilience Action Plan' in the past, that a 'Heat Resilience Plan' was currently being developed, and that work was underway to devise a 'Regional Resilience Plan'. These three explicit schemes related to climate adaptation presented potential for synergies. There was therefore great interest in the issue, and this was also complemented by a high level of enthusiasm among civil society.

Figure 1: Results of the rapid assessment tool developed for the ICT-A Program in India. GIZ, 2018

Subcategories	Weight		Bhubaneswar	Coimbatore	Kochi	Criteria
A. Climate risk & data						A
Climate change risks	8%		0.17	0.10	0.15	1-8, 13-15
Infrastructure deficits	4%		0.11	0.08	0.06	9,11,13
Economic and institutional risks	4%		0.08	0.09	0.08	12-14
Data availability	4%		0.13	0.09	0.13	16
Social vulnerabilities	4%		0.08	0.06	0.06	10,14
	25%	Sub-Total	2.30	1.67	1.94	
B. Climate adaptation						B
Climate adaptation in the Smart City proposal	5%		0.13	0.11	0.09	1
Climate adaptation in the Masterplan	5%		0.11	0.05	0.15	1.4-1.7
Climate relevant actors	5%		0.12	0.13	0.13	2-4
State plans, policy and actions	5%		0.17	0.12	0.17	5-6
City plans, policy and actions	5%		0.15	0.10	0.10	7-11
	25%	Sub-Total	2.67	2.05	2.55	
C. Digital, ICT in city government						C
Digital solutions in the Smart City proposal	6%		0.19	0.14	0.13	1-3
Open Data platforms and policies at the city-level	6%		0.08	0.04	0.04	4-6
City digital projects	6%		0.17	0.19	0.08	7-11
State digital policies and projects	6%		0.19	0.13	0.25	12
	25%	Sub-Total	2.50	1.98	2.00	
4. ICT innovation ecosystem						D
Local tech ecosystem	13%		0.33	0.40	0.43	1-4
Educational institutions and civic organizations	6%		0.13	0.10	0.08	5-7
Digital infrastructure	3%		0.06	0.07	0.06	8-14
Education level	4%		0.11	0.08	0.08	15
	25%	Sub-Total	2.03	2.29	2.28	
		Total	2.38	2.00	2.19	

For the report of the rapid assessment tool developed for the ICT-A Program in India, please see annex 1.

3.2 Climate Challenge Identification Workshop

It is of the utmost importance to identify and frame the challenge that should be tackled along the ideation and development process of the digital solution, and this is therefore the first step. In the specific case of the ICT-A global program, this is done as part of a multi-stakeholder kick-off workshop and the challenge aimed to tackle one of the five main impacts of climate change in cities established by the Intergovernmental Panel on Climate Change (IPCC) in their report 'Climate Change: Implications for Cities'[1]:

1. extreme weather events,
2. increased temperatures,
3. food insecurity,
4. freshwater availability and
5. sea-level rise. However, it is important to highlight that the workshop can be carried out following the same structure and methodology in order to tackle urban challenges in other areas such as health, education, gender, etc. Stakeholders that attended the kick-off workshop were city officials from different institutions, citizens' representatives, the private sector, universities and training institutes, non-governmental organizations, civil society organizations, etc.

In order to frame the climate challenge and provide a scope of intervention, a two-day workshop was carried out in each city. The program of these workshops was mainly divided into two blocks:
Block 1. Generating a common understanding of the goals and scope of the ICT-A global program based on the Strategic Principles (please refer to Chapter I – Strategic Principles for Climate Smart Cities), and
Block 2. Defining the climate challenge and pilot area (please also see 3.3 Identification of pilot area).

The case of Guadalajara, Mexico

The results of the climate identification workshop in Guadalajara, Mexico, showed the urgent necessity for the city to tackle two main climate change impacts:
1. increased temperatures and
2. extreme weather events. These two challenges were identified and reinforced by the citizens' demand to allocate more resources to improving the quality and quantity of urban trees, which was highlighted in the city's participatory budget of 2017. Guadalajara's citizens wanted to have a greener city. Thus, given that mature trees can help regulate water flow, prevent floods and reduce the risk of natural disasters, as well as to cool the air by between 2 and 8 degrees Celsius, it was collaboratively decided that the challenge would be tackled by improving the city's urban trees.

3.3 Identification of Pilot Area (criteria)

The identification of the pilot area aims to define a circumscribed geographical location within the city where the digital solution will be co-created and first tested in a real setting with final users. The definition of this area was agreed during the kick-off workshops following a set of criteria that focused on diversity:
1. highly mixed land use (residential, commercial, industrial, etc.),
2. socio-demographic characteristics of the population (gender, age, education, occupation, etc.), and
3. balance between built and natural environment (if relevant), among others. However, the criteria should be carefully reviewed and adapted to each specific case so that they respond to each specific challenge. For example, natural areas might not be as relevant if you want to test a digital solution that tackles a challenge in education.

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1 Intergovernmental Panel on Climate Change (IPCC) 2014: Climate Change: Implications for Cities. Key Findings from the Intergovernmental Panel on Climate Change, Fifth Assessment Report. University of Cambridge and ICLEI. URL: *https://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-climate-science-business-briefings/pdfs/briefings/IPCC_AR5__Implications_for_Cities__Briefing__WEB_EN.pdf*

Figure 2: Climate challenge identification workshop in Guadalajara. GIZ, 2017

The case of Guadalajara, Mexico

In the case of Guadalajara, Mexico, the pilot area 'Lomas de Polanco' was mainly selected for its environmental fragility and the implications that this had on the social vulnerability of its inhabitants. The area was carefully defined in an attempt to balance its industrial character with residential and commercial land use, as well as the rich demographic mix of the population, which ranges from senior citizens that had lived in the neighborhood since their childhood to children that only go to school in the area. Such diversity will make it possible to identify and learn how useful the digital solution will be, in order to not leave anyone behind.

3.4 Data Privacy and Responsible Data Management Training

How can the great potentials of data be utilized while at the same time protecting citizens' rights and the reputation of cities, municipalities and public institutions? Data and data-driven innovation offer huge opportunities for cities and municipalities. However, an increasing number of cases where data has been misused have caused unintended harm, or spurred irritation among citizens. Aware of this, the ICT-A global program developed data privacy training which provides practical information about responsible data management for data and innovation projects. The aim of the course is to raise awareness about good data handling practices that integrate principles of data protection and fairness, and their use in the design of innovation projects. To that end, the training is of use to anyone in a city department that is involved in innovation projects, open data practices, data-driven projects or civic technology.

The course was designed and developed by two experts in the subject, Fieke Jansen and Julia Manske. In order to design a practical and relevant course that truly responds to needs of the cities, the development process was carried out in three steps:

1. *Identification of partner needs and concerns:* questionnaires were sent to key representatives in the program's partner cities and followed by a set of online interviews. This allowed the consultants to tailor the course to the true needs and concerns of the city staff.
2. *Pilot trainings:* The preliminary course was tested in-situ with local staff and fine-tuned to meet the potential for improvement observed and feedback provided.
3. *Digitalization to an e-learning format:* The last step was to develop an e-learning concept that could be digitalized for a further outreach.

Leading questions for the discussion with local stakeholders in order to identify a pilot area were the following:

1 What kind of problems are we facing because of the selected climate challenge in the city? Possible reasons?
2 What are the different socio-economic groups in the proposed pilot areas?
3 What are the different types of land use in the proposed pilot areas?
4 Have we identified the most vulnerable areas?
5 What are city officials doing in the proposed pilot areas? How can the ICT-A program contribute?
6 How can we involve citizens of the proposed pilot areas in a co-creation process for the digital solution?
7 Are potential stakeholders missing in the discussion?

Figure 3: Climate challenge identification workshop in Guadalajara. GIZ, 2017

The online courses on data privacy and responsible data management for cities and municipalities can be accessed here:

▪ Data Privacy Training (English version): *https://www.climate-digital-cities.com/elearning-course/*
▪ Data Privacy Training (Spanish version): *https://www.climate-digital-cities.com/curso-de-aprendizaje/*

Please see annex 2 for the data privacy and responsible data management training toolbox for cities and municipalities.

3.5 Design Thinking

In the interests of a well-defined and well-framed climate challenge, design thinking was used as a method to ideate how this challenge was going to be tackled. The aim was that the solution would meet the city's and citizen's needs and desires, in a technologically feasible and iterative, problem-solving manner. In other words, the focus was placed on the final user (citizens and city officers), and therefore, driven by and approached in line with their own views and inputs.

Design thinking, according to the Hasso Plattner Institute of Design at Standford's d.school, consists of five phases[2]:

1. *Empathize:* Gain an insightful understanding of the problem that is being solved through user research (including observance, interviews, etc.). This phase requires detailed observation, engagement and immersion into the citizens' environments and experiences to be able to understand how they think and live.

2. *Define:* This is the phase where all the information and empathy insights are synthesized to come up with the 'Point of View (POV)' or problem statement and the so called 'personas'. The POV draws on the unique findings of the empathy research and, therefore, refines the definition of the challenge in a unique design manner (please refer to the cases below to access examples of POVs and personas).

3. *Ideate:* Drawing upon the knowledge gained during the Empathize and Define phases, it is during the *Ideate* phase that brainstorming takes place to come up with ideas that tackle the problem in ways that would be seen as 'thinking outside the box'. This phase is better tackled through collective thinking, especially in diverse environments.

4. *Prototype:* The result product of the prototyping phase can be as diverse as a quick paper prototype such as a post-it or the first mock-up of a software. The important output of the phase is to get the ideas out of the citizens' minds into the physical world.

5. *Test:* During this phase the main goal is to try out the solutions and evaluate them to identify areas of improvement. The testing phase is presented as
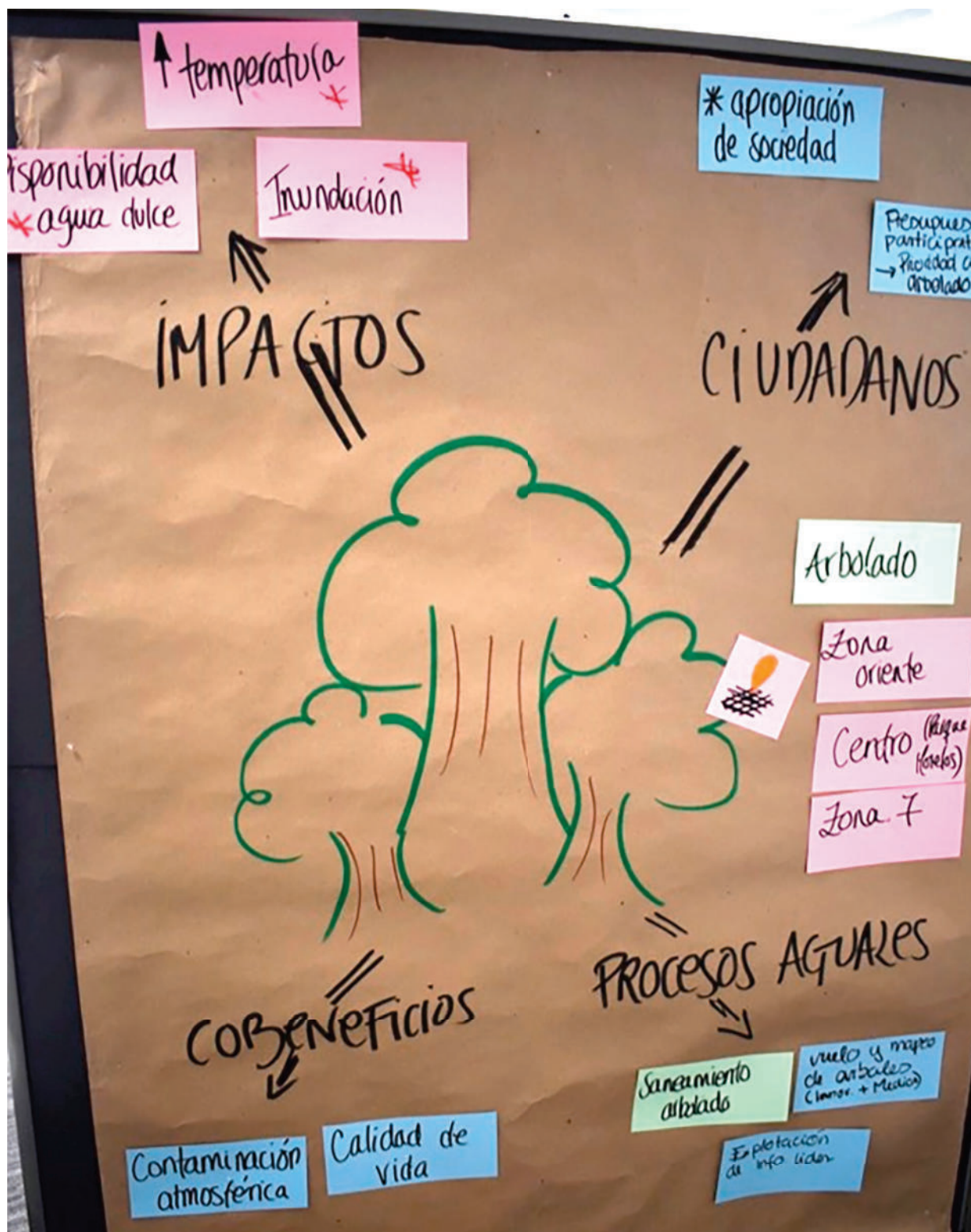
Figure 4: Climate challenge identification workshop in Guadalajara. GIZ, 2017

Figure 5: Climate challenge identification workshop in Guadalajara. GIZ, 2017

the final phase of the process but it is very important to highlight that design thinking is an iterative process, which means that after testing there is always the possibility to go back to any of the previous phases to redefine one or more problems that might come up.

In order to carry out the different phases mentioned above, design thinking draws upon different formats to bring citizens together for collective thinking, put together first models and ideas, and/or try out solutions under real-life conditions.

Design thinking sprints were the formats used and customized to the needs and requirements of the different processes in each ICT-A partner country. A design thinking sprint brings together key stakeholders with the objective of 1) putting all information and knowledge on the table so that all participants are on the same page, 2) concretizing and summing up ideas and 3) first developing 'quick-and-dirty' prototypes. ICT-A carried out design thinking sprints in all three partner countries.

The case of Trujillo, Peru
In the city of Trujillo, the ICT-A program carried out a design thinking sprint, putting all the knowledge on the table and bringing all stakeholders up to speed in order to boost open innovation and collective ideas. The design thinking sprint was carried out in a two-day event in which participants framed their challenges related to the main climate challenge threatening the city: extreme weather events, especially flooding. Participants were city officials, citizens and citizens' representatives from the pilot area, academia and private sector.

The design thinking sprint consisted of five steps:
1. Gathering the knowledge and perspectives of the citizens most vulnerable to the climate challenge and of those responsible for taking action
2. Conceptualizing a process: preliminary considerations, identifying resources, scheduling dates
3. Designing workshops and interventions: briefing for the team of facilitators, meetings with the project team, workshop schedule and outline, cohort composition and invitation of participants

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2 Hasso Plattner Institute of Design at Standford's d.school 2018: Design Thinking Bootleg. URL: *https://static1.squarespace.com/static/57c6b-79629687fde090a0fdd/t/5b19b2f2aa4a99e99b26b6bb/1528410876119/dschool_bootleg_deck_2018_final_sm+%282%29.pdf*

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4. Implementing the sprint: venue selection and preparation, production of the final schedule, clients' roles during the sprint, welcome, introduction of the topic and structure of the sprint, sprint delivery, conclusion and evaluation, recording of outcomes and outputs

5. What next?: documentation of outcomes, evaluation of lessons learned, going back to the client (debriefing), guidance on the 'next step' set for the process (other outputs, agreements, definition of quality criteria, decisions regarding adjustments, support to participants and partners).

The three main challenges that were framed by the 43 participants during the design thinking sprint were used as challenges for the following hackathon that was embedded in the design thinking process (see 3.6).

Please see annex 3 for the manual on designing and implementing a citizen-centered innovation process using agile methodologies of the ICT-A program in Peru.

The case of Guadalajara, Mexico
In the city of Guadalajara, the ICT-A program also boosted collective ideas by means of design thinking sprints.

The first design thinking sprint was a two-day event in which all 15 participants framed their issues related to the main climate challenges: increasing temperatures and heatwaves. Based on that as well as on the results of the Empathize and Define research, they refined the main three personas and developed five prototypes that were the basis for the following coding and testing of the digital solutions.

The second design thinking sprint was a one-day event in which participants focused on an interactive table for showing data gathered with the piloted digital solution to citizens without good connectivity. All participants specifically empathized to understand the needs of the users: How should they feel using this product? Does the interactive table have to fit in the car? Does the interactive table have to be easy to transport? Should it look more competent and useful for the work being done or does it make the users feel proud? The final owner of the interactive table is the Metropolitan Institute of Planning of Guadalajara (Instituto Metropolitano de Planeación, IMEPLAN) as it has a decentralized citizen council that represents the citizens who use the table, thus sharing ownership with them.

The case of Bhubaneswar, India
Three problem-opportunity spaces were identify by the ICT-A team in India based on interviews and discussions with various stakeholders: (1) flood prevention, (2) flood damage minimization, and (3) flood response, with the aim of applying citizen-centered

Figure 6: Design thinking sprint in Trujillo, Peru. GIZ, 2018.

innovation to develop a digital solution for adaptation to urban flooding in Bhubaneshwar.

The design thinking sprint consisted of three phases:
1. Defining the problem-opportunity space: primary research, secondary research, research synthesis, problem framing (problem-opportunity mapping)
2. Ideation, testing and iterating: Sprint 1.0, Sprint 2.0; here two Scrum sprints were built into the design thinking process in order to ensure ownership by city officials (see 3.7)
3. Handover and documentation.

During the design thinking sprint, all participants identified flood prevention as a problem-opportunity space, with the following two key insights gained through design research:
▪ Citizens litter drains – key to floods
▪ The Bhubaneshwar Municipal Corporation (BMC) has limited resources to identify and clean key blockages in drains before the monsoon.

Consequently, the participants defined the problem statement as follows: 'How might we help the municipal officials to be informed of the drain status in Nayapalli and Satabdinagar areas as quickly and dynamically as possible so that they can optimize their resource deployment?" Nayapalli and Satabdinagar

were defined as pilot areas during the kick-off workshop.

Please see annex 4 for a summary of the design thinking process of the ICT-A program in India.

3.6 Hackathon

The 'Adaptatón' hackathon was a competition for the ICT-A program in Peru in which prototypes of digital solutions were developed as answers to three challenges:
1. How can we learn about the best transport routes during an extreme flood?
2. How can we protect our homes from the danger of floods and landslides?
3. How can we get information and help family and friends at risk?

The challenges were the result of a design thinking sprint focused on citizen-centered innovation and involving representatives of the affected neighborhood and city officials. A hackathon can support your city not only with gathering innovative ideas and solutions, but also with connecting experts from different areas of expertise and with getting the local digital ecosystem running.

The characteristics of the hackathon were: a free and flexible space of co-creation that was prepared

Figure 7: First design thinking sprint in Guadalajara, Mexico, GIZ, 2018.

with working tables, WIFI, food and drinks to accommodate 100 participants (during 32 uninterrupted hours); access to new sources of data; participation of interdisciplinary groups of professionals and citizens. There were introductory sessions to the topics and collaborative sessions of teambuilding, concept discussion and prototype construction using digital solutions.

The hackathon focused on meeting the needs of challenges proposed by the citizens of Trujillo who are affected by floods caused by climate change, especially in the pilot area, and accompanied by local authorities. The teams identified and developed digital solutions in the form of software mock-ups that could be used during the hackathon and the following process. Participants were assisted by mentors to support their prototypes. The developed usable software mock-ups were evaluated by the jury and the three best software mock-ups received prizes defined in the rules of the hackathon.

The hackathon was announced through a website hosted at http://adaptaton18.pe. This informed the participants about the rules, the location, the schedule and the jury and allowed them to register for participation.
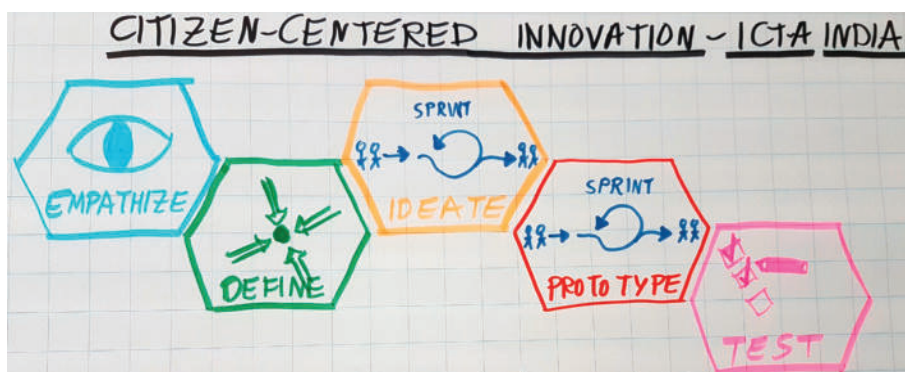

Figure 8: Design thinking process in Bhubaneshwar, India, GIZ, 2018

Figure 9: Hackathon in Trujillo, Peru, GIZ, 2018

The registration of participants had to be closed one day before the hackathon because the assigned room at the local University Antenor Orrego de Trujillo (UPAO) only had capacity for 120 participants.

The hackathon began on 27 April from 17:00 to 20:30 for the presentation of challenges and continued from 28 April at 9:00 to 29 April 29 at 18:00 for the development of prototypes or software models of digital solutions. The hackathon was carried out with the following agenda:

- On Saturday 28 April 2018, the room was opened at 8:30 and the hackathon started.
- The microphone was switched on, and the representatives of the affected neighborhoods explained their needs and challenges, outlined in the design thinking sprint.
- The space was reorganized, and the participants were assisted in setting up groups.
- A 'Solutions Clinic' method was applied on Saturday afternoon and evening, with about six sessions. These sessions were attended by the experts present.
- The 'Pitches Clinic' method was carried out and the jury decided on the winning teams.

The hackathon in numbers: More than 120 citizens registered and participated in the hackathon: they worked continuously for 32 hours to develop solutions; 12 teams were coached and there were 3 winning teams. A combination of the winning prototypes that came first and third was then coded to the digital solution that was piloted, launched and transferred in the following phases of the ICT-A program.

3.7 Scrum

The ICT-A global program had the mandate to develop a digital solution in co-creation with the digital ecosystem that supports our partner country India and our partner city Bhubaneshwar in achieving their Sustainable Development Goals (SDG) and Nationally Determined Contributions (NDC) faster.

The Scrum is the answer to the question: 'How to solve big problems and test new ideas in just five days'. This is actually the name of a Scrum book that we used for guidance in designing the process with our partners in India. Scrum is a methodological approach whereby a decider, a facilitator and a diverse team can start working on a solution for a big problem.[3]

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3 Knapp, Jake / Zeratsky, John / Kowitz, Braden 2016: SPRINT: How to Solve Big Problems and Test New Ideas in Just Five Days. Simon & Schuster Paperbacks. New York.

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We dared to use Scrum because we were running out of time. We had no time to spare for huge studies and analyses and were looking for a method to work fast in a hierarchical society such as India. We embedded one sprint into two of the steps of the design thinking process. The product owners were the city officials, especially the city's commissioner. The diverse team included city officials, citizens and citizens' representatives as well as technology experts. During the process, other groups such as ward representatives, students, teachers and volunteers were also involved at the request of our partners.

The lesson we learned here is: The more diverse the team, the better. At the beginning of the process we were cautious about handling the hierarchical local situation, but during the process our partners started requesting the involvement of other groups such as those mentioned above. Scrum is useful if you want to promote the structured inclusion of many different perspectives and increase the acceptance of the results among citizens.

3.8 Smart City Sushi

Digital solutions are a means of finding a solution to a problem. If partners and stakeholders keep focusing on the technologies (the answer) instead of focusing on the problem to be solved (the question), we can play Smart City Sushi! This is an interactive game where participants receive a short introduction to the main technologies (Internet of Things, online platforms, augmented reality, drones, artificial intelligence, blockchain, etc.). After that all participants form groups and try to identify a problem or challenge in the city to which a chosen technology would be a good answer, using a digital twin or a city map with layers. Smart City Sushi follows two steps:

1. There are many digital technologies (ingredients for sushi)
2. But if you put them together (making sushi):
    a) these are a good overall solution (sushi is delicious)
    b) these do not match (sushi does not taste good)
    c) the result backfires and is even poisonous for a society (sushi makes you sick); here there is a link to topics like just transition, lack of participation, unemployment, etc.

Instructions: It all depends on the mix!
Game idea:
Which digital technology could be a good answer to a problem/challenge in my city/program/project?
The idea is to combine digital technologies and solutions with the Nationally Determined Contributions (NDCs) and the Sustainable Development Goals (SDGs) in certain scenarios, depending on the participants' projects, in such a way that the opportunities

Figure 10: Screenshot of the hackathon's landing page, GIZ, 2018

offered by digitalization are used well and risks and problems are limited for the common good in a city and society.

Game preparation:
There are three charts with city landscapes. The charts are expanded according to the interest of the participants. Then all the charts are mixed with the digital technologies (Internet of Things, artificial intelligence, online platforms, drones, etc.). All participants take a card with a digital technology and place it in front of them.

A lottery is drawn to determine who will start the game. Then the game commences clockwise.
Each participant presents a concrete application scenario for a digital technology in response to a need/challenge in his/her city/program/project. After the presentation of the respective use cases, it will be checked if they could have positive and/or negative effects on the citizens in this scenario and if they are in accordance with the NDCs and SDGs.

The results are summed up in a SWOT analysis: Strengths, Weaknesses, Opportunities and Threats.

3.9 Mapathon
Mapathons were employed in all partner cities and were a versatile methodology that promoted dissemination and acted as an initial feedback mechanism.

During a mapathon, users of the digital solution are challenged to 'map' (generate data using the digital solution) variables in a given window of time. For example, in Mexico users were given a time window of 72 hours to map as many trees as possible using the Árbol IoT App. At the end of the time window, the persons with the highest number of generated data points were awarded prizes.

Within this mapathon, announced over social media and other communication channels, potential users are made aware of the existence of the digital solution and motivated to begin using it due to the prizes. Thereafter, the enjoyment gained from using the app as well as the sense of competition that is sparked in the participants of the mapathon are expected to promote the long-term use of the digital solution.

Due to the high number of data points created throughout the mapathon, developers can test the functionality of the back-end of the digital solution and ensure that their system works as originally planned. The presence of employees of the corresponding municipality in the target areas throughout the mapathon enables and promotes the possibility for users to report on bugs and glitches in the digital solution. The feedback collected during the mapathon can consecutively be utilized to enhance the user experiences and fix small errors that had not been encountered before.

Figure 11: Hackathon in Trujillo, Peru. GIZ. 2018.

The case of Guadalajara, Mexico

The mapathon in Mexico was programmed to take place on a weekday (Friday) and two weekend days (Saturday and Sunday). The idea of this was to reach children while at school and afterwards give them time to take part in the mapathon with their parents during the weekend. This also gave rise to a press conference right after the on-site activities on Monday to present the results and award prizes to the winners.

During the mapathon in Mexico, an info stand/pavilion was set up in the pilot area to provide users with information on how to use the app and attend the meetings and training sessions during the day. The stand/pavilion was usually open and attended from 9:00 to 18:00. GIZ and the municipal partner's staff took shifts to man the stand/pavilion during the opening hours according to a pre-agreed program. The mapathon in Mexico was designed as follows:

Day 1: Friday *Morning*		
Location	**Activity**	**Participants**
Pilot area (Information stand/ pavilion)	Internal kick-off meeting of the mapathon	▪ Municipal administration staff ▪ GIZ advisors ▪ Technical team (consultants and app developers)
Pilot area (information stand/ pavilion)	Opening talk and testing with community leaders to show them how to use the platform and engage them into promoting the app with the community	▪ Municipal administration staff ▪ Community leaders ▪ GIZ advisors
Pilot area (private houses)	Installation of five environmental sensors in the houses of volunteering neighbors. This was done in private properties with the consent of the households for security reasons.	▪ Municipal administration staff ▪ GIZ advisors ▪ Technical team (consultants and app developers) ▪ Volunteering neighbors ▪ Community leader (if desired)
Pilot area (public schools)	A round of visits to school for promotion and engagement purposes	▪ Municipal administration staff ▪ Community leader/representation ▪ GIZ advisors

Day 1: Friday *Afternoon*		
Location	**Activity**	**Participants**
Pilot area (information stand/ pavilion)	First data privacy training for citizens	▪ GIZ advisors ▪ Consultants
Pilot area (information stand/ pavilion)	General liaison with neighbors, users and visitors to the stand/pavilion. One-to-one explanation on how to use app and the mapathon.	▪ Municipal administration staff ▪ GIZ advisors

Day 2: Saturday *Morning*		
Location	**Activity**	**Participants**
Pilot area (information stand/ pavilion)	Second data privacy training for citizens	▪ GIZ advisors ▪ Consultants
Pilot area (information stand/ pavilion)	General liaison with neighbors, users and visitors to the stand/ pavilion. One-to-one explanation on how to use app and the mapathon.	▪ Municipal administration staff ▪ GIZ advisors

Day 2: Saturday *Afternoon*		
Location	**Activity**	**Participants**
Pilot area (private houses)	Monitoring of the installed environmental sensors	▪ GIZ advisors ▪ Consultants
Pilot area (information stand/ pavilion)	General liaison with neighbors, users and visitors to the stand/ pavilion. One-to-one explanation on how to use app and the mapathon.	▪ Municipal administration staff ▪ GIZ advisors

Day 3: Sunday *Morning*		
Location	**Activity**	**Participants**
Pilot area (information stand/ pavilion)	General liaison with neighbors, users and visitors to the stand/ pavilion. One-to-one explanation on how to use app and the mapathon.	▪ Municipal administration staff ▪ GIZ advisors ▪ Technical team (consultants and app developers)*

The technical team was on site during the entire mapathon in order to help solve problems and to learn about things that needed to be improved.

Figure 12: Mapathon in Guadalajara, Mexico, GIZ 2018

Day 3: Sunday *Afternoon*		
Location	**Activity**	**Participants**
Online/ consultants office	The challenges should end at some time in the afternoon in order to give time to identify the winners and prepare the speeches for the next day's press conference.	▪ Municipal administration staff ▪ GIZ advisors ▪ Technical team (consultants and app developers)*

Day 4: Monday *Morning*		
Location	**Activity**	**Participants**
Press conference room of the Municipal Palace	Press conference with the Mayor and directors of the different departments to present the first results of the mapathon and award the prizes to winners.	▪ City Mayor and directors of the different departments ▪ The media ▪ The winners of the challenge ▪ Leaders for interviews (if desired) ▪ GIZ advisors

The technical team was on site during the entire mapathon in order to help solve problems and to learn about things that needed to be improved.

3.10 Drills

The drills are simulated events that take place in a real environment. They are carried out to test and practice how the digital solution would be used in case of an emergency. Within the framework of the activities of the ICT-A global program in Peru, the drills were only implemented in the cities of Trujillo and Chiclayo to simulate a flood emergency after an extreme weather event caused by El Niño. The flood drills provided insightful feedback that helped the iterative design process.

The case of Trujillo and Chiclayo, Peru

The flood drill that took place in the cities of Chiclayo and Trujillo was organized in the same way. For this, it is important to know that the project was developed right from the start together with the following units or offices from the respective municipalities:

Municipality of Trujillo
(Municipalidad Provincial de Trujillo, MPT)
- Gerencia del Plan de Desarrollo Territorial de Trujillo (Management of Trujillo's Urban Development Plan)
- Gerencia de Sistemas (IT Systems Management)
- Sub Gerencia de Defensa Civil (Civil Defense Sub-Management)
- Sub Gerencia de Participación Vecinal (Sub-Management of Neighborhood Participation)

Municipality of Chiclayo
(Municipalidad Provincial de Chiclayo, MPCH)
- Instituto Metropolitano de Planificación Territorial y Gestión Catastral (Metropolitan Institute of Urban Planning and Cadastral Management)
- Centro de Defensa Civil y Gestión de Riesgos de Desastres (Center for Civil Defense and Disaster Risk Management)
- Gerencia de Tecnología de la Información y Estadística (Information Technology and Statistics Management)
- Sub Gerencia de Participación Vecinal (Sub-Management of Neighborhood Participation)

Once the municipal structure was defined, the steering offices determined a pilot area in each city, and involved the respective neighborhood leaders during the development of the AYLLUDAMOS platform. The city of Chiclayo worked directly with the Municipality and its board of directors, while the city of Trujillo designated the "neighborhood Mayors" (neighborhood leaders) and its board of directors as partners. An initial assessment was carried out to identify leaders with a higher level of acceptance in their territories and to verify the specific conditions of those territories with regard to flooding from extreme weather events. These leaders set the bases for defining a specific polygon within the pilot area. In the city of Trujillo the

Figure 13: Mapathon in Guadalajara, Mexico, GIZ 2018

flood drill took place in Neighborhood Territory 28 (Mampuesto), while in Chiclayo it took place in the Santo Toribio de Mogrovejo settlement.

It is important to note that these drills would not have been possible without the active participation of the neighborhood leaders and their associates. Likewise, the involvement of civil society and of the municipal staff played a fundamental role in the drills.

The organization of these drills involved the following stages:

a) implementation and dissemination of the digital solution,

b) preparation and dissemination of the drill,

c) execution and evaluation of the drill.

The following topics were discussed in all the office meetings:

▪ Management of the Trujillo Urban Development Plan – MPT and Metropolitan Institute of Urban Planning and Cadastral Management – MPCH. What could the digital solution do to generate new tools for sustainable urban development and an improvement in the quality of life of the citizens from the Smart Cities perspective and the work on a city's big data?

▪ IT Systems Management – MPT and Management of Information and Statistics Technology – MPCH: How does the digital solution adapt itself to the dig-

ital and computer systems of the municipalities and how is it intertwined with the information generated between all the authorities involved in the project? In addition, it was discussed how reports are generated on the conditions of the project and its actual operation for presentation to the General Management and the Office of the City Council.

▪ Sub-Management of Civil Defense – MPT and Center for Civil Defense and Disaster Risk Management – MPCH: How does the digital solution become a tool for better management of the extreme floods and their consequences, thus being a catalyst and an instrument that makes it possible to help the population better and faster when events such as those mentioned above, or other local events, occur.

▪ Sub-Management of Neighborhood Participation, for both municipalities: in these offices we work on how the population obtains direct and immediate benefit from the digital solution and based on that, we involve them in the project and the next stages.

At this point it is very important that the counterpart and the GIZ approach the piloting area and especially the sector where the drill takes place in order to demonstrate the importance of the digital solution, its operation and advantages for the population and the time of use. If it is possible, it is important to design tactics that incentivize the population to use the dig-

Figures 14 and 15: Mapathon in Guadalajara, Mexico, GIZ 2018

ital solution. These tactics generate good results because they make it possible to learn about the digital solution faster and better.

a) Preparation and dissemination of the drill
This is strictly a field stage in which we (the counterpart and GIZ) approach each of the human settlements or piloting areas. Also, we start by determining the most obvious areas for the drill and the neighborhood leaders that have the greatest power to call on the local people to participate.
- The criteria for choosing the areas for the drill are:
  - Flood conditions and flood risk Situation of social exclusion and danger to the population based on widespread crime.
  - Access to basic services: water, drainage, electricity and telecommunications.
  - Distance from urban equipment: firefighters, commissioners, health centers, schools, water reservoirs, etc.

These characteristics are useful for determining the complexity of the possible areas where the drill would be carried out and the best conditions for its implementation.
- Criteria for working with a neighborhood leader or other:
  - Identification and empathy with the population

- Knowledge about the territory that is represented
- Relationship with the neighborhood leaders of other territories
- Relationship with municipal authorities and the city council.

The neighborhood leaders who meet these conditions to the sufficient degree will ensure that the population commits to participating in the drill and will make sure that citizens from other areas are informed about what to do during the drill. This will also guarantee that the authorities provide unconditional support during the drills.

For the preparation of the drill, the population from the selected sector must be trained, within the area of piloting. A large number of citizens or leaders from that sector should also be motivated to become committed and to disseminate the digital solution and the drill event.

In the case of the municipality, training must also be provided on how to manage the back-end and about how it interacts with the population at the time of the drill and during its use in real life.

It is at this stage that contacts are established with the National Police of Peru (PNP), the Peruvian General Fire Corps (CGBP), and other institutions that ensure a rapid response to the emergency, such as the Peruvian Red Cross (CRP) among others.

Figure 16: Official press conference with Mr. Enrique Ibarra, Mayor of the City of Guadalajara, for launching the digital solution 'Arbol IoT', Guadalajara. GIZ, 2018

Figure 17: Official press conference with Mrs. Soumini Jain, Mayor of the City of Kochi, for launching the digital solution 'Flood-free Kochi, Kochi'. GIZ, 2020

The connectivity and internet access of citizens in the neighborhoods should be considered, since not all of the local people have an internet flat rate for their mobile phones. Three or four internet points must therefore be established where the neighbors can connect to a WiFi network so that their mobile phones have the necessary connection to use the AYLLUDAMOS application.

b) Execution and evaluation of the drill
For the execution of the drill, times must be arranged for the arrival of the reaction units such as National Police, General Fire Corps and the Civil Defense, so that they are placed in specific areas adjacent to the site of the drill.

Once these units have arrived, the neighbors must assemble at the reporting areas (WiFi access zones) to start generating reports simulating heavy rain, so that the fire units (pump trucks) then enter to water the area where the flood is supposed to occur.

When the citizens have spent about 10 minutes issuing reports, the Municipality assesses the reports from its facilities and the rescue units such as ambulances, fire brigade, and the National Police approaches the different points where the reports were generated so that the affected citizens are evacuated safely, preferably to a hospital and that these citizens wait there until the end of the drill.

3.11 Launch Events
After internal testing and piloting with citizens and city officials, launch events represent a major milestone in the roll-out of digital solutions, in order to reach out to all citizens that were not directly involved in the co-creation and pilot phases. A rule of thumb for launch events is that the higher the rank of the city official launching a digital solution, the better. This is why all launch events were headed by mayors or commissioners.

Launch events usually consist of two parts:
▪ Events with the citizens in different parts of the city
▪ Official press conference with the Mayor or Commissioner

After the launch events and a period of observation and preparation of the transfer packages for the digital solutions, we supported our partner cities in approaching the national partners to exchange lessons learned, present the transfer packages and discuss possibilities for anchoring the digital solutions in national systems for the purpose of scaling up.

The case of Bhubaneswar, India
In the case of the ICT-A global program in India, students from the local universities and training institutes were identified as change agents, so that the municipal

Figure 18: Closing event with Mrs. Marushka Chocobar, Secretary of Digital Government of the Presidency of the Council of Ministers of Peru (SEGDI/PCM), for scaling up the digital solution 'AYLLUDAMOS', Lima. GIZ, 2019

corporation issued a call for volunteers that met with an enthusiastic response from the students.

They identified a school at the heart of the piloting area for the main community event within the framework of the official launch, providing adequate space for a large number of individuals and engaging different age and ethnic groups. The fact that the school was located in one of the areas usually affected by the challenge of urban flooding facilitated the engagement of the attendees, as they were frequently impacted. In terms of outreach and carrying the message and use of the digital solution beyond those immediately present at the meeting, children will tell parents and grandparents about the use of the digital application and the underlying environmental and behavioral trends (climate change and increased rainfalls coupled with the inadequate disposal of waste in the storm drainage system). Also, parents who were picking up their children from school were able to partake in the meeting.

Correct choice of promotional material and form of dissemination of information:
If the aim is to foster community engagement and spread awareness of a particular digital solution, the use of communication materials and their mode of dissemination should be taken into consideration. Here, options include brochures and printed material, social

media channels, TV advertisements, community engagement teams and more.

In Bhubaneswar, a city with many digital enthusiasts and digital natives, direct use of the digital solution combined with social media was the best approach. Individuals were contacted who were eager to dive straight into the Google Playstore in order to utilize the volunteer app right away. That being said, the fact that volunteers were able to establish a personal connection with potential users and explain the process and purpose of the application was a great asset in its dissemination.

Based on the experiences made in Bhubaneshwar, we would encourage all experts and organizations that would like to launch their own application to provide a QR code that leads users to the application in the Google Playstore, Apple Appstore and others, as it reduces the time during which (busy) pedestrians need to stop in their tracks when being approached.

CHAPT

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Annex

A Rapid Assessment Tool for Partner Cities for ICT-based Adaptation to Climate Change in Cities

Global Program „ICT-based Adaptation to Climate Change in Cities" (ICT-A)

Author:
Ankit Bhardwaj

4.1

A Rapid Assessment Tool for Partner Cities for ICT-based Adaption to Climate Change in Citites

Global Program „ICT-based Adaptation to Climate Change in Cities" (ICT-A)

Contents

List of Abbreviations

ACCCRN	Asian Cities Climate Change Resilience Network
ADB	Asian Development Bank
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AR5	Fifth Assessment Report
ATREE	Ashoka Trust for Research in Ecology and the Environment
BDA	Bhubaneswar Development Authoirt
BMC	Bhubaneswar Municipal Corporation
BSCL	Bhubaneswar Smart City Limited
BUKC	Bhubaneswar Urban Knowledge Centre
CC	Climate Change
CEO	Chief Executive Officer
CII	Confederation of Indian Industry
CODISSIA	Coimbatore District Small Industries Association
COINDIA	Coimbatore Industrial Infrastructure Association
COINTEC	Coimbatore Trade Fair Complex
COJEWEL	Coimbatore Jewellery Manufacturers' Association
CPR	Centre for Policy Research
DPR	Detailed Project Report
DRR	Disaster Risk Reduction
FICCI	Federation of Indian Chambers of Commerce & Industry
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
HUDD	Housing and Urban Development Department
IAMAI	Internet and Mobile Association India
IAS	Indian Administrative Service
IBM	International Business Machines Corporation
ICCI	Indian Chamber of Commerce and Industry
ICLEI	ICLEI – Local Governments for Sustainability
ICT	Information and Communication Technology
IDRC	International Development Research Centre
IED	Institute of Entrepreneurship Development
IFS	Indian Foreign Service
IIHS	Indian Institute of Human Settlements
IIT-B	Indian Institute of Technology - Bhubaneswar
INCCA	Indian Network for Climate Change Assessment
INDC	Intended Nationally Determined Contribution
INR	Indian Rupee
IPCC	Intergovernmental Panel on Climate Change
IRADE	Integrated Research and Action for Development
ISNA	Information and Services Need Assessment
IT	Information Technology

ITAO	Information Technology Association of Odisha	
JNNURM	Jawaharlal Nehru Urban Renewal Mission	
KIIT	Kalinga Institute of Industrial Technology Bhubaneswar	
LAN	Local Area Network	
MIS	Management Information System	
MOU	Memorandum of Understanding	
NASSCOM	The National Association of Software and Services Companies	
NRDC	Natural Resources Defense Council	
NGO	Non-governmental Organisation	
ORSAC	Odisha Space Applications Centre	
OSDMA	Odisha State Disaster Management Agency	
PMU	Project Management Unit	
PWD	Public Works Department	
RAAC	Resident Awareness Association of Coimbatore	
RCP	Representative Concentration Pathways	
SAFE	Scientific Awareness Forum	
SAPCC	State Action Plans on Climate Change	
SDC	Swiss Agency for Development and Co-operation	
SPV	Special Purpose Vehile	
SWOT	Strengths, Weaknesses, Opportunities, Threats	
UDA	Urban Development Authoirt	
ULB	Urban Local Body	
UN	United Nations	
UNDP	United Nations Development Programme	
UNISDR	United Nations International Strategy for Disaster Reduction	
US AID	United States Agency for International Development	
USA	United States of America	
WAN	Wide Area Network	
WRII	Working Group II	
WWF	World Wide Fund for Nature	

Summary & city choice

Of late, two distinct trends are influencing city-based climate efforts in India. First, India's Intended Nationally Determined Contribution (INDC) set a strategic direction of climate-aware growth in India. The INDC made explicit reference to schemes such as the Smart Cities Mission which enable the mainstreaming of climate friendly and sustainable planning practices and projects in cities. Second, is the push for a more digital economy and government with schemes such as Digital India and Startup India. These have anchored the role of Information and Communication Technology (ICT) as critical to the growth of a city and success of its schemes. This project ICT-based adaptation to climate change in cities intends to bring together expertise in urban development, climate change adaptation and information and communication technologies (ICT) together. In cooperation with partner cites a digital solution which engage citizen in the co-creation of their cities to achieve urban resilience should be developed, customized and tested.

The purpose of this report is to make an evidence-based selection of a partner city for the project. The three cities of Bhubaneswar, Odisha, Coimbatore, Tamil Nadu and Kochi, Kerala were shortlisted for selection. The selection was done in a two-stage process. First, for each city, a rapid assessment was made on the basis of desk analysis. Multiple criteria for the following categories were analysed: A) climate risk and data availability, B) climate adaptation, C) digital and ICT practices and D) ICT innovation ecosystems. The raid assessment prioritises selection of cities that are at higher risk to climate change and have a more mature IT ecosystem by assigning these criteria a higher weight. The rapid assessment found that Bhubaneswar was most suitable for the project, though Coimbatore and Kochi offered viable options. As a second stage of the analysis, a verification and scoping trip was made to Bhubaneswar.

Amongst the three, there is no wrong choice. All have a history of climate adaptation projects including ones in partnership with international agencies and have relatively mature ICT ecosystems and a conducive state policy environment around climate change and ICT projects.

However, **Bhubaneswar** stands out. It is the most prone to climate change, with high levels of projected heat stress and cyclonic risk. Over the past two years it has faced two heat wave episodes of note. The city has relevant local data due to projects with UNDP and World Bank on local hazards, vulnerability and resilience action plans. It also has an ongoing project with the IDRC on formulating a climate adaptive plan for the city. Subsequent city planning, including the city's Comprehensive Development Plan, has incorporated these climate adaptation goals into the city's objectives. In conversation, the city government also stressed the related risks of water logging and flooding. The city also highlighted that it had a past 'Local Resilience Action Plan', an ongoing development of a 'Heat Resilience Plan' and a future proposed 'Regional Resilience Plan' in the works. These three-explicit climate adaptation body of work will have useful synergies with this project. Interest on the issue was thus high and was also complemented by an enthusiastic civil society.

This has been complemented by the city's strong performance in the Smart City Mission, where it aims to enhance local startups and availability of open data in the city. Organizations such as Bhubaneswar Development Authority and the Bhubaneswar Municipal Corporation also displayed enthusiasm in using ICT-based tools for planning and collecting data at the city level. Ongoing projects include the Information Management System being setup by Bhubaneswar Smart City Limited, uniquely amongst the three cities, it also has a GIS-based open data platform, 'Bhubaneswar One' and aims to scale up its efforts with a Bhubaneswar Urban Knowledge Centre.

Unlike the other two, it is also a state capital. The state government is actively involved in local affairs and pilots and showcases state schemes in the city. The state government has also made a

strong push to enhance the city and state's IT sector, including bolstering local educational institutions and startup incubators. A potential challenge is, however, that the majority of relevant data rests with the State government. Buy-in from these organizations need to be garnered as part of a parallel process.

The city's IT sector is anchored around big companies and its universities. The latter in particular, are aiming to foster an environment conducive to innovation by providing lab support, and entrepreneurship and digital incubators. The student body too is enthusiastic in its pursuit of digital innovation and involvement in activities such as hackathons. However, few local companies or startups have been involved in projects with the city government. The city's IT sector primarily has a hardware focus. But still , the innovation ecosystem of Bhubaneswar provides a good basis for the successful implementation of the project with multiple large IT companies and a vibrant IT-focused university faculty and student body.

All things considered, the advantages of an active and consenting city government and related institutions outweigh the potential risks of the city's nascent IT ecosystem and State government exclusivity of data. Mitigating these risks is possible. The city's universities and large student base offer a potential enthusiastic base to generate local innovation. The State government too has active related projects, such as an early warning system for cyclones, which can potentially be tied into city initiatives. An ambitious project can also involve dedicating resources towards bringing State government on board, and creating a portal, perhaps based around Bhubaneswar One, which collates, synthesizes and analyses various climate adaptation related data sets for the city, from state, city, primary and other sources.

Table 1: Summary of Index from Rapid Assessment

	Bhubaneswar	Coimbatore	Kochi
Climate Risk & Data	2.30	1.67	1.94
Climate adaptation	2.67	2.05	2.55
Digital, ICT in City government	2.50	1.98	2.00
ICT, Innovation Ecosystem	2.03	2.29	2.28
Total	**2.38**	**2.00**	**2.19**

The other two also present viable options with mature ecosystems. Coimbatore has multiple incubators and angel investor networks. It's city government also has a track record of ICT-based citizen engagement. Coimbatore however, is projected to be relatively sheltered from climate change's impacts. Kochi too has a far more mature startup ecosystem, bolstered by an active state policy on digital innovation, including investment in infrastructure in the city of Kochi. This has also attracted the UN to setup a Technology Innovation Lab in Kochi and the ADB to assist the state government with a Kerala Sustainable Urban Development project. Kochi is also highly prone to flooding due to sea-level rise, and has ample local data on this issue. These factors indicate that these cities are also suitable to the project, and are viable options, if not chosen, for upscaling.

This report will summarize the method used to the assess the cities and then provide a brief interpretive review of each city along the chosen criteria. Then it will dive into a deeper analysis of the city of Bhubaneswar, reflecting findings from the visit to the city. Finally, a set of upscaling options are outlined.

Method

This analysis will happen in two steps. First, a desk based rapid assessment of the three cities was conducted followed by a scoping and verification trip to the city that topped the assessment.

Step 1: Rapid Assessment

The assessment evaluated cities on four categories:

A. Climate risk (and data availability)
B. Climate change adaptation policy in the city
C. Digital and ICT policy by city government
D. ICT Innovation ecosystem in city and region

For each category, multiple criteria were identified. The methods involve both a thorough analysis of each category based on current available information via desk research, and information from further interviews with GIZ members and city officials. Both quantitative and qualitative material will be utilized. Datasets and evidence from academia, policy institutions and government will be incorporated.

Data for each of the criteria in a disaggregate matter has been collected in the accompanying excel sheet. For each criterion, cities were assigned a 'score' from 1 to 4 where:

- 4 is (Highly Recommended)
- 3 is (Recommended)
- 2 is (Partially Recommended)
- 1 is (Not Recommended)

The scores were summed to given an indication of the city's performance in the category but is also complemented with an inductive interpretation.

For each city, the assessment identifies:

- Critical climate risks which can be the focus of the adaptation projects
- Potential partner and stakeholders within each city
- Ongoing practices by actors, if any, will be collated as part of potential upscaling options.

A. Climate Risk (and data availability)

The first set of metrics develop a vulnerability profile of a city, its residents, infrastructure and economy. The index will also be cross-checked with other indices in the literature. A focus will be given to granular analysis and data collection, prioritizing city-level analysis, then region, and eventually State as in the State Action Plans on Climate Change (SAPCCs).

This index assesses the physical vulnerabilities to climate change, disaster and environmental risks. Acknowledging the additional vulnerability due to infrastructure deficits it also analyses infrastructural and locational vulnerabilities which will be further stressed due to climate change. It also assesses "extent" of loss by characterizing importance to state economy and type of employment. Subjectively assessing these various factors, an understanding of local data availability is also developed.

S/no	Index	Sources and notes
A.1	Recent climate change relevant disasters	Relevant disasters of past 5 years; media search
A.2	Heat stress projections	Increase in morality due to heat via RCP models eg. Garg et al.
A.3	Water stress projections	Indiawaterportal.com
A.4	Storm and Cyclone Risk	National Disaster Management Agency
A.5	Flood Risk	National Disaster Management Agency
A.6	Drought risk	National Disaster Management Agency
A.7	Air pollution	Urbanemissions.info,
A.8	Land-based vulnerabilities	City profile

A.9	Deficit in Infrastructure	Census: Lack of shelter, congested housing, piped water, drainage, hospitals per 1000 people etc.
A.10	Vulnerable population	Census: Working Age Population, % Children, Urban poverty ratio, Slum dwellers
A.11	Future growth	World Urbanization Prospects
A.12	Risk of economic loss	% GDP of State, % non-Tertiary workers, % casual labour
A.13	Climate vulnerability index	Kelkar et al.
A.14	Sustainability index	Reddy & Tiwari
A.15	Expected Risk due to Climate Change	INCCA 4x4 India Climate Vulnerability assessment; locally available data
A.16	Availability of local data	Subjective assessment from above

B. Climate change adaptation in the city

How familiar is the city to climate adaptation practices? How attuned are the governance structures to climate adaptation? Is there data available at the city level to begin fostering such responses? These set of indices outline the extent to which the municipal government and other key actors have incorporated climate adaptation into their governance practices.

Other key actors include relevant para-statal agencies or parallel governance organizations such as SPVs, local civic society champions or most crucially the State government who are responsible for climate adaptation and relevant sectors. Thus, plans such as the State's Action Plans on Climate Change and relevant schemes will also be reviewed as part of the assessment. India's INDC also has explicit reference to urban development and climate adaptation and the alignment of city activities with such goals will also be considered during analysis.

Actors also will be included as per the relevance of their activities with climate adaptation. This is also broadly defined to include activities which are related to or have co-benefits of climate adaptation as a "process of adjustment to actual or expected climate and its effects" (WRII, AR5, IPCC Report: 40). Both incremental and transformational initiatives will be included.

S/no	Index	Sources
B.1	Integration of "climate adaptation" in city plans	Smart Cities Proposals, Masterplan, other relevant city level plans such as the "Comprehensive Development Plans" (CDPs), Sanitation plans and mobility plans, Alignment with actions in the INDC; Kumar and Geneletti
B.2	Local practitioners, technical consultancies, and NGOs in climate adaptation space	Web search; Organizations searched will range from local planning groups to NGOs in related space
B.3	Local or regional university departments working in climate adaptation	Web search
B.4	International climate agencies and National and Global Expertise in the city	Eg. international climate specialist groups such as ICLEI
B.5	State focus on climate change	SAPCCs
B.6	Urban focus of State Action Plans on CC	SAPCCs

B.7	Municipal Corporation governance structure	Analysis focused particularly on hierarchy and also sectoral distribution of work especially of departments relevant to climate adaptation eg. Water. Will highlight relevant iCT cells.
B.8	Parallel institutions with focus relevant to urban adaptation	Prevalence of parallel urban/ para-statal institutions with technical or ICT expertise eg. Smart City SPVs, Urban Development Authorities (UDAs), Public Works Department (PWD), urban scale water / sewerage departments. Local hybrid institutions such as consultancies, knowledge centres, incubators which have an active relationship with the Urban Local Body (ULB) and gv't. State authorities also included
B.9	Membership to climate or disaster response networks	Eg. ICLEI, C40, Indian Ocean Tsunami Warning System
B.10	Past and ongoing projects with relevance to climate adaptation	Web search with attention to projects by of International Development Agencies and Financial Institutions eg. ADB, KfW, AfD
B.11	Disaster response practices	Does the city have cyclone or flood response systems in place?

Sections B.4-B.8 will be used to develop a stakeholder map for each city.

C. Digital and ICT policy by the city government

A push for "Digital India" and "Smart Cities" has fostered a host of ICT and digital based practices in cities. How have the cities fared on this front will provide an indication of the political and institutional willingness for ICT based approaches? Both adoption of digital practices in recent plans for the Smart Cities Missions Records and ICT adoption such as digitization of records, of governance and municipal services will also be used to evaluate a city government's embracing and enabling of digital reform and innovation.

S/no	Index	Sources
C.1	Extent of Digital solutions in Smart Cities Mission	Smart Cities Proposals and DPR
C.2	Presence and scope of an "Integrated Command and Control Centre"	Smart Cities DPR and Media tracking
C.3	Creation of "City Mobile App" as part of Smart Cities Mission	Smart Cities Proposals and DPR
C.4	Presence of other "open platforms" of interaction between actors	Focusing on platforms related to climate adaptation early warning or crowdsourced disaster mapping systems
C.5	Usage of GIS and availability of open GIS data	Municipal sources, City Masterplan.
C.6	Open data available at the city level	Interviews, web search to identify if municipal and other related databases are analog or digital and/or available on the web. Potential institutions are local urban government, para-statal bodies, State government stakeholders -

C.7	Adoption of e-Governance as per JNNURM reforms	Computerization of Property tax collection, accounting, water supply and other utilities, birth and death registrations, health programs, citizen grievances, personnel management systems, building plan approval, e-procurement, bills and payment, online payment capacity, e-mail usage from JNNURM documentation
C.8	Access to LAN, WAN and State Data Centre	Information and Services Need Assessment (ISNA) Study for Urban Local Bodies
C.9	Status of municipal website	Municipal website
C.10	Usage of social media	Presence on Facebook, Twitter, MyGov.in, Instagram, Whatsapp etc.
C.11	Other digital initiatives by ULB, sectoral departments, parallel institutions or closely related private or civic actors	Search of other existing digital initiatives related to schemes such as 'Digital India' or 'BharatNet'
C.12	State and city digital and data strategies and governance	Understanding of state initiatives, policies, schemes, financing and programs oriented towards digitization of data, open data and data production, especially if relevant to climate adaptation

D. Digital and ICT Innovation Ecosystem in the

Fourth, as the project involves ambitious, and potentially transformative practices in the cities, and understanding of the "innovation ecosystem" is required. This index will provide an understanding beyond capabilities of the municipal government and seek to understand the local environment of digital innovation and capacity. These indices map local extent of ICT-related businesses, institutions and practices working at the intersection of urban planning, climate adaptation and ICT. The focus will be on identifying actors which can be potential local champions and partners in the ICT based adaptation pilot. Such actors will be enablers of digital transformations in the city. This will also include citizen access to internet, local smartphone penetration and usage of social media platforms, thus building a basis to explore options of either telecom based warning and messages, or even crowdsource based approaches. It will also assess the digital infrastructure in the city.

S/no	Index	Sources
D.1	Presence of Multi-national IT corporations in the city	Eg. Siemens, Microsoft, IBM, Honeywell etc.
D.2	Presence and names of local ICT based or digital small to medium enterprises (SMEs) and startups	FICCI numbers, CII, websearch
D.3	Local innovation hubs, co-working spaces, fabrication labs, civic hacker or IT groups, incubators, innovation and startup funding schemes	Web search. Also including number of local SEZs
D.4	Trade fairs, industrial organizations in digital and ICT sector	FICCI, CII, web search
D.5	City planning organizations and practitioners using ICT	Web search, including organizations

D.6	Local civic actors with ICT capacity	
D.7	Local university with ICT departments	Web search
D.8	Internet (including smartphone penetration)	IAMAI database
D.9	Mobile penetration	Census
D.10	Computer penetration	Census
D.11	Computer based Internet penetration	Census
D.12	Usage of social media in city	Number of tweets in onemilliontweets map
D.13	Digital infrastructure in city	ICT infrastructure include fibre-optic access (BharatNet), 4G network, broadband
D.14	Affordability of digital access, internet, and mobile networks in the city	Price indices (Komparify)
D.15	Education level of the city	% of Graduates in the city (Census)

Step 2: Scoping Visit

The second step involved visiting the city that emerged as the most viable option from the rapid assessment, in this case Bhubaneswar. The purpose of the trip was three-fold:

1. Verifying and substantiating the desk analysis conducted for the city on its climate risk, data availability, ongoing climate adaptation, digital or ICT projects and ICT innovation ecosystem,
2. Identifying potential stakeholders in the city,
3. Gauging the interest level or potential co-operation of important actors in the city.

During the trip we engaged with members of city government, those involved in the local IT ecosystem including universities, startup incubators, IT associations and startups, and members of the civil society concerned with climate adaptation. We conducted semi-structured interviews with each of the stakeholders to both verify information we gauged from the desk analysis but also gauge interest level in the project. In the appendixes, you can find the loose set of questions we structured the interview around, adapting the questions to the various actors.

For the city of Bhubaneswar, we then developed a detailed "Strengths, Weaknesses, Opportunities & Threats (SWOT)" analysis for the city, and a map of the various stakeholders and their interests, incentives and ongoing projects. In the appendices, we also provide short summaries of each of our meetings with the various interviewed.

Results from the Rapid Assessment

This section provides an interpretative review of the findings from the desk research. Further detail of the cities' features are available in the accompanying excel sheet, and sources for the analysis are available in the appendix.

Table 2 provides an extended summary of the various cities features alongside multiple criteria. This is an expansion of Table 1. For sake of convenience and presentation, criteria have been categorised into sub-categories. For each of the subcategory, criteria scores from 1-4 are averages and then

multipled by the assigned weight. Both criteria included in each subcategory and the assigned weights are detailed in Table 2.

The weightages provide equal priority to each of the four categories but prioritise the city's local IT ecosystem and climate change risks in the subcategories. This was done in consultation with GIZ. Sub category scores are summed to provide category scores, and then ranked 1st (green), second (yellow), and third (red) for each of the categories. These are then averaged for the final score.

As Table 2 makes evident, Bhubaneswar is the city at most risk to climate change, has the most robust history of climate adaptation and digital action by the city government but does not have as mature of an ecosystem as Coimbatore or Kochi. However, it has a set of adept educational and civic society institutions along with adequate digital infrastructure and a high proportion of educated population which can provide conditions for IT innovation in the city.

We provide an interpretative analysis for each of the cities in the following sections.

Table 2: Detailed summary of cities by criteria and weights

Subcategories	Weight		Bhubaneswar	Coimbatore	Kochi	Criteria
A. Climate Risk & Data						A
Climate change risks	8%		0.17	0.10	0.15	1-8, 13-15
Infrastructure Deficits	4%		0.11	0.08	0.06	9,11,13
Economic and Institutional risks	4%		0.08	0.09	0.08	12-14
Data availability	4%		0.13	0.09	0.13	16
Social vulnerabilities	4%		0.08	0.06	0.06	10,14
25%		*Sub-Total*	*2.30*	*1.67*	*1.94*	
B. Climate adaptation						B
Climate adaptation in the Smart City proposal	5%		0.13	0.11	0.09	1
Climate adaptation in the Masterplan	5%		0.11	0.05	0.15	1.4-1.7
Climate relevant Actors	5%		0.12	0.13	0.13	2-4
State plans, policy and actions	5%		0.17	0.12	0.17	5-6
City plans, policy and actions	5%		0.15	0.10	0.10	7-11
25%		*Sub-Total*	*2.67*	*2.05*	*2.55*	
C. Digital, ICT in City government						C
Digital solutions in the Smart City proposal	6%		0.19	0.14	0.13	1-3
Open Data platforms and policies at the city-level	6%		0.08	0.04	0.04	4-6
City digital projects	6%		0.17	0.19	0.08	7-11
State digital policies and projects	6%		0.19	0.13	0.25	12
25%		*Sub-Total*	*2.50*	*1.98*	*2.00*	
4. ICT Innovation Ecosystem						D
Local tech ecosystem	13%		0.33	0.40	0.43	1-4
Educational institutions and civic organizations	6%		0.13	0.10	0.08	5-7
Digital infrastructure	3%		0.06	0.07	0.06	8-14
Education level	4%		0.11	0.08	0.08	15
25%		*Sub-Total*	*2.03*	*2.29*	*2.28*	
		Total	**2.38**	**2.00**	**2.19**	

Bhubaneswar

Bhubaneswar is the capital of the State of Odisha. It is located approximately 50 kilometres inland from the eastern coast of India, on the Bay of Bengal. It is near the Mahanadi river and has a population of around 850,000 as per the census, though it is part of a larger metropolitan region with Cuttack of about 1.4 million people.

Key climate adaptation challenges and risks

Amongst the three cities, Bhubaneswar is at the most risk to climate change.

In the previous two years, the city has faced severe **heat waves** in the summer which has also led to water shortages. Climate change is set to exacerbate this. As per a modelling of climate change 's impact on Indian cities, in a mid-range scenario, Bhubaneswar will see a 37% increase in heat related mortality by 2080.

Bhubaneswar is also in the high **cyclone risk** zone, near the Bay of Bengal coast. It last faced a cyclone in 2013, Cyclone Phailin. While cyclones are more destructive in Orissa's coastal and rural regions, Bhubaneswar is also prone to flooding due to cyclones.

Climate related disruptions also has immense implications to the regional economy as the city is primary economic hub of the state. Planning for resilience is thus critical for Bhubaneswar.

Both these risks have been part of research and project efforts in the city for the past decade.

- The World Bank aided in the creation of a Local Resilience Action Plan which focused on alleviating heat stress and flood risks in the city.
- The UNDP facilitated a Hazards and Vulnerability Index for the city which covered a variety of climate and disaster related risks faced by the city.
- NDRC planned to do a local heat stress assessment study in the city.
- The IDRC, along with local partner IRADE, is creating a climate adaptive plan for the city.

Bhubaneswar also has the highest proportion of slum dwellers amongst the three cities and has the least amount of residents with treated water and drainage. Without adequate infrastructure, the city's residents more vulnerable to climate stresses.

Key takeaways and highlights on city governance and digital ecosystem

Due to the previous projects on climate adaptation in the city and state level, Bhubaneswar's masterplan has an explicit focus on 'Environment and Disasters' including mitigating air, water, heat and flood related risks. Climate agencies such as ICLEI and ACCCRN are also active in the city.

In particular, what set Bhubaneswar apart from the other two cities was the focus of its Smart Cities Mission on enhancing city level open data and the startup environment. The special purpose vehicle designated part of the mission, Bhubaneswar Smart City Ltd., also has an explicit aim to create a mobile application aimed at improving disaster responses. The city has also begun to implement these aims. **Bhubaneswar One** is a city-level open data platform based on GIS and integrating multiple city-level databases. It also plans to setup a **Bhubaneswar Urban Knowledge Centre** to anchor these initiatives.

Bhubaneswar's Municipal Corporation's IT efforts are currently headed by a dedicated BMC IT Project Management cell. This has also been bolstered by the active and sustained involvement of technical planning practice IBI Group in the city, especially in the Smart Cities Mission. The city has also previously collaborated with Axis Bank and WIPRO to digitize its data.

The State government plays an active role in setting the climate adaptation agenda. The SAPCC has a set of relevant urban guidelines on heat, flood and community-based planning. State organizations such as **Odisha State Disaster Management** Agency (OSDMA) have also been critical in mainstreaming resilience planning in the city, including in the creation of an Early Disaster Warning System.

Recently, Odisha has made a strategic overture to enhance the regional IT sector with its data and ICT policies and state sponsored trade fairs such as Advantage Odisha. Bhubaneswar has been central to these efforts with local organizations such as **IT Association of Odisha** (ITAO) playing an active role in convening and enabling digital innovation in the city. This has also attracted international businesses such as Schneider Electric which has signed an MOU with local engineering colleges to enhance digital skills. Universities such as IIT-Bhubaneswar and Kalinga Institute of Industrial Technology (KIIT) have also led incubation of multiple startups in the city. The city also has a sister city relationship with Cupertino, USA in Silicon Valley.

Preliminary Stakeholder map

	City government	Other government	Civic organizations	International agencies	Technology groups
Climate adaptation	Bhubaneswar Municipal Corporation; Bhubaneswar Development Authority	Odisha State Disaster Management Agency Odisha Urban Infrastructure Development Fund	LGNet, RMSI, Public Health Engineering Organization, Swahiman, CURE, Udyama, IRADE, Bernard Van Leer, SOS Children Villages	NRDC IDRC World Bank UNDP ICLEI ACCCRN US AID	IIT – Bhubaneswar IBI Group WIPRO Axis Bank
Digital and ICT ecosystem	Bhubaneswar IT PMU; Bhubaneswar Smart City Ltd. Bhubaneswar Urban Knowledge Centre; Bhubaneswar One	Odisha Startup Summit Odisha Computer Application Centre Institute of Entrepreneurship Development	TiE NASSCOM	Sister City with Cupertino	KIIT E-Cell IIT-B Startup Centre IT Assc. Of Odisha Schneider Electric

Coimbatore

Coimbatore's is Tamil Nadu's second largest city and economic hub. It is known for its manufacturing and IT sector and is located on the base of the Nilgiris mountain range. Coimbatore's climate is warm and humid and consistent across the year. It has a population of 2.3 million people.

Key climate adaptation challenges and risks

Coimbatore is projected to have a relatively weak impact from climate change. It will see a 2% increase in heat related mortality due to climate change by 2080. It is at no risk to systemic flooding. In the shadow of the Nilgiris mountain range, it is not prone to extreme rainfall, and also has a secure water supply. Due to urban growth, it can potentially face **water shortage**. But it has multiple secure reservoir sources 40-50 km away and high rates of infrastructure coverage. It has also signed a major contract with engineering firm Suez to enhance the city's water supply system.

As a result, the city has little climate adaptation data available. However, data is being generated as part of SDC's CapaCITIES project for which the agency is creating a City Climate Action Plan with ICLEI. AECOM and UNISDR also selected Coimbatore to create a scorecard on natural hazards, but the results are not publicly available.

Key takeaways and highlights on city governance and digital ecosystem

Unlike the other two cities, Coimbatore's masterplan has no reference to climate change, reflecting the lack of priority of the issue in the city. Its Smart Cities Mission has a focus on the environment and lake restoration including the setting up of live water and air quality monitoring systems and a GIS mapping and spatial information centre. However, international climate agency ICLEI has been an active part of the city's efforts since 2009 and is part of the Durban Adaptation Charter for Local Government.

The city has an active relationship with its citizenry, including having won awards for **the ICT-based citizen engagement**. ICT efforts by the city include an active usage of WhatsApp (instant messaging group) platforms, free Wifi, a "no dumping" waste management app, a unified communications system and even a citizen charter with an explicit goal to make city information transparent. Civil organizations such as **Siruthuli and 'Residents Awareness Association of Coimbatore** (RAAC) have played an active engagement with the municipal corporation on a variety of issues.

Coimbatore is also an education hub with local universities: Anna University, Tamil Nadu Agriculture University, PSG Group of Institutions and Karunya University playing an active civic role. National research organizations such as Centre for Policy Research, Indian Institute of Human Settlements and Ashoka Trust for Research in Ecology and the Environment also have active projects in Coimbatore related to climate change.

The Tamil Nadu government has also been involved with high profile projects with World Bank, ADB and KfW around the 'Sustainable Urban Development Project' and 'sustainable municipal infrastructure finance'. The state also has an active open data policy. The State's push on e-governance has also been implemented at the city level, however there is little city-specific open data available.

The city, however, has a bustling digital and ICT innovation ecosystem. This has been exemplified by the setting up of an **innovation lab with German research organization, Fraunhofer**. The city also has a sister relationship with German city Esslingen am Nerhau. The city also has high rates of internet usage (including mobile) at 68%, and has twice the social media (twitter) usage compared to the other two cities.

Coimbatore's ICT ecosystem is highly dynamic, with multi-national corporations such as Bosch based in the city. However, it is also host to a variety of incubators and angel funding networks which bolster local startup efforts such as **FORGE,** PSG.Step, Headstart, Unitus Seed Fund, Nature

Angel Network, Gazelle Ventures and Coimbatore Innovation Business Incubator. This has also been backed by local industrial organizations such as CODISSIA, CII-Coimbatore Chapter, ICCI and COINDIA.

Stakeholder map

	City government	Other government	Civic organizations	International agencies	Technology groups
Climate adaptation	Coimbatore City Municipal Corporation Coimbatore Local Planning Authority	Tamil Nadu Sustainable Urban Development Project (World Bank, ADB) Tamil Nadu Urban Infrastructure Financial Services Ltd.	Siruthuli RAAC ATREE CPR IIHS WWF	SDC ICLEI Durban Adapt. Charter for Local Government	Karunya University Tamil Nadu Agriculture University
Digital and ICT ecosystem	Coimbatore Smart City Ltd. CCMC E-Governance Cell Citizen Charter Citizen engagement platforms eg. Whatsapp	Tamil Nadu E-Governance Agency Tamil Nadu Startup Warehouse	CODISSIA CII-Coimbatore Chapter ICCI COINDIA SITRA COJEWEL COINTEC Jumpstart TiE NASSCOM	Fraunhofer Innovation Lab Sister City with Esslingen	iCliniq Coimbatore Innovation Business Incubator FORGE PSG.Step Headstart Nature Angel Network Unitus Seed Fund

Kochi

Kochi is part of Kerala's largest metropolitan area and is the core of the state's economy. It is located on the Arabian Sea coast on the mainland and a set of islands. The metropolitan area has a population of 2.3 million and the city has a burgeoning IT industry.

Key climate adaptation challenges and risks

Kochi is prone to flooding due to **sea level rise**. The city has been suffering floods during the rainy Monsoon season over the past couple of years. This is set to intensify due to climate change. The city has 87% households covered by drainage, however its canals have recently been suffering from silting.

Kochi also faced a rare Arabian Sea cyclone in 2017, Cyclone Okchi.

The city is also potentially prone to **water insecurity**, and has been suffering a bouts of water shortage over the past two years.

Kochi is slightly more prone to heat stress than Coimbatore, with a projected 5% increase in heat related mortality due to climate change.

Kochi has been subject to sustained attention by international agencies interested in climate change. It was part of early efforts by the Asian Cities and Climate Change Resilience Network (ACCCRN). US AID, along with the Oak Ridge National Laboratory and Cochin University of Science and Technology carried a vulnerability assessment of the city. Multiple studies have also tried to assess the impact of sea level rise on Kochi, including studies by local ocean research institute. This cluster has led to the wide availability of local data on climate adaptation.

Key takeaways and highlights on city governance and digital ecosystem

Kochi's masterplan has an explicit section around water and climate related disasters, focusing on the city's flooding challenges. Its Smart City Mission also mirrored this priority, with a component on restoring the city's canals. The city is also part of the ICLEI, ACCCRN networks and is also part of the World Mayor Council on Climate Change and ACCCRN. The city has been supported by projects by the UN, AfD and ADB in the city.

The city has a variety of local civic actors such as Centre for Public Policy Research, Kerala Environment Congress, Cochin Environmental Protection Agency and Scientific Awareness Forum (SAFE) which have engaged the municipal corporation and other actors on issues of the environment in the city.

The State government has also played an active role setting a climate adaptation agenda. Kerala's SAPCC includes explicit reference to flood control and urban vulnerability to diseases. State level urban development schemes such as Kerala Sustainable Urban Development Project, run with ADB also include linkages between urban and climate goals.

Kerala also has a progressive startup and ICT policy with its IT Mission, Startup Mission and "Bridging the Digital Divide" initiative. Kochi in particular has been the subject of state focus on creating a viable startup environment. The city has 323 startups, double that of Coimbatore and triple that of Bhubaneswar. Kochi's **Startup Village** was voted India's best incubator in 2016. The **UN has also decided to setup a Technology Innovation Lab** in the city. The city also has a sister relationship with Menlo Park, USA in Silicon Valley.

Stakeholder map

	City government	Other government	Civic organizations	International agencies	Technology groups
Climate adaptation	Kochi Municipal Corporation Greater Cochin Development Authority Goshree Islands Development Authority	Kerala Local Self Gv't Dept. Kerala Sust. Urban Development Project	Plan@Earth Cochin Environment Protection Agency Scientific Awareness Forum (SAFE)	ICLEI AfD United Nations World Mayor Council on Climate Change ACCCRN	National Ocean Inst. Kerala University of Fisheries and Ocean Studies Cochin University of Science and Technology
Digital and ICT ecosystem	Kochi Smart Mission Ltd	Kerala State Council on Science, Technology and Environment Kerala IT Mission Startup Kerala	Young Entrepreneur's Summit TiE NASSCOM	Sister City with Menlo Park, USA	Startup Village Maker Village Headstart KSIDC Business Incubator

Scoping Visit to Bhubaneswar

As part of the second stage of the study it was decided that a scoping visit was to be made to the city of Bhubaneswar, Odisha, based on the city's suitability as per the desk analysis. The trip was for 3 days, from the 6th to the 8th of March. The trip verified that Bhubaneswar is a viable choice as a partner city, as summarized in the 'city choice' section.

Over the course of the trip, the team interviewed 11 different actors.

City Government

1. Dr. Krishan Kumar, Municipal Commissioner, Bhubaneswar Municipal Corporation
2. Vineel Krishna, CEO, Bhubaneswar Smart City
3. Biswa Kalyan Nayak, Technology Officer, Bhubaneswar Smart City Ltd.
4. Bankim Kalra, Bhubaneswar Urban Knowledge Centre (Operators and Managers of the Management Informational Systems including Bhubaneswar One)

IT Innovation Ecosystem

5. Dr. Akhilesh Barve, E-Cell, Indian Institute of Technology, Bhubaneswar
6. Soubhagya Routray, President IT Association of Odisha
7. Sakyasingha Mahapatra, Odisha Startup Summit
8. Kalinga Institute of Industrial Technology's E-Summit 2018
9. Startups: Webcrunch Technologies, SAK Robotics, MedicalATM, Composite 2D,

Urban Planning & Climate Adaptation Practitioners & Civil Society

10. Pradeep Mohapatra, Udyama (Climate Resilience Planning Group)
11. Prabhal Mallick & Sukanya Roy, Civil Society

The trip also coincided with a local university's, Kalinga Institute of Industrial Technology's, "E-Summit" which convened local innovators, interested students and startups.

This section summarizes the findings of the visit. It has two analytical components. First is a "Strengths, Weaknesses, Opportunities & Threats (SWOT)" analysis for the city, and second is a detailing of the various stakeholders' interests, incentives and ongoing projects.

SWOT Analysis for Bhubaneswar as a partner city

Strengths

The strengths of the city are multiple. The city has expressed interest, has a track record of climate adaptation projects and in Bhubaneswar Urban Knowledge Centre, an adept agency which can handle the project. The city's ecosystem – its universities and civil society in particular – are vibrant and suited to such a project.

- City government expressed an immediate interest in the project, including highlighting ongoing and previous projects along the same lines eg. 'future proofing' as part of the Smart Cities Plan and the World Bank led "Local Resilience Action Plan"
- Active convening role played by adept team at the Bhubaneswar Urban Knowledge Centre; including data and portal quality control
- Active civil society concerned and familiar with climate change, and desiring of more usable information
- A good university ecosystem which aims to facilitate local innovation
- State government has a good disaster response setup

- Internet and data collection infrastructure has improved to par over the past few years

Weaknesses

The city's weaknesses primarily lie in its nascent IT sector, which is yet to be engaged with the city government in a sustained manner. The IT sector is primarily based around large companies, is mostly hardware based and has a nascent startup ecosystem.

- "Top-heavy" IT sector and policy, primarily focused on attracted larger investments and companies – these groups might have less incentive to join a "climate adaptation" project
- Startup ecosystem not as mature as rhetoric, but growing
- IT Sector primarily hardware focused, with nascent ICT and digital sectors
- Few local companies involved with digital projects by city governments

Opportunities

Opportunities lie around the city's interest in exploring urban adaptation related issues such as water logging, environment stresses and a "regional resilience plan". The city has already begun the process of collecting better environmental data for the city and has identified the gap of creating analytical tools which can be utilized the data for decision making. Complementarily, an open data policy for the city is being devised. The city also has a vibrant student body which actively participates in hackathons and innovation challenges.

- City government expressed interest in tackling water logging and flooding in the city, and open to other challenges
- Bhubaneswar Smart City Ltd. Building a "Management Information System", contracted to Honeywell and in co-ordination with Bhubaneswar Urban Knowledge Centre which will include an explicit "Environmental Management System" component tracking air quality, air pressure, temperature etc.
- City government will aid in the data collections but has also useful identified the gap in finding "applications" for the data, and building analytical layers
- Bhubaneswar Urban Knowledge Centre starting the process of creating a Regional Resilience Plan which includes dimensions such as climate adaptation, urban farming, heat island effect, and hinterland impacts such as migration and food systems
- City is building an Open Data Policy. Though terms not set, potentially can be shaped.
- State government support for IT startups
- City has a vibrant student community which are active participants in startups and Hackathons

Threats

The largest threat is potentially in the collection of the data, as the sources primarily rest with the State government which have varied incentives. There was also some scepticism expressed by interviewees on the viability of the data available and skillset of digital and ICT practitioners in the city. The "anchor" institutions driving the use of digital and ICT based tools in the city are also young.

- State government holds much of the data and garnering buy-in a different process. Relevant organizations with data include the Odisha Space Applications Centre (Remote Sensing), Orissa State Disaster Management Agency, the Housing and Urban Development Department
- Some scepticism from interviewees on the quality of skills in the city

- Data at times is unverified, and can be unreliable
- Institutions at the city managing the digital projects and data still nascent

Detailed Stakeholder Map

This section further details the objectives, interests and ongoing projects of various stakeholders in the city, with an eye to stakeholders which are potential partners in the projects, and their degree of interest. A summary of each of the meetings with these stakeholders is available in the appendix, as are their contact details. Figure 1 provides a graphical summary of the various actors related to climate adaptation and digital innovation in the city of Bhubaneswar.
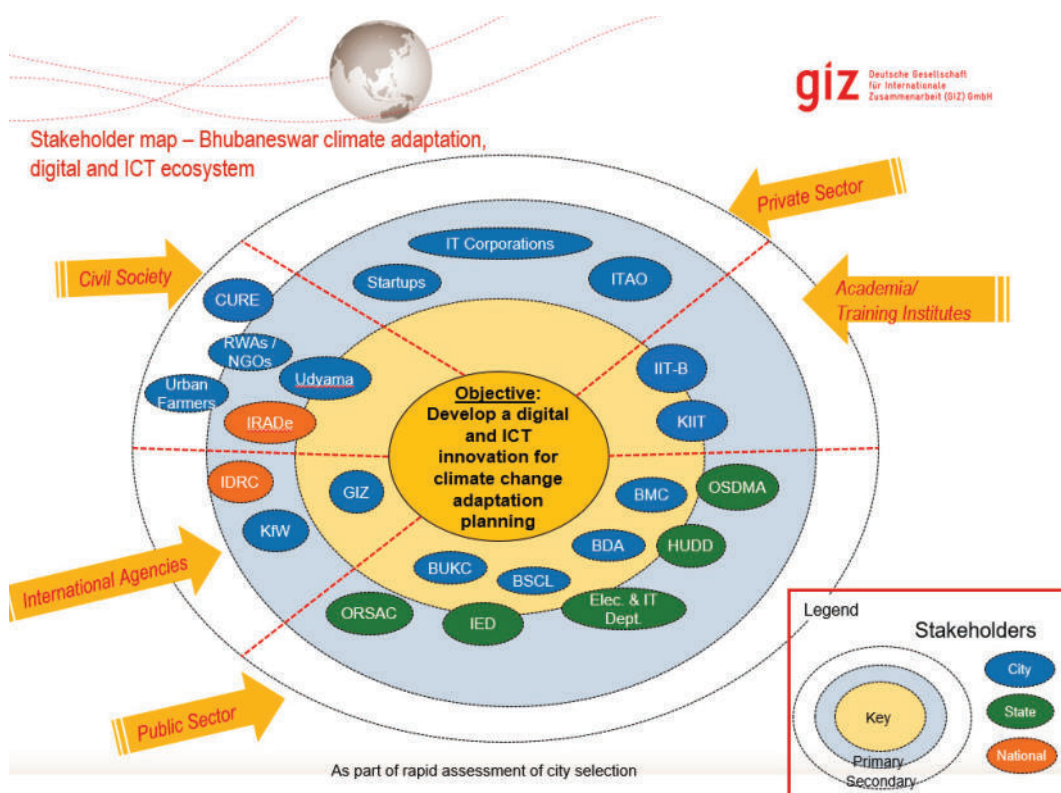

Figure 1: Detailed Stakeholder Map for Bhubaneswar (to be added)

City government

Bhubaneswar Municipal Corporation (BMC)

Mandate & Scope of Work:

The BMC is the urban local body which is in charge of the Bhubaneswar Municipal Area. It is headed by the Mayor, an elected official, though this post has little executive power. Instead most decisions are spearheaded by the appointed bureaucrat, the Municipal Commissioner. The BMC is in charge of disaster management, housing & sanitation, slum development, solid waste management, sewerage, urban greenery, and providing online services. As per devolution guidelines, four functions have not yet been transferred to the BMC including urban planning and regulation of land-use (under the BDA), fire services and water supply. The BMC is also tasked with the implementation of National & State schemes.

Nodal Person:

Dr. Krishan Kumar, Municipal Commissioner

Interest in Project:

The Municipal Commissioner expressed interest in a project that will address climate adaptation in the city and was especially excited by the prospect of developing data based or IT based tools which could be used by the city to enable decision making. The city is also deliberating an "Open Data Policy" which could facilitate the creation of a usable data portal.

Bhubaneswar Smart City Limited (BSCL)

Mandate & Scope of Work:

The BSCL is the special purpose vehicle (SPV) which is solely designated as the implementor of the Smart Cities Mission projects. It has little planning capacity but is designed as a project management body of the city's area based and pan city plans. It devises detailed project reports and floats tenders. As a result, it is also the body that has been designated as the implementer of the digital projects under the Smart City Mission.

Nodal Person:

Dr. Vineel Krishna, Chief Executive Officer

Mr. Biswa Kalyan Nayak, Technology Officer, Bhubaneswar Smart City Ltd.

Dr. Krishan Kumar, Managing Director

Interest in Project:

There was interest expressed if a project could be developed with related to the Management Information System being developed. This system is being implemented by Honeywell and managed by Bhubaneswar Urban Knowledge Centre (along with Bhubaneswar One).

Bhubaneswar Development Authority

Mandate & Scope of Work:

The BDA is the state designated planning body for the Bhubaneswar Development Area which has a jurisdiction larger than the BMC's. It is in charge of developing land, regulating land use and undertaking works pertaining to housing, commercial complexes. It also plays a role in co-ordinating the delivery of public services.

Nodal Person:

Dr. Krishan Kumar, Vice Chairman (same person as the Municipal Commissioner, *Bhubaneswar Municipal Corporation*)

Interest in Project:

The BDA expressed high levels of interest in the project. They particularly highlighted the ongoing issue of water logging and flooding in the city which is not yet being tackled and has direct climate adaptation and urban planning relevance. The city was also open to also addressing other issues such as urban heat island effects.

On terms of the digital and ICT component of the project, the city expressed the need for help in creating analytical layers to data sets in the city.

Past Relevant Projects

- World Bank facilitated "Local Resilience Action Plan"

Ongoing Projects

- "Regional Resilience Plan" with Bhubaneswar Urban Knowledge Centre
- "Heat Action Plan" with Integrated Research for Action and Development (IRADe)

Bhubaneswar Urban Knowledge Centre

Mandate & Scope of Work:

The Bhubaneswar Urban Knowledge Centre is the technical support arm, consisting of professional consultants, to the Bhubaneswar Development Authority, Bhubaneswar Municipal Corporation & Bhubaneswar Smart City Ltd. They manage and control the quality of ongoing projects, including ones explicitly related to climate adaptation and data management.

Nodal Person:

Mr. Bankim Kalra

Interest in Project:

Specifically, they are planning to develop a "Regional Resilience Plan" in the coming months and will be collecting and building decision making tools as part of the project. They made explicit interest to work with GIZ on the project and would be adept partners if the project were to move forward in this city.

Past Projects

- Bhubaneswar Smart City Proposal

Ongoing Projects

- Management of the Smart City "Information System"

- Development of the Data Policy with City authorities
- Management of the Bhubaneswar One data portal
- Development of a "Regional Resilience Plan"

Odisha State Government

Interest for the State government was not gauged as part of the visit, however is critical in garnering relevant data that only the State government holds and creating institutional mechanisms to utilize the decision making and planning tools developed.

But the State has active, and conducive, IT and Startup policies which were explicitly cited as supporting mechanisms to the local IT ecosystem and startups. They would potentially be encouraging of such a project if couched in terms of digital innovation.

Odisha Electronics & IT Department

Mandate & Scope of Work:

This department has the mandate to utilise electronics and IT for innovation and citizen participatory governance. The department is in charge of building capacity within government to utilise electronics and IT in their governance.

It also has the mandate to foster economic development by creating IT & Electronics based jobs, innovation, entrepreneurship and skills in the state. The department works closely to bolster the state's IT sector by providing infrastructure and support to IT and electronics companies in the form of promotion and incentives such as land allocation. It also builds awareness for different stakeholders such as industries and universities.

It also provides support the startups within the state along with the Micro, Small & Medium Enterprises Department's Startup Policy.

Nodal Person:

Shri Ashok K.K. Meena, IAS, Principal Secretary

Interest in Project:

As part of the State IT policy, the aim of the department is to develop electronics and IT innovation in the state. On this front, this department would potentially be interested in this project.

As was indicated by the official from ITAO, an industry body that works closely with this department (see below), the interest in the project will rise if there is investment in the state involved. The department would potentially provide capacity training and other incentives if the project was part of a larger program or planned investment.

Startup Secretariat, Institute of Entrepreneurship Development (IED), Odisha

Mandate & Scope of Work:

This is an initiative that is under the State's Micro, Small & Medium Enterprises Department which manages and implements the State's Startup policy, 'Startup Odisha'.

IED itself leads capacity building and training for entrepreneurship education in the state. It provides capacity building support for startups in the state and is associated with the state-run Utkal University.

As part of the 'Startup Odisha' initiative, the Startup Secretariat qualifies different companies as a 'Startup' under the program, registers them and provides them monthly allowance of 20000 INR along with product development and marketing/publicity assistance upto 15,00,000 INR. It also provides assistance towards cost of raw materials and those justified for innovation.

It also provides incubator related benefits such as funding and official recognition to independent centres, universities and industry groups.

The target is to develop 1000 startups in the state in the next five years, provide skills-based training to this end and encourage large companies to incorporate local startups in their activities.

Nodal Person:

Shri Samarendra Sahu, IES, Director General

Interest in Project:

As part of the startup policy, the state government provides startups with a 20,000 INR after an approval process. Applicants are judged on the basis of their innovativeness. Potential interest in this project will be high as it aims to encourage digital innovation in the state, but the scope of financial support will possibly be limited.

Startups that arise of the project can also apply for funding and support from the State.

Odisha State Disaster Management Agency (OSDMA)
Mandate & Scope of Work:

The OSDMA is the official disaster management agency of the Odisha state. It was setup in the immediate aftermath of the 1999 Supercyclone which brought havoc to the state and since has developed an important role of both disaster responses and reconstruction but also preparedness. They work in close co-ordination with line ministries, but also aid agencies and NGOs.

Their primary mandate is disaster management while they have also been involved in a "climate risk management" project with the Government of India and UNDP which involved creating hazard risk and vulnerability analysis for Bhubaneswar, a disaster management plan, and developing an "Early Warning" system.

The agency also maintains a GIS system which collects data and is used a decision support tool for preparedness, early warning and damage assessment. They have related data on levels of vulnerability, and even potential location of potential shelters and camps.

Nodal Person:

Sri Bishnupada Sethi, Managing Director

Bholanath Mishra, GIS Expert & Environment Specialist.

Arabinda Ray, System Expert & MIS Specialist.

Interest in Project:

While explicit interest in the project has not been gauged, it will potentially be high as it involves climate adaptation and digital decision support tools, both aspects of which OSDMA has internal capacity to develop, and previous experience in developing. Their currently operational "Early Warning" and GIS systems can potentially be upgraded as part of the project to incentivize involvement. OSDMA can also be a useful repository of climate vulnerability related data and analyses.

Odisha Space Applications Centre (ORSAC)

Mandate & Scope of Work:

This body is in charge of the state's GIS, GPS and Remote Sensing projects. As a result they have developed multiple repositories of relevant data for the state of Odisha using remote sensed data alongside field observations and secondary data. A broadly scientific institute, ORSAC has explicit objectives to apply these technologies and datasets for development planning activities and the active mapping, monitoring and management of natural resources and the environment. They are also the state's premier repository of data related to natural resources, socio-economic, demographic and development data and have been active participants in developing the 'Odisha State Data Policy'.

Nodal Person:

Dr. Sandeep Tripathi, IFS, Chief Executive.

Interest in Project:

ORSAC has not been engaged with yet but it is within their mandate to utilise digital based platforms for development-based decision-making. There is little explicit about climate change adaptation within ORSAC's mandate, however they are the primary body which holds information relevant to adaptation issues in the state. A project which involves data-based analysis or decision-making tools will ideally engage with ORSAC to make open their data for use.

Odisha Housing & Urban Development Department (HUDD)

Mandate & Scope of Work:

HUDD is the primary urban department of the state of Odisha. Its mandate involves the implementation and co-ordination of national schemes such as the Housing for All, Smart City Mission and AMRUT (basic infrastructure services). It aims for the provision of affordable housing, safe drinking water, roads, public transit and creating economic opportunities in cities.

HUDD collects data and is held accountable to service level benchmarks on water supply, solid waste management, urban flooding and water logging, water supply, sewerage and coverage of sanitation etc. The department collects and manages data for each of these benchmarks for each local urban body.

HUDD is the agency which monitors with work of the different urban local governments in the state, including BMC and also the planning efforts of local urban bodies such as BDA.

Nodal Person:

Shri G. Mathi Vathanan, IAS, Commissioner-cum-Secretary

Interest in Project:

Interest of HUDD has not been explicit gained, but their interests are in line with those of BMC and BDA as the supervising body for both these urban governance institutions. If the project involves financial outlay from either the state or city government, approval will have to be gained from HUDD. HUDD might also potentially have interest in upscaling this project and its outputs to other cities in the state.

Universities

The universities have setup startup incubators in their campuses, providing lab access, mentorship and office space to members. Both are developing multiple ongoing projects aimed at enhancing the local startup and innovation environment. For startups based in these incubators, they have also been important lobbies in garnering state support. Interest will depend on alignment of project with ongoing initiatives and terms of partnership.

Indian Institute of Technology, Bhubaneswar (IIT-B)

Mandate & Scope of Work:

IIT-B has a few technology and digital startup incubators and research centres which are attempting to build an innovation ecosystem in the city. They have a few research incubators which startups can apply to be a part of. Startups part of this incubator get mentorship from the university's professors and access to the university's lab and testing infrastructure. They also get support in the form of a room in the incubator and guidance on how to access funding, including from government schemes.

Nodal Person:

Dr. Akhilesh Barve, Professor-In-Charge, Entrepreneurship-Cell, Startup Centre

Interest in Project:

IIT-Bhubaneswar's incubators are more oriented towards mechanical and hardware applications such as robotics, though digital projects are growing such as a centre on Augmented and Virtual Reality which has funding support from private philanthropy and the national government.

However, most of the university's research capacity and interest rests in mechanical and hardware applications such as robotics. The Entrepreneurship Cell & Research Park mostly hosted startups which had a mechanical or materials focus.

Projects that are in-line with these centres current focus on either virtual reality or hardware startups will have a higher chance of receiving relevant support from these incubators. The organisation will also be interested in funding opportunities for any of their startups.

Kalinga Institute of Industrial Technology (KIIT)

Mandate & Scope of Work:

KIIT is a private educational institution which has a strategic focus on fostering startups. Its education curricula and culture are oriented towards encouraging students to startup initiatives and build an entrepreneurial spirit.

The KIIT model differs to that of IIT-B. While the latter has provided more technical support to their startups, KIIT has a wider net towards potential investors. KIIT also focuses more on softer training for its students, encouraging them towards starting their own initiatives.

KIIT has a formal entrepreneurship cell which can be used by students to base and develop their ideas.

KIIT also hosts annual "E-Summits" which attracts industry leaders and provides exposure to local and regional startups. Startups use the opportunity for networking and fund-raising purposes.

Nodal Person:

Anil Bajpai, Director, Kiit School Of Managment

https://ecell.org.in/about-us

Interest in Project:

KIIT's primary interest would be to provide opportunities to their students and related startups for innovation. The student body is active and can be a potential base that will participate in Hackathons and digital summits, such as KIIT's E-Summit. Discussions with startups led by students at the E-summit indicated a dearth of exposure to unique innovation challenges and also opportunities for funding to take their projects forward.

Startups & Broader IT Ecosystem

Startups' primary interest is in generating investment for their projects. However, as Bhubaneswar startup environment is still nascent, any support is appreciated. There were no startups that had a focus directly related to climate adaptation.

The city's broader IT ecosystem is primarily based around a few large companies such as Infosys, Cognizant & Mindtree whose primary objective is to take advantage of the skilled employee pool in the city. Most of these organizations do not yet work with the city government.

IT Association of Odisha (ITAO)

Mandate & Scope of Work:

The ITAO is an industry organisation which effectively serves as a co-ordination, discussion forum and lobbying group for the state's IT companies. They have a robust relationship with the State government and are actively involved in discussions around the State's IT policies.

The ITAO represents over 100 members based around the states, which accounts for 75% of the market share of Odisha's IT business. They have been active in hosting and convening IT related forums in the city of Bhubaneswar.

Most of the members have companies that are hardware based.

Nodal Person:

Soubhagya Routray, President

Interest in Project:

Interest in the project was linked with the potential investment it could bring. As the representative of the ITAO stressed, they and the state government are dedicating efforts towards attracting investment in the State's IT sector and will encourage projects that do bring such investment.

They also stated that they will support projects that encourage IT innovation and can potentially facilitate a positive relationship with State's IT department.

Webcrunch Technologies

Mandate & Scope of Work:

Webcrunch are a data management company based in Bhubaneswar. Their clients are primarily based in the USA. They provide basic data entry, database building, data scraping and basic research services. The company has around 20 employees.

Nodal Person:

Arun Naik, Managing Director

Interest in Project:

Webcrunch did not express any interest in participating in the innovation component of the project but were interested in building a database for use with the government. They stated they had experience in digitising Odisha State government records including transcribing data in the local language, Oriya to a digital database.

SAK Robotics

Mandate & Scope of Work:

SAK Robotics is a firm based out of IIT-B's startup incubator. They are developing robotics application suited towards local applications such as coconut harvesting and drain cleaning. They also build robots for custom applications. Their ambition is to vertically integrate and mass manufacture robots in the state.

Nodal Person:

Sakyasingha Mahapatra, CEO

Interest in Project:

While there was little interest in digital solutions to climate adaptation, they were open to exploring options that including a mechanical solution involving robots. Sakyasingha Mahapatra is also an active leader in the local startup community and showed interest in helping build a local network of researchers that could anchor the innovation.

Civil Society

The city's civil society, exemplified by Udyama and Organic Terrace Farmers, has had an explicit focus on community resilience for some time. They cited with 1999 Super Cyclone as an event which centred resilience and climate adaptation in their psyche. Interest levels are aimed at improve

the city's climate resilience, but also to hold the government accountable to these terms. Interest was especially high in a project that will make available data on heat waves, urban flooding, and greenery in the city. These organizations were also interested in using and visualising available data to garner community interest and involvement.

Udyama

Mandate & Scope of Work:

Udyama is an NGO which specifically focuses on building resilience in the state of Odisha. They currently operate primarily in rural Odisha, building food security and sustainable rural livelihoods. Their current initiatives include a 'Smart Agriculture' program.

The NGO also has interest in addressing issues of climate adaptation in peripheral urban spaces. They aim to address issues such as lack of greenery and urban flooding through a "community resilience" model. They have an history and ethic of engaging and co-creating projects with local community members. They are active members of the civil society in the city of Bhubaneswar.

Nodal Person:

Pradeep Mohapatra, Secretary & Team Leader

Interest in Project:

Interest in the project expressed is high, especially if this can be tied towards larger efforts around building resilience at the community level. While the NGO does not have internal capacity to develop IT projects, they are open to be partnered with such a project. However, they do have familiarity and experience in building resilience in rural and peri-urban communities and exploring issues of environmental and climate risks.

Organic Terrace Farmers

Mandate & Scope of Work:

Bhubaneswar has a small but active group of urban farmers who are tending and developing their private plots of land and terraces for growing food. While, they have no formal advocacy platforms, members of the group are active members of the civil society and have interest in issues of climate change.

Prabal Mallick runs a blog to disseminate knowledge of urban farming and environmental issues.

Nodal Person:

Prabal Mallick, Urban Farmer & Artist

Interest in Project:

The interest in the project is two-fold. First, they expressed interest in creating tools which will enable civil society to hold government accountable on terms of climate change and the

environment. Open data platforms such as those tracking trees and greenery in the city would be used for advocacy.

Second, they expressed interest in a project which will increase the awareness of the public on issues of the environment and climate change, including awareness building of ongoing sustainability and climate adaptation related initiatives that the city or state government or even citizen groups are already conducting. Their interest related to this is also intimately linked to disaster preparedness which they invoked the need of, following the trauma of the devastating 1999 cyclone which flattened the city.

Upscaling options & synergies

Upscaling options has only developed in more detail for the city of Bhubaneswar, however for each of the three cities projects or actors with potential synergies have been identified. They build upon ongoing climate adaptation and ICT projects, existing state initiatives and schemes and relevant local actors in the city.

Bhubaneswar

Regionally, there is potential to upscale the project to Bhubaneswar's sister cities, Cuttack or Puri which are only 40-50 km away. However, both Cuttack and Puri are not part of the Smart City Mission thus potentially have less capacity than the city of Bhubaneswar to champion such a project. However, they do suffer very similar climate risk problems, and if the State government is engaged during the course of the project, garnering data for the cities will not be more difficult.

Other potential options with synergies include engaging

- Bhubaneswar Urban Knowledge Centre which is pursuing a 'Regional Resilience Masterplan'
- IDRC & IRADe who are developing a Heat Adaptation plane
- OSDMA's warning system
- Smart City Mission – City App/Startup Environment
- Bhubaneswar One
- IIT-Bhubaneswar, KIIT-E-cell

Coimbatore

In Coimbatore, the following organizations and project have potential synergies:

- Smart City Mission – Environmental Monitoring
- ICLEI and Swiss Agency for Development & Co-operation's CapaCITIES project and the development of Coimbatore City Climate Action Plan
- Local environmental NGOs such as Siruthuli
- Digital citizen engagement platforms
- Tamil Nadu Sustainable Urban Development Project (World Bank)
- Startup environment (Forge, Headstart, Nature Angel Network, Unitus Seed Fund, PSG.Step)

Kochi

In Kochi, the following organizations and project have potential synergies:

- UN Technology Innovation Lab
- Kerala Startup Mission and Startup Village, Kochi
- Cochin University of Science and Technology

Appendix

Interview Questionnaire

Substantiating desk analysis

1. Is the city at risk to climate change and what are form your point of view the main challenges regarding climate change adaptation?
2. Is climate adaptation a priority? Has it been incorporated in your plans?
3. Have there been any past projects that have focused on climate adaptation?? Have any of these included digital projects?
4. What other digital and ICT based initiatives are there in the city? By the state?
5. What data is available for the city? Any climate or environment related? What data are missing?? Are there projects for data gathering or digitizing existing data (e.g. set up of an GIS system)
6. What is your perspective on the city's IT sector? Are there many innovative companies in the digital space?
7. Has there been co-operation between government and companies in the sector?
8. Are there any actors or institutions you recommend us talking to?

Gauging city interest and buy in

9. Are there ongoing projects or schemes where the city is aiming to enhance either digital or climate adaptation? If yes, in what ways can efforts be improved?
10. Are you interested in enhancing local data availability and openness?
11. Is there interest in a project that addresses the city's climate adaptation with digital innovation?
12. Are there any issues of particular interest you would like to focus on in either a climate adaptation or digital project? (prompt: data, e-governance, computerization of records, management information systems, mobile or app based services, social media)

Implementation

13. If yes, are there any ongoing schemes that such an digital initiative can help address?
14. Which units or departments will co-operate in the innovation process?
15. Are there any actors, departments or institutions you can think of that will be interested in such a project?

Minutes of Meetings with Stakeholders in Bhubaneswar

City Government

1. Dr. Krishan Kumar, Municipal Commissioner, Bhubaneswar Municipal Corporation
2. Vineel Krishna, CEO, Bhubaneswar Smart City

- Data is being collected through state remote sensing and other planning activities
- Biggest issue is urban flooding and about fixing the drainage system, identifying vulnerability points and creating datasets. Refering to a report by Ashok Singh
- *When asked if heat will also be considered?* Municipal Commissioner responded enthusiastically that they were open to multiple ideas
- Such as IT solutions in the heat waves
- Other projects included
- Reference to the previous project by the UNDP on Urban Vulnerability analysis – big issue was water logging

- IRADe's heat action plan project
- Smart Cities Plan had a section on "future proofing"

3. Biswa Kalyan Nayak, Technology Officer, Bhubaneswar Smart City Ltd.

- Master System Integrator being designed by Honeywell – transit, parking, traffic, BRT, e-Governance, Free WiFi
- Currently the Municipal Commissioner's priority is e-Governance and Smart traffic management
- Setting up the digital display boards + the creation of the integrated command and control centre. This will be part of the data and informational management infrastructure to which modules can be added
- The environment management system involves 4 multi-criteria sensors in the city which measures air quality, rainfall, humidity, barometric pressure. Full details not yet finalised. The environment management systems are part of Phase II which will happen in 3-4 months from April
- Open data policy for the city is also being developed
- Currently developing an e-governance platform which citizens can use
- Stakeholder current involved are BDA, BMC, India Meteorological Department, Pollution Control Board, Police (perhaps hinting that getting the State is harde to get on board)
- Potential to develop transit management sytems with data analytics for the surveillge system + merging with data from other agencies
- CISCO is creating a Community Digital Platform and a "Hadoop" networking software that allows the computer to begin to process big data
- Honeywell are the main project managers but many subvendors are involved including SAP (network), Quadragen (communication), CSM Technology (local company), property management system
- Current gap is intelligence and analytics
- Working with BUKC on some applications for child-friendly spaces and public areas
- BhubaneswarOne was part of a project by a Singapore startup
- Currently being mooted to develop a solar based adaptive green corridors
- Bringing together agencies such as the Policy department, Fire department, Emergency response on a co-ordinated platform
- Developing a "continuity plan" with data backups

4. Bankim Kalra, Bhubaneswar Urban Knowledge Centre (Operators and Managers of the Management Informational Systems including Bhubaneswar One)

- Focus on Tier 2 & 3 cities a strategic direction taken by IBI as easier to convince stakeholders
- Were already placed in a good position was Smart Cities Mission came along
- Both helped in the proposal building process and now integral as a project management unit to the scheme
- Role of BUKC is to provide technical support to the BDA and act as an anchor to ongoing projects.
- Initial mandate was with Bernard Van Leer foundation and designing child friendly smart cities.
- Role here is to facilitate connections between different actors in the city as well

- On ICT based projects, most are being pursued by BSCL where we are acting as co-ordinators and quality control of actions by subcontracted companies such as Honeywell.
- A challenge and opportunity is to play the role of data integration
- On climate adaptation, we will be beginning a 'Regional Resilience Strategy' where we will also be collecting primary data, and updating old plans. Specifically we aim to look at issues of climate change, migration, food security, urban flooding and heat island. Mandate will be for the broader capital region. No explicit technology component yet
- Open data policy is being mooted but challenge is to extend to the State where most of the data is being held.
- BhubaneswarOne, the common GIS platform, was developed by a Singaporean consultant who was also part of the OneMap project in Singapore. We are thinking of ways to extend it capabilities. It was rolled out quickly as there was criticism that nothing had happened on the Smart Cities Mission yet. We have to think of what the content aspect of this platform will be – how will it be different to something like Google Maps?
- There is interest from the city leadership to increase transparency for citizen services (government to citizen). Provide an easy one-stop portal of location of services
- Second basis is government to government platforms. Stuff that state departments, police and city departments can think of together; find synergies
- IT industry is not yet involved – decent IT setup of big companies but not much involvement
- But they are good at getting secondary data. We are trying to do this as well as we are facing a challenge of collecting state data because the approval process takes time from organisations such as ORSAC. Can we think of private sources we can use? Can we use data mining techniques to get them
- Couple of local IT companies getting involved. Spark (GIS) and CSM. Some focus around skill and youth development also can bring incentives

5. Dr. Akhilesh Barve, E-Cell, Indian Institute of Technology, Bhubaneswar

On IIT-Bhubaneswar

- 8-10 startups based out of IIT's research park
- Focus is mostly on hardware, and technical prototype building
- Digitalisation has not yet kicked into scope
- Support provided to support is space at the startup centre, mentorship and lab facilities
- The Startup Centre has suppor from the Department of Science and Technology (DST)
- New Research Park at IIT-B based around Augmented Reality and Virtual Reality; support from national, state government and private philanthropy

On Bhubaneswar's startup ecosystem

- Last 2 years has seen a rise and interest is increasing
- We have gotten 50 odd applications of which 30 are then shortlisted and then goes through a three round interview process
- Yet money from government from the different schemes has not yet come

6. Soubhagya Routray, President IT Association of Odisha

- ITAO has been around for 25 years and involves the owners of different groups. Hosts the annual IT conclave, an Expo and a Mantham (school). ITAO is actively involved in developing policy with the state
- Bhubaneswar is the best hub in the state for big companies and for startups
- Big challenge in the state is to attract investors, effort along with state government is attract investment. Regions targeted right now is South East Asia, Taiwan
- Companies are moving slow, but there is interest eg. Honeywell Cognizant
- Most companies are Hardware based (60%) and a few doing software but basica applications like web-design
- The IT sector is mostly focused around the big universities
- But local universities such as IIT, KIIT are building relationships – 100,000 students, 96 engineering colleges. There is potential here
- Digitisation in the city government , process is as expected slow.

7. Sakyasingha Mahapatra, Odisha Startup Summit, SAK Robotics

- Company is research and product development of robotics applications.
- Looking into agriculture, drainage cleaning, coconut harvesting, oil & gas sector
- Also provides some training to students in the city
- Skeptical of growth. Ecosystem does not seem to be involving
- Odisha Startup summit has been running for 63 months (5 years+) and with an active facebook community
- Government startup policy has not yet translated to practice on the ground
- However, long term opportunities for growth. Potentially also in manufacturing
- Smart City Mission has brought the buzz but startups are being sidelined. Big companies involved for example Honeywell have not yet involved local startups

8. Kalinga Institute of Industrial Technology's E-Summit 2018

- The E-Summit involved inviting startups to present their innovations
- I met with three different startups informally. Most were based out of KIIT and had received support from the university's entrepreneurship lab
- Most applications where e-commerce platforms, and video games
- One company stood out which aimed to create Medical ATMs for access in rural areas
- The active student body expressed the need for better support. To get official support from the State they had to register as a startup and then go through a series of interviews
- They were excited by the idea of hackathons or innovation challenges: "we need as much support as we can get"

9. Startups: Webcrunch Technologies

- Client is primarily based in the USA
- Analysis and development of data for the financial industry

- History of project with the central government where the team helped develop a database on labour contractors. With the Odisha government there was a project mooted which involved translating Odiya text
- Was previously based in Bangalore, but came to Bhubaneswar as it was his home
- Main challenge is to find employees in the city with the correct qualifications
- But there has been a host of change since 2008 to now: startups are officially registered, infrastructure is better
- Bhubaneswar Smart City has not brought a shift in startup involvement, but improving infrastructure

Urban Planning & Climate Adaptation Practitioners & Civil Society

10. Pradeep Mohapatra, Udyama (Climate Resilience Planning Group)

- Primarily working in Sustainable Food Systems with actors such as UNDP
- Main ethic is around people's participation which is then the basis of conservation of natural forests, reduction of carbon footprint
- Challenge is in peri-urban areas where ecosystem interacting with city-government
- After Cyclone in 1999 resilience became important. Therefore we focus on "community resilience"
- Also part of a global network of DRR – focused on flooding from cyclones, monsoon, riverine floods. Urban Heat Island effect also a growing issue in the city
- Bhubaneswar also facing migration, but which can increase vulnerability
- Issues of resilience in the city including the cutting of big trees but also inadequate infrastructure
- Digital innovation is incredible as it increases access to information for example with the disaster warning system they helped develop
- There is a good relationship e=between the civil society and the government
- Big issue is that there is little data, with no verification and standardisation. Little co-ordination with research organisations, civil society and universities which are doing research in the city
- But data also about creating institutions to manage and update constantly. Data is useless if not up to date
- Also not just about access to information but about application – how can the community get involved?

11. Prabhal Mallick & Sukanya Roy, Civil Society

- Technology focus can sometimes be over bearing. IT is attractive but an easy solution. Managing nature is something that cannot be automated
- Running a small group of urban farmers for more than a year. 20 odd people which tend to their gardens and terraces – grow vegetables and fruit
- As a farmer we can sense the increasing un-seasonality of the weather, and we sense it is climate change. Earlier Bhubaneswar used to have a winter but that no longer exists. Summers area also becoming unbearable
- Another issue is urbanisation where the woodlands cover and urban greenery that previously was there is decreasing.

- The cyclone was also a shock to the people, and also removed a lot of trees (more than a million were lost). The people were shocked and it affected them psychologically
- There seems to be inaction. Issues like waterlogging and lack of trees can be tracked better. So can increase number of concrete spaces. We can use this information for education of our communities – big challenge is making the information accessible to the community to educate them to instill those value
- Planting of fruit trees can also encourage biodiversity

Bhubaneswar Stakeholder Contact Details

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Responsible Data Management in Cities and Municipalities Training Toolbox

Data Protection Component - Product #3, as part of GIZ's program "ICT-based Adaptation to Climate Change in Cities"

November 14, 2018
Fieke Jansen and Julia Manske
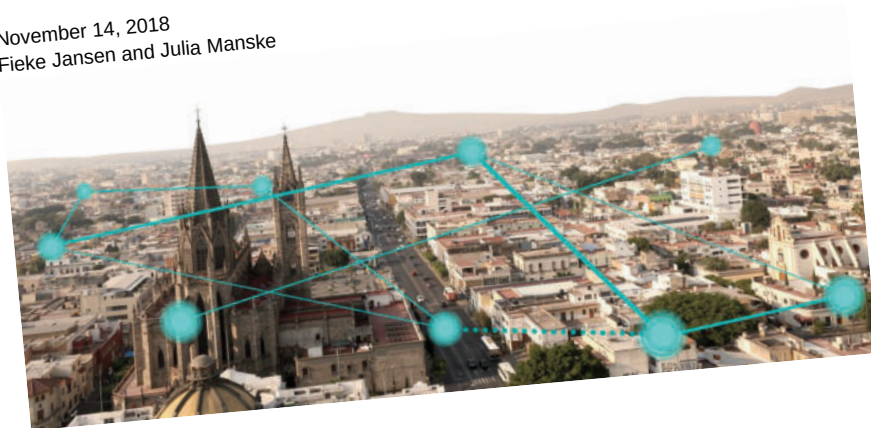
Responsible Data Management in Cities and Municipalities Training Toolbox

4.2

Responsible Data Management in Cities and Municipalities Training Toolbox

Data Protection Component - Product #3, as part of GIZ's program "ICT-based Adaptation to Climate Change in Cities"

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November1, 2018
Fieke Jansen, Julia Manske

I. Introduction

Urban areas with high population and infrastructure density are particularly affected by climate change. Consequently, climate change adaptation strategies for cities and metropolitan regions become increasingly important. ICT-based approaches to collect, analyse and simulate local scenarios can allow city administrations and political representatives to obtain the necessary information in order to develop and implement local adaptation strategies. However, public institutions are confronted with insufficient good quality data, shortage of capacities to utilize these technologies, and the involvement of associated civil society in the existing governance and urban planning structures is low. The global GIZ program "ICT-based Adaptation to Climate Change in Cities" aims to support municipalities in the development of ICT and data based approaches to increase urban resilience.

The GIZ program "ICT-based adaptation to climate change in Cities" recognized that the lack of capacities is not only reflected in the application of technology but furthermore in a responsible approach towards these instruments. With a growing outcry about the potential downsides of data that is intentionally or unintentionally misused, GIZ acknowledges the importance of integrating principles of responsible data management in ICT based projects. When implementing any ICT-based approach in municipalities, local capacities regarding data protection, privacy, international and national regulatory frameworks and the social-economic impact of opening up data become crucial. For this reason the program "ICT-based Adaptation to Climate Change in Cities" developed an adult learning curriculum that facilitates trainings on data protection and privacy in the context of urban development.
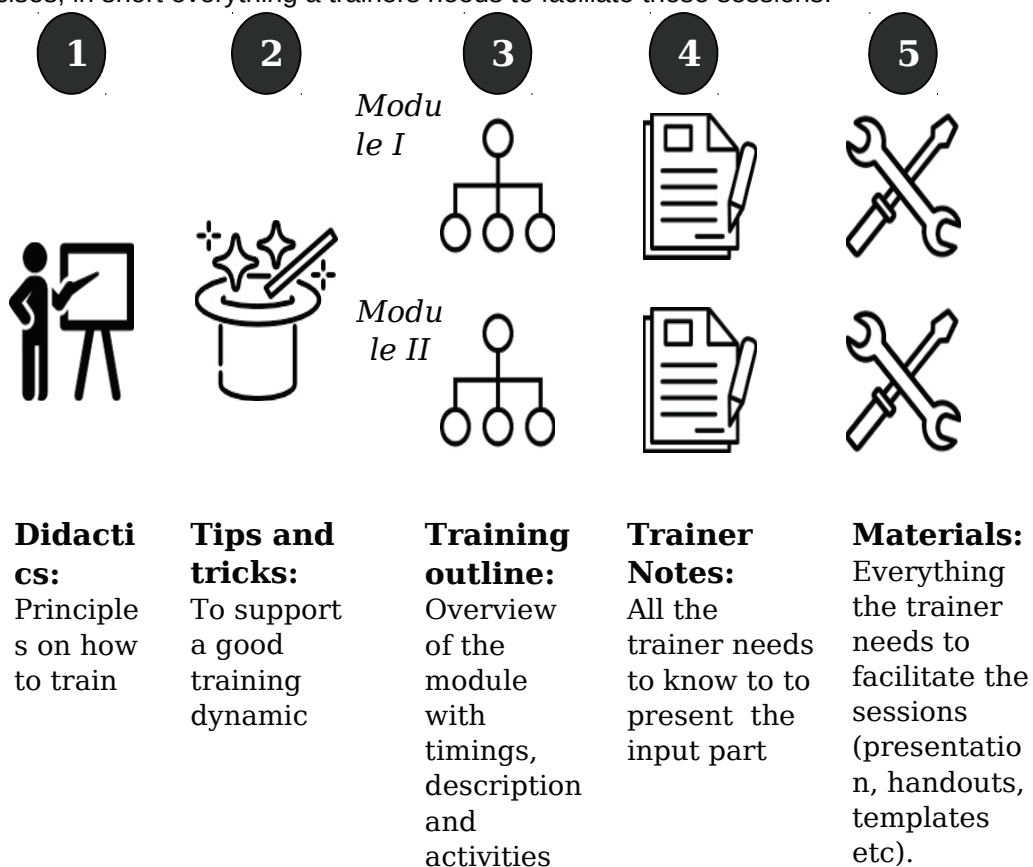
The curriculum consists of two modules. The first module aims to raise general awareness amongst citizens about the implications of data sharing through online services. The second module aims to provide urban practitioners practical guidance on responsible data management in the context of processing, sharing or opening up government data.

Eventually, the Responsible Data Management Training Toolbox aims to facilitate the replication of privacy and data protection trainings in other cities. Its content is based on several interviews, desk research, development, testing and iteration of previous versions of the curriculum. While the Toolbox has been developed as part of the program "ICT-based Adaptation to Climate Change in Cities", both modules can be used flexibly in other thematic contexts, as their focus is on responsible data handling in urban planning and awareness raising about data protection among citizens in general.

The Toolbox allows trainers to provide a training of 90 minutes or 120 minutes targeted at citizens, or a training of 210 Minutes targeted at city officials. The workshops were developed from the perspective that they are conducted by two trainers. However, if necessary module I can be conducted by one trainer if there are less than 12 participants. For module II we strongly recommend to have two trainers and not more than 22 participants in total.

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November1, 2018
Fieke Jansen, Julia Manske

While this document should prepare any potential person to conduct the training, it is important to note that it will not turn him or her in an experts. It provides a structure and the detailed workshop content, but it will never substitute the knowledge of an expert. We highly recommend to work with people who on the one hand are experienced in facilitating trainings, and who one the other hand have a profound legal, technological and societal understanding of privacy, data protection, open data and responsible data management. Given that the trainings are targeted at adults who are experts in their fields they will also expect to spend this time with an expert in the field of the workshop. Furthermore, it is very likely that the participants will have questions on particular details of the content or that go beyond the scope of the workshop, or they will seek advice and recommendations on the exercises and the group work, and hence it will be important that the trainer can provide this expert information.

This toolbox offers a trainer a didactic approach, tips and tricks, training outlines, trainers notes and materials that will enable a training to prepare and conduct the responsible data managment training sessions. The didactic approach underpins the decision that were made in the development of these training sessions. The tips and tricks offer practical best practices on how to facilitiate a group process. The outline offers the structure, timing and different elements of the training. The trainers notes offer background information for some exercises and the content of the presentations. The materials offer presentation, handouts and templates for exercises, in short everything a trainers needs to faciliate these sessions.

1	**2**	**3**	**4**	**5**
		Module I		
		Module II		
Didactics: Principles on how to train	**Tips and tricks:** To support a good training dynamic	**Training outline:** Overview of the module with timings, description and activities	**Trainer Notes:** All the trainer needs to know to to present the input part	**Materials:** Everything the trainer needs to facilitate the sessions (presentation, handouts, templates etc).

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Didactics

The privacy and data protection modules developed for GIZ's global program "ICT-based Adaptation to Climate Change in Cities" are based on the following didactic principles:

<u>Do No Harm approach</u>: This approach assumes that all the action and behaviour of the trainer and other participants have consequences, both positive and negative. All training intervention seek to increase the positive impact of our actions and reduce possible negative impacts[1]. Examples of practical implementation of the Do No Harm approach is creating a training environment that provides a safe space for learning by making deliberate choices on venue, being aware of power relations in the group, inclusive participant selection and respecting the different knowledge and skill levels of participants.

<u>Adult learning principles:</u> These principles recognize that adults learn differently than children. Adults have a world of experience, are no longer used to the traditional learning methods and are very practice oriented. Therefore, it is important that any training intervention for cities takes adult learning principles into account. Practically, this includes amongst others that the training is clear about the goals of the workshop, explaining what an adult gets out participating in the session, offering them the possibility to bring in and share their own experience in the workshop, and learn by doing. Therefore it is important that the learning objectives and implementation of the workshop are problem oriented and experiential[2].

<u>ADIDS methodology</u>: ADIDS[3] is a didactical approach that translates adult learning principles into a training structure. It stands for Activity, Discussion, Input, Deepening and Synthesis (ADIDS). The Activity and Discussion sections offer adults the opportunity to share their own experiences and knowledge. In the Input section the trainers provide expert input. The Deepening sections offers adults the ability to apply the newly gained knowledge and learn by doing. Synthesis ties the workshop together and highlights the key learnings the trainers wants the adults to walk away with, and offer additional resources for learning.

<u>Training Needs Assessment</u>: for multiple day trainings it is common practice to conduct a training needs assessment, so that participants' knowledge and skill levels determine the training agenda. The most robust approach is to interview or send a questionnaire to participants prior to a training, which asks them about their knowledge and experience with responsible data management, privacy and data protection. However, this will not always be possible, and for a 2 and 4 hour workshop it might be a disproportionate investment of time. Therefore, in this case it is recommended that the training needs assessment is substituted with

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[1] Holistic security Do No Harm approach
https://holistic-security.tacticaltech.org/chapters/strategise/3-6-security-and-the-do-no-harm-approach.html
[2] https://myshadow.org/ckeditor_assets/attachments/262/methodologies-feb2018.pdf
[3] https://www.level-up.cc/before-an-event/levelups-approach-to-adult-learning/

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in-depth discussion with the organizers of the workshop, to gain a better understanding of the profile of the participants, their knowledge and skill level and their reason for participating.

Modularity: The skill level, interests and needs of the participants should determine the agenda for each training. The modules are designed to provide some flexibility, so they can be adapted accordingly. It is recommended that after the identification of the participants needs and the length of the workshop the trainers make small changes to the module and presentation.

Training Tips and Tricks

Arranging the space
Adults learn best in an informal setting which facilitates discussion, enables learning by doing and does not imply a hierarchical environment. Prior to the participants' arriving the trainers should rearrange the space to offer a workshop environment that is relaxed, informal and inviting. For example she or he can arrange the chairs - or if needed chairs and tables - in a circle, so all participants can see each other.

A comfortable start
It is advised to plan with enough time before the workshop to prepare the space, set up the presentation and workshop materials, and welcome the participants. If the trainers run late or run into unforeseen technological challenges during the preparation in best case scenario they will hit the ground running or start late. Preparation and early arrival will not only prevent an uncomfortable start, where the first hour is spent on catching up, it will also allow to welcome and get acquainted with the participants prior to the workshop.

Introductions
The introduction of each workshop gives the trainer the opportunity to set the stage, understand and debunk any of the expectations of the participants, run through the agenda and layout the ground rules. Clarifying the objectives of the workshops and comparing these to the expectations of the participants, as well as highlighting which expectations will and which won't be met, will prevent potential disappointment. Suggested workshop ground rules be 'there are no dumb questions', 'give everyone space to participate, step up if you are more quiet and take a step back when you are very present', 'interesting but not on topic questions will be parked for if there is time at the end of the workshop' and 'be on time after the breaks'. Laying these ground rules out at the beginning of the workshop will allow the trainer to keep the workshop on track and manage potential disruptive participants.

Breakout groups
Group dynamics from participants reality can be transferred into the workshop space, personal experiences, gender and organizational power asymmetries can influence how comfortable participants are in speaking up in larger groups. To give everyone a space for active participation these workshops move between small group exercises and plenary group activities. The smaller group exercises allow all participants to share and receive knowledge.

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Time keeping

One of the biggest frustration of participants in a workshop is loose timekeeping, this is among other caused by a trainer not properly managing time, the workshops getting derailed by non essential discussion between trainers and a small group of participants or when a trainers tries to put too much content in the limited time of the workshop. The following tips can help the timekeeping of the workshop:

- When running the workshop with two trainers they can agree on a clear role division prior to the workshop, where one trainer takes on the role of a lead content facilitator and the second trainer takes on the role of process facilitation. The process facilitator is responsible for timekeeping, keeps an eye on the interactions between participants and makes sure all participants have the opportunity to share they knowledge or ask questions.
- When the workshop is run by only one trainer he or she can ask a participant or the organizer to assist in keeping the time.
- Agreeing on visual timekeeping cues between lead content facilitator and timekeeper can be helpful.
- When participants are working in groups, it helps to give clear instructions of how much time they have for the exercise, to check mid way how the groups are progressing and if needed to give them more time (which means another part of the workshop will be cut short) and to give them a sign when there is 5 min, 2 min, 1 min left.

When the workshop is threatening to go over time the initial instinct is to talk faster and cut activities short, to ensure all the planned knowledge and skills get transferred to the participants. This practice can have the opposite effect as the workshop can feel rushed and participants can get the feeling they are missing out. When running out of time, the trainer can reevaluate the agenda, see which sections of content can be cut short. If he or she decides to skip a specific section, it is recommended to inform the participants of the decision and to explain why this choice is made. Checking if everyone is happy with these changes will avoid disappointment on the side of the participants.

Another option to reclaim some time is when a coffee break is before or after an activity, those can be turned into flexible breaks. This means that participants start their activity while they are on a break. The downside is that participants will not get a proper break and might feel overwhelmed.

…. last but not least, it is of course important that not only the participants but also the trainers enjoy the training and have fun!

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- In case it did not change their mind, why not?

If none of the participants read any of the Terms of Services or Privacy Policies, ask them why not?

Explain how Terms of Service or Privacy Policy are a companies interpretation of the law.

Ask the participants how data protection regulation applies to them; and if they know what their rights are.
Add aspects they have not mentioned taking into account the local law; you can further mention that in other countries you might have additional rights.

In most countries you have
- Right to access to your personal identifiable information. In some cases you have the right to change, add or delete to this information, if you think it is inaccurate. For example, the larger companies like Google and Facebook have a user portal where you can access and delete some of your personal data (myaccount.google.com)
- Submit a complaint to your data protection officer.
- *Trainers note:* ask if any participants knows the name of the local data protection office and if anyone ever contacted them. Share with them the name of the local authority (on slide), explain its duties and encourage participants to contact the agency in cases of doubt.
- In some countries (like in the European Union) you can sue a company if you feel they are not compliant to the local data protection regulation and have misused your personal data.

Background information

Data categories
- Personal Identifiable Information:
  Any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly.
  Data Protection Regulation applies to this category of data.
- Plus, category of Sensitive Information:
  Sensitive personal data is a specific set of "special categories" that must be treated with extra security. These categories are: Racial or ethnic origin; Political opinions; Religious or philosophical beliefs; Trade union membership; Genetic data; and Biometric data (where processed to uniquely identify someone).
  Data Protection Regulation applies to this category of data; and often requires special protection mechanisms.
- Non Personal Identifiable Information:
  Any information that can not be used to identify a natural person ("data subject"), meaning (1) raw data that can not be used to identify a person, (2) anonymised data, and (3) aggregated data which is can not be used to identify a person.
  Data Protection Regulation does not apply to this category of data.

Data Protection Frameworks
As of January 2018, over 100 countries around the world have enacted comprehensive data protection legislation, and around 40 countries are in the process of enacting such laws.[5] A number of these laws are based on the European Directive 95/46/EC on data protection. They are so called Omnibus Laws

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[5]   https://privacyinternational.org/report/2255/data-protection-guide-complete

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written down in the constitution covering a number of areas. Other countries may have privacy laws applying to certain areas and sectors, for example for children or health data, but do not have a comprehensive law on data protection (for example in the US).

In many countries around the world (in particular in Latin America), there exists a Constitutional right of "Habeas Data", similar to the German "Right to Informational Self Determination", which is designed to protect the data of an individual by granting them the right to access the information held about them, and providing for the individual concerned to submit a complaint to the court.

Currently the most advanced data protection law is the new European Union General Data Protection Regulation (GDPR), enacted in 25 May 2018. It requires companies and organizations to handle personal data of European citizens in the following way:

1. Limits collection of personal data. Only collect what is necessary to make tool/service function, billing purposes and required by law.
2. Need active consent in case of collecting additional personal data. When a company or organization wants to collect more data than is absolutely needed for legitimate use or legal compliance, they need to actively ask for consent of the data subject to collect and process this data.
3. Right to information on what personal data companies or organizations process and how they use it. In the case a company uses profiling techniques, you have a right to know what is in your profile.
4. Right to secure handling of your data: regulates that personal data should be stored and processed securely. If a company or organization has lost your data through a data breach, they have to inform the Data Protection Officer in 48 hours. If they lost 'sensitive' personal information they will also have to inform the user.
5. Right to access the personal data a company or organisation holds on you, and ask them to:
   a. Change or complete the data in case it is inaccurate.
   b. Delete your data if the data is no longer necessary
   c. Delete your data, if you initially gave more data than was necessary to run the tool or service.
6. With automated decisions, you have the right to explanation and human intervention.

Section III: Choosing Tools Framework

Ask the participants why they use the tools and services they use? What were the reasons why they started using Whatsapp, Gmail, Google maps, their default browser or others?
The most likely answers will be, that they use it because their friends are using it, because it is free, because it came with the phone by default etc.

After that, ask them what would be privacy criteria to choose a tool. Crowdsource their answers.

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Fieke Jansen, Julia Manske

The "Choosing Tool Framework[6]" is a way to assess tools and services on the basis of their security features and privacy friendliness.

For a 90 minutes workshop walk through the "Choosing Tools Framework", highlighting the criteria with one of the participants favorite apps.
For the 120 minutes workshop draw the Choosing Tools grid on a flipchart, add the different chat apps you want to discuss and fill it out column by column.

The privacy and digital security criteria are:
1. *Who owns the tool?*
2. *Where is the company based?*
   For example, if the company is based in the US, it is subject to American legislation. From US-American Whistleblower Edward Snowden we know that under the Patriot act, American companies have been forced to provide access to user data. Ask yourself what is the relationship between your government and the US government. If your government is a close ally or friendly with the US government, or if they have common interests like border protection, it is likely that they will share user data.
   The same might apply to other countries. If the company behind your tool or service is from China, like WeChat, they will be subjected to Chinese legislation. Chinese companies are asked to surveil and censor content on tools and services.
3. *Do they offer any security?*
   Communication tools offer different levels of security. Think of user security, transport layer encryption and end to end encryption? Security is all about layering. The best security is offered when the above mentioned protection mechanism are in place. Protected in transit in combination with content protection.
4. *What privacy protecting measures do they offer?*
   Security is about keeping your data safe and secure from others. Privacy is about keeping your identity safe and secure. When you are registering or using your tool does it allow you to keep your identity private, for example assess the following questions for the service...
   - Does it allow you to use a fake name?
   - Does it allow you to create an anonymous account that is not tied to your name, email or phone number?
   - Can you change default settings to limit data collection?
   - Can you still use the service even if you do not agree to additional data collection?
5. *Do you know which other companies get access to the data you are using via that service?*
   There are different ways in which the data you create while using a specific tool or service can end up in the hands of other companies. There is an entire industry based on buying and selling data, such as we have seen in the example on Cambridge Analytica who buy data from companies that are specialized in accumulating data from different data sources. This is also known as the data broker industry.
6. *What are other features that are important to you?*

[6]   The Choosing Tools Framwork is inspired by the My Shadow Choosing tools framwork
https://myshadow.org/ckeditor_assets/attachments/126/choosingtools_emptyframework.pdf

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From the interaction other features were already mentioned by the participants. It is important to also note them, as these are relevant to them. For example, Telegram got very popular in Latin America, because it provides stickers.

This might feel like it is too much for you to answer. Luckily, there are digital security experts who have done this for you and are curating a list of resources they recommend, which will be discussed in the next part of the workshop and can be found in the handouts.

Background information

Security options
- *User security:* Does the tool or service offer you basic user security, for example does the app ask you for a password to log into it, does if offer the feature of automatically deleting or disappearing messages after so many days?
- *Transport layer Encryption (HTTPS or SSL):* protects the content in transit. For example on email, HTTPS or SSL protects your email from your computer to the mail service you use. Note that your email provider will still be able to read your messages.
- *End to End Encryption:* protects the content of your messages from endpoint to endpoint. For example on chat apps like Signal and Whatsapp, the content of your messages is scrambled on your phone and descrambled on the phone of the receiver. This means that when your messages goes through the servers of the Signal or Whatsapp, they are not able to scan or read the content of you messages.

*Encryption: is the computational process of protecting data, that allows authorized parties to access it and those who are not authorized cannot.

See https://myshadow.org/materials for more information on the Choosing Tools Framework

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Example for "Choosing Tools - Grid"					
	1. Owners	*2. Where is the headquarter?*	*3. Do they offer any security measures?*	*4. Do they provide privacy?*	*5. What is the business model of the company?*
FB Messenger	Facebook	US	Si, but only from cell phone to FB servers (FB can read content)	No, you have to use your FB account	Sellign data
Google Hangout	Google	US	Yes, but only in transit	No, they have access to your Google ID	Selling data
iMessage	Apple	US	Yes, end to end, but without internet connection the message is sent as an SMS	No, apple has access to their phones and content; but they don't sell data	Selling hardware like computer and iPhones not data

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Signal	Open Whispers System	US	Yes, end to end	No, they have access to the phone, but business model is not to sell data	Supported by public human rights funding
Telegram	Telegram	unclear / unknown	Yes, end to end	No, they have access to the phone	unclear / unknown
Whatsapp	Facebook	US	Yes, end to end	No, FB has access to the phone	Selling data
SMS	Telco	depending on Telco	No	No	Telecom subscription
Wire	Wire	Switzerland	Yes, end to end	Yes, you can create an anonymous account with an email address	unclear / unknown

Section IV: Increasing Your Privacy and Security

1. **Increasing your privacy and security**

Instruction:
Ask the participants if they take any actions to increase their privacy or digital security, for instance, a password on their phone, an ad blocker in their browser, changing access control on their phone, setting up child safety features etc. Use their answers in the examples below.

Trainers notes:
For the 90 min workshop this section will explain the different strategies, without going into detail about the different tools (no hands-on, if there is time the trainer can show participants how to activate their incognito browser).

For the 120 min workshop, explain the different strategies, integrate some hands-on aspects in it by walking the participants through some of the actions they can take, such as deleting the browser history, using DuckDuckGo or activating their incognito browser)

Depending on the audience it might be helpful to hand out the resource "Resources to Protect Your Privacy" already at this point, so that they can see the different strategies including links in front of them.

There are four broad strategies[7] that you can use to increase your privacy and security.
(1) Minimize data collection:

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[7]   These strategies build on the My Shadow Strategies of Resistance
https://myshadow.org/ckeditor_assets/attachments/226/strategies_of_resistance.pdf

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If they can not collect data about you, it can also not be processed or misused. Actions you can take are for example:

- Not fill out all the registration data;
- Delete the apps you are not longer using from your phone;
- Log out of services in the browser, like Facebook and Gmail, when you are no longer using them.
- Delete your browser history from your phone and computer.[8]
- Install Anti-Tracking add-on like Privacy Badger in the browsers Firefox, Chrome or Chromium. Or Firefox Focus on your mobile phone. This will block cookies.

(2) Make decisions and choose alternatives

Alternatives are applications, tools, services and operating systems, that first and foremost respect your privacy and strive to minimize data collection and processing. Most of these alternatives are voluntarily build by the open source community or have received public funding. Provide the participants in the presentation with a list of alternatives that have been curated by digital security experts. After the workshop handout a list of alternative tools, resources and guides.

Trainers notes: a hands-on component can be for participants to try out DuckDuckGo as a search engine. Installing alternative messenger apps will probably cost too much time as you are depending on good internet connectivity, people's devices and speed in which people get accustomed to a new interface.

(3) Separate your online identity.

Different tools and services have different data about you, not one of them knows the full picture. Action you can take are using different tools for different purposes. For example one email for work, one for private and one for spam.

(4) Strengthen your digital self.

By practicing basic digital hygiene you can keep many unwanted parties away from your data. Action you can take are for example:

- Update your software on your computer and phone.
- Install antivirus on your phone and computer. For example Avira
- Find my phone (as service of Avire, or build in with iPhone 'Find my iPhone')
- Cover your webcam
- Update and strength your passwords. Create a unique passphrase for everything. You can show how long it takes to crack a password by going here or live demonstrating it here.
- Install a password manager, to enable you to create strong and unique passphrases. KeepassX or KeepassXC.
- Changing your default settings in your Browser, and on your email, social media and chat.

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[8] Deleting your browser history does not delete your data traces from the internet, or from the companies who have already collected your browser behavior. What it does do is create a fresh browser environment which prevents companies and new website trackers from collecting your historical browser data.

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- User privacy browsing mode
- Install HTTPS everywhere in the browser of Firefox, Chromium or Chrome.

Trainers notes: One hands-on component can be for participants to try figure out how to activate their incognito settings in the browser in their phone (as shown for each browser in the presentation)

Background information

<u>Delete browser history</u>
- Firefox: Go to Menu > Settings > Clear Private Data > Click on Clear Private Data
- Chrome: Go to Menu > Settings > Privacy > Clear browsing data > Click on Clear Data
- Safari: Go to Settings > Safari > click on Clear History and Website Data

<u>Install privacy badger</u>
Trainers note: is only supported on Firefox, Chrome and Chromium on the computer and the Firefox extension on Android. Therefore, this is not suitable for hands-on in this type of workshop

<u>Alternative tools and services</u>
Email: Riseup.net, Protonmail.com, Tutanota.com
Search: Duckduckgo.com
Browser: Firefox, Firefox focus (mobile only), Chromium.
Chat apps: Signal, Wire and Telegram

<u>Passwords</u>
Trainers note: do not recommend participants to change their password in the workshop, as they might forget it, get locked out of an account, and get frustrated which will lead to an adverse reaction to taking privacy and security actions in the future. It is recommended to change passwords at home in a quiet environment.
These guides explain how to create strong and unique passwords
https://ssd.eff.org/en/module/creating-strong-passwords

<u>Private browsing mode on your computer</u>
Open browser and…
Safari y Chrome: Windows: Ctrl + Shift + n
                                Mac: ⌘ + Shift + n
        Firefox: Windows: Ctrl + Shift + p
                                Mac: ⌘ + Shift + p
<u>Private browsing mode on your mobile</u>
- Firefox: open Firefox > Click on multiple windows > Click on the mask
- Chrome: open Chrome > Click on menu > Choose "New Incognito tab"
- Safari opening private browsing mode: open Safari > Click on multiple windows > Click on 'Private' (bottom left).
- Pre-installed browser on many Android Phones: open Browser > Click on multiple windows > Click on the little figure (top, right).
Trainers note: a private browsing mode is like creating a temporary clean browsing environment. When you close the private browsing option you will delete all the stored third party trackers. It is important to regularly close the private browsing mode, otherwise it becomes like a normal browser.

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Note that the private browsing mode does not anonymize your surfing activity, your IP address and your browser fingerprint will stay the same and third parties like your internet provider, the website you visit and the trackers on this website will still have access to this.

Install HTTPS Everywhere
Trainers note: is only supported on Firefox, Chrome and Chromium on the computer and the Firefox extensions for Android. Therefore, this is not suitable for hands-on in this type of workshop

Guides and resources
https://ssd.eff.org/es
https://myshadow.org/es
https://securityinabox.org/es/

Data brokers:
An entire industry exists of companies who are specialized as selling and buying data of users/citizens. This data brokering industry is a multimillion -dollar industry, that is commodifying our data as a product, pushing the frontiers of ways to identify users, create profiles and develop advanced algorithms.

Section V Closing

Questions:
Answer questions from the audience. In the interest of time, park questions that are to specific and tell the participant that you can talk about it after the workshop. Or when there are too many questions, refer them to the handouts and online materials (in the last slide).

Resources:
Provide the participants with the handout that directs them to resources on privacy and data protection.
- Glossary
- Decision Making Framework
- Guidelines and resources to increase your privacy

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IV. Module II Responsible Data in City Planning

Training Outline

The module addresses the staff of the city administrations in partner countries, particularly those that are involved in the implementation of the pilot project "ICT-based Adaptation to Climate Change in Cities". **The goal** of the training is to increase the capacity of the participants to responsibly handle act data in their institutional environment. Hence, this module will include **practical guidance for their day-to-day work;** and will focus on the intersection of data protection and open data in the context of municipalities.

Target group: Urban practitioners   Level: Introductory/Intermediary

Time frame: 4 didactic hours practical training session,total of 210 minutes (inkl. Break)

Venue requirements: It should be possible to arrange tables and chairs and to hang posters and notes on the walls
Number of participants: for two trainers we suggest a group with min. 13 and max. 22 participants

Materials needed:
- Presentation, incl. country specific input that covers basic legal situation and any other context specific issues
- Paper
- Post-its
- Pens
- Flipcharts
- Process map (Print enough process map on A2 paper for all the different sub groups)
- Handouts (Print enough for all participants)

Trainer resources (to find further information):
- „Open Data Release Toolkit" of the City San Francisco
- Green, B. a.o. 2017. Open Data Privacy (2017). Berkman Klein Center for Internet & Society Research Publication, p.84; http://nrs.harvard.edu/urn-3:HUL.InstRepos:30340010
- GDRP Explained: https://gdprexplained.eu/es/
- See as bedrock the Privacy Impact Assessments UK
- Anonymisation (advanced level):
    - UK Anonymization Network "Anonymisation Decision-Making Framework" or "Case-Studies".
    - See explanation of the anonymisation procedures Website of UK Police Data.
    - https://data.police.uk/about/#anonymisation

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- [University of Texas Anonymisation Toolbox](#)

Preparation:

Making choices: The presentation needs to be adapted to the level of experience and knowledge of the participants based on a pre-assessment. While some of the slides focused on the very basics of data governance are only relevant for beginners (for instance, participants that work in other sections of the government, but have recently started to contribute to the open data endeavours), other content of the presentation is only relevant for advanced participants who are data experts (such as input on anonymisation). Trainers therefore have to decide which content is most suitable for their group.

On average you will take 2 minutes per slide. For a 45 minute dynamic input you would want no more than 15 slides.

Preparing local content: A specific slide on the data protection regime of the country the workshop is taking place in needs to be prepared. In case you know that there is a local expert on data protection laws present, you should integrate him actively and ask him to lay out the main principles of the law.

Downloading Excel Data File: The trainer needs to make sure that the Excel slide on bicycle data that works as an example for anonymization can be used and scrolled through during the presentation.

Preliminary structure:

Time (Total: 210 Min)	Format
15 Min	Introduction
45 Min	Part 1 - Process Map: Project overlook
10 Min	Report Back
15 Min	*Break*
40 Min	Input by trainer
40 Min	Part 2 - Process Map: Data Details
15 Min	*Break*
10 Min	Report Back
15 Min	Part 3 - Process Map: Project Measures
5 Min	Synthesize

Format type
Input

Interactive

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Minutes	Activity
15 Min	Introduction - Trainers introduce themselves and the objectives of the workshop (underline that this is not a legal workshop, but its objective is to convey the broader context of data handling) - Participants are asked to briefly state their name (or the name they would like to be associated with), what they hope to take away from this workshop, and which data or dataset they are currently working with - Trainers outline the agenda for today. They acknowledge which participants expectations will be met and which won't. - Define the scope of the workshop: we will be talking about their work in relation to privacy and data protection. Before we get started with the workshop we want to make sure everyone understands the same when we talk about issues like open data, data protection, privacy and FOI (definitions can be found in the Module II trainers notes). Explain the terms that are most relevant for the workshop.
45 Min	INTERACTIVE ACTIVITY PART 1 Group Work -- Process Map • Explain page 1 of the process map exercise to the participants. The group will be broken into small groups (preferably 4 per group, a minimum of 2) and they will have 45 minutes to fill out the process map from the perspective of their ICT project. The process map has a predefined format. In this first section each group is asked to fill out part 1, which include the following aspects: ○ Value Mapping ○ Aims ○ Organizational culture ○ App development process ○ Legal environment • After 45 minutes the groups will be asked to report back, there will be no time to report back in detail, each group will be asked to report back on three questions (see below). • Divide the participants into small groups according to the project they work on. People working on the same project ideally form a group. In case all participants come from different departments within the city divide them according to topic or interest. • Each group defines one projects that all group members have worked on to ensure that they can start from their own experience. If all participants work on an App as part of the 'ICT-based Adaptation to Climate Change in Cities' programme, they select this example. If not, they select another ICT project from a city. Note: It is important that at least one person in the group has been involved in the project.

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10 Min	**Discussion:** • Ask each group to report back on the following three questions after working on the first part of the process map: ○ What is the one thing your groups will take away from this exercise? ○ Did the process map give you a new insight into your technology project? ○ Which sections of the process map did the group find most difficult to answer? • Trainers will collect main findings and questions on a flip chart, and give feedback on why such a mapping is helpful, plus explain the relevance of different section (for instance, why organizational values are important, i.e. if the key value is transparency there will be natural friction with data protection) • Recommend to continue this exercise at another point
Break (15 min)	
40 Min	**Input by trainers** Trainer will give an interactive presentation, which should encourage participants to actively participate. The presentation aims to raise awareness on key elements of responsible data management, which goes beyond compliance, and covers the following topics: 1. Clarification of Concepts Increase knowledge on data in the city context and connecting this to the participants personal data and private life. 2. Privacy, Data Protection Mechanisms and risks in the context of Cities Raise awareness on the different data protection mechanisms and how this relates to Freedom of Information Requests and open data, show risks and highlight the responsibility of cities. 3. Data Handling Privacy Impact Assessment and Consent as approaches to integrate responsible data management in the development process and running of an app, and in the decision to open up data. Find detailed script for each of the topics in the trainer's notes for module II.
40 Min	**INTERACTIVE ACTIVITY PART 2** Deepening: process map part II Data Management This section covers the element risk / value assessment and privacy impact assessment. • The trainer explains the part 2 (a) and part 2 (b) of the process map, walking through the template Data Management Characteristics (2a), and

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	the Risk / Value assessment (2b).
	● After 40 minutes the groups will be asked to report back, however, there will be no time to report back in detail, each group will be asked to report back on three questions (see below).
	● After the instruction the trainer will ask participants to return to their small groups, the group will divide into two subgroups. One will focus on the 2a - Data Management Characteristics, answering questions on
	    ○ Data Characteristics
	    ○ Risks and Values of the data
	    ○ Nature of processing
	    ○ Data Sharing and third party involvement
	    ○ Scope of Processing
	    ○ Context of Processing
	The other subgroup will focus on the 2b - Risk / Value Assessment, assessing the likelihood of risks and potential mitigation strategies.
	● While the groups are formed the trainer hands out the sheet two and three (PART 2) of the process map.
	● After the 25 to 30 minutes the small groups come back together and spend 10 minutes explaining to each other what they have done and what they found.

Break (15 min)	

10 Min	Deepening: Report back and discussion
	● Ask each group to report back on the following three questions after working on the second part of the process map:
	    ○ Is there something that remained unclear?
	    ○ What stood out while working on the risk and privacy impact assessment?
	    ○ Share what you want to learn more about and why
	
	After all the groups have reported back the trainers will synthesise the key insights of the groups, limitations to implement privacy and data protection measures and clear articulation of needs. He or she will furthermore recommend to go through the exercises again with the whole team after the workshop.
	Note: point that will come up is individual responsibility of government official

15 Min	INTERACTIVE ACTIVITY PART 3 Closing The trainer explains the third part of the process map, which focuses on next steps. While participants return to their groups, the trainers hand out part three of the process map, which includes ● Consultation ● Mitigation strategy

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	- Communication Strategy - Needs and Responsibilities - Next steps The trainers explain that for this exercise the participants should only focus on Communication, Needs and Responsibilities. He or she can indicate that the other sections can be included when the team revisists the process map after the workshop.
5 Min	Wrap up: The trainer brings the group together and asks if there are any questions, wraps up and hands out of training materials.

Module II Trainers notes for input

Section 0: Introduction

- Trainers introduce themselves and the objectives of the workshop
    - Underline that this is not a legal workshop, but its objective is to convey the broader context of data handling and responsible data
    - Why? Data is everywhere and they offer a number of opportunities in particularly for cities
    - But simultaneously we see an increasing number of cases where data has been misused or spurred irritation among citizen
    - The workshops aims to show how these cases are also connected to cities and their work with data
    - Cities have the opportunities to position themselves as pioneers of good practice in responsible data handling
    - Hence, the idea is not to limit data innovation but rather to show how responsible data can be integrated in the design of projects from the beginning
    - The workshop also wants to help to identify and highlight the resources and knowledge that already exists in the city (represented by the participants) so that in the future the city can build up on this existing expertise
    - Lastly, this is a workshop and not a course, so it requires active participation
- Participants are asked to briefly state their name (or the name they would like to be associated with), what they hope to take away from this workshop, and which data or dataset they are currently working with
- Trainers outline the agenda for today (see table page 2)
- They acknowledge which participants expectations will be met and which won't.
- Trainer explains the terms that are most relevant for the workshop.
    - Data
    - Metadata
    - Personal data
    - Data processing
    - Database

Background information

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November1, 2018
Fieke Jansen, Julia Manske

What is data?
Data is the physical representation of information in a manner suitable for communication, interpretation, or processing by human beings or by automatic means.

What is personal data?
Personal Data is any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity.

What is metadata?
Metadata is data about data, and is created by your technology and devices. Metadata is necessary so that an email can be sent, to walk and talk with your mobile phone (location data, so the network knows where they can reach your mobile phone). For more information see for example video by Privacy International:
https://www.youtube.com/watch?v=xP_e56DsymA

What is data processing
Any operation or set of operations which is performed upon data, whether or not by automatic means, such as collection, recording, organization, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, blocking, erasure or destruction.

Section I: Introduction and Clarification of concepts

1. Data in the context of cities

Instruction:

Ask the participants to collectively define Responsible Data Management by cities. For the discussion draw on the definitions and terms used in the introduction and the inherent tension between processing personal data and privacy / data protection, touch upon concepts such as Freedom of Information and Open Data Policies.

Background information
Responsible Data Management:
Responsible data management it the duty to account for unintended consequences of working with data by:
1. prioritising people's rights to consent, privacy, security and ownership when using data,
2. implementing values and practices of transparency and openness[9].

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Freedom of Information Request (FOI):
FOI legislation applies to information held by government bodies and in certain circumstances to private bodies. It stipulates that citizens can request access to governmental information, and is seen as a tool to keep governments and in some cases companies to account for their actions.

Open Data:
Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike. Open data should be:
- Availability and Access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.
- Re-use and Redistribution: the data must be provided under terms that permit re-use and redistribution including the intermixing with other datasets.
- Universal Participation: everyone must be able to use, re-use and redistribute - there should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions that would prevent 'commercial' use, or restrictions of use for certain purposes (e.g. only in education), are not allowed.[10]

Open government data:
Open government data is nowadays an integral part of the digitalization strategy of many governments, as they are seen as a source of increased accountability as well as innovative solutions. Open data is used by the administrations itself, by civil society, start-ups and companies and research departments.

Open-by-default:
Many government implement open-by-default policies. According to this approach, all data and information generated by the government are in principle open and freely accessible in standardized machine-readable format, and can be modified, used and shared freely, by anyone for any purpose.

Freedom of Information vs Open Data:
There are many overlaps between the principles of FOI and those of open data. And yet, with regard to the protection of privacy, it is important to clarify their differences:

FOI:
- Reactive sharing of data: governmental bodies and some private bodies only release data after they have gotten a request.
- In most countries FOI requests are backed by a legal right (goal is to increase transparency and allow civil society / journalists to hold governments or the private sector accountable.)
- Many requests made under the FOI Act apply to the retrieval of documents (e.g., protocols, contracts). But also records / databases can be the subjects of FOI requests or serve the purpose of transparency and accountability. For example, if they contain household data, data on procurement, salaries and benefits or lobby registers.

[9]   https://responsibledata.io/
[10]   http://opendatahandbook.org/guide/en/what-is-open-data/

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[9] https://responsibledata.io/
[10] http://opendatahandbook.org/guide/en/what-is-open-data/

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- FOI inquiries are based on a clear question or "purpose" (why the information is requested).
- In many countries, the answers are made available to the requesting party only. In many cases they can furthermore not be published or can be only further processed in a restrictive manner.

Open Data:
- They are proactively provided by the government (but no legal entitlement exists).
- As many actors as possible can (and should) access and use them in many ways.
- The theoretically conceivable range of use cases of the data may still be unclear upon publication and only fully reveals once published. They also have the potential to provide unpredictable added value for a large number of actors. Therefore, they are also a source of innovation and can also be the starting point for economic added value.
- The value of open data increases once it is connected to other databases.
  - Examples:
  - In New Zealand, health, census and social security data are combined and evaluated to predict the need for preventive measures against child birth defects in newborns.[11]
  - In San Francisco, data about accidents, roads, and traffic data are used for better traffic management.[12]
- However, this increases the risks associated with the data: Data can be easily connected with other publicly available data sources (for instance social media data)

2. **Connecting Privacy and Data Protection to the participants' life**

Instruction:
Privacy and data protection are very high level and abstract terms. For the individual user they do not mean that much, as our brains do not translate data we create and the idea of privacy into something we actually care about, or that has real world consequences, like exposing ourselves and our loved ones to harm, when exposing the location of our house and the fact we are going on a holiday to thieves; or leaving our identity unprotected, and digital criminals steal our identity to commit crimes; or possible financial repercussions as an financial institution determines your credit score on the basis of you online behaviour.

The challenge does not only start with the abstract concept of privacy, it already starts with the limited mental models we have to understand how technology works, which data is created and collected and how this data is analyzed.

Walk the participants through the following exercise of discovering their own digital footprint:

[11]   http://www.msd.govt.nz/about-msd-and-our-work/publications-resources/research/predicitve-modelling
[12]   "Data-Driven Policy": San Francisco just showed us how it should work."
        https://medium.com/@abhinemani/data-driven-policy-san-francisco-just-showed-us-how-it-should-work-c7725e0e2b40

- *Location history.* Ask all participants to take a few minutes to think about where they have been last week. Then walk them through the slides that says how they can find their location history on their phone. For those participants who find out that they are not saving their location history, tell them to look at their neighbor's phone. Give them 2 minutes to look at their location history, get everyone back into the group and ask them what they notices. Was there anything different between what they remembered and what their phone remembered?
- Tie this exercise back to their work at the city. If location data was mentioned by the participants in the previous exercise, tie it to this. Otherwise comment that a lot of city data is geo-located, which could reveal similar patterns on city life as a whole and on individuals.

Background info:
Finding location history on participant mobile phones:
- Iphone: Settings > Privacy > Location Services > System Services > Significant Location > Enter you passcode/password > click on a location > click on a location under the map
- Android: Google Maps > Menu > Your Timeline

Section II: Privacy, Data Protection Mechanisms and risks in the context of cities

1.Privacy and Data Protection Mechanisms

Instruction:
If you have time you can ask the group why they think that Privacy is important for our democracies.

Right to Privacy
Privacy is a fundamental human rights, and is protected under Article 12 of the United Nation Declaration of Human Rights, covering both (a) Physical Privacy, and (b) Informational Privacy.

"*No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honor and reputation. Everyone has the right to the protection of the law against such interference or attacks.*"

This right is both a right in itself, but also needed to be able to exercise other fundamental rights. To that end, the Right to Privacy is an enabling right, it is the basis for other fundamental rights and freedoms, such as the Freedom of Expression, religious freedom and protection against discrimination.

To protect our Informational Privacy most countries in the world have Data Protection Frameworks that regulate data collection and data processing. It is important to note that the role of these frameworks is not to protect the data, but always to protect the data subject. Each

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country or region will have their own Data Protection Frameworks, depending on the participants country of residence the local framework will apply.

Background info:
The origins of the right to privacy are often references to the article, "The Right to Privacy" Warren and Brandeis wrote the for the Harvard Law Review in 1890. In the article Warren and Brandeis stress that privacy is the "right to be let alone", and is focused on protecting individuals.

Under the Universal Declaration of Human Rights it is stressed that:
- The Right to Privacy, divided into (a) Physical Privacy, and (b) Informational Privacy, the ability of a person to control, edit, manage and delete information about themselves and to decide how and to what extent such information is communicated to others.
- The Right to Privacy is an enabling right, it is the basis for other fundamental rights and freedoms and, such as the Freedom of Expression, religious freedom and protection against discrimination.

Data Protection Regulation
Instruction:
Explain how data collection and data processing is governed by a Data Protection Framework, which are aimed at protecting their privacy. Most countries in the world have Data Protection Regimes. It is important to note that their role is not to protect the data, but always to protect the data subject. Each country or region will have their own Data Protection Frameworks, depending on the participants country of residence the local framework will apply.

- Most Data Protection Frameworks make a distinction between three data categories
    1. Personal Identifiable Information also known as personal data, this includes data that can be used to directly (name) or indirectly identify (title, shoe size) a data subject
    2. Sensitive data, and
    3. Non Personal Identifiable Information.
    Data Protection Frameworks govern the first two data types and not the third.

Trainers prompt: Ask the participants if they work with personal data. Those who say yes, ask them what data they process and who they share it with. The slide in the presentation gives a number of examples of data sets that are usually hold by city departments. Discuss those data sets with the participants based on the distinction of personal data and non personal data.
    A suggestion is to plot their answers down on a flipchart according to who they share it with.
    - Within their department
    - Between departments within the city
    - Between other government bodies
    - With companies

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- As open data

Data protection regulation restricts the collection, processing and sharing of personal identifiable data. However, as we all know a number of services process personal data all the time. How is that possible? Because there are three exceptions that allow the processing of personal data - legitimate interest, legal compliance and consent.
- <u>Legitimate interest</u> is the data needed for the tool or service to function (Whatsapp needing access to your phone number in order to function).
- <u>Legal compliance</u> can be data collected and stored for law enforcement.
- <u>Consent</u> is based on companies or organizations gaining active consent from users for the collection and processing of additional personal data, which is not needed for legitimate interest or legal compliance.

Background information

<u>Data categories</u>
- Personal Identifiable Information:
  Any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly.
  Data Protection Regulation applies to this category of data.
- Plus category of Sensitive Information:
  Sensitive personal data is a specific set of "special categories" that must be treated with extra security. These categories are: Racial or ethnic origin; Political opinions; Religious or philosophical beliefs; Trade union membership; Genetic data; and Biometric data (where processed to uniquely identify someone).
  Data Protection Regulation applies to this category of data; and often requires special protection mechanisms.
- Non Personal Identifiable Information:
  Any information that can not be used to identify a natural person ("data subject"), meaning (1) raw data that can not be used to identify a person, (2) anonymised data, and (3) aggregated data which is can not be used to identify a person.
  Data Protection Regulation does not apply to this category of data.

<u>Data Protection Frameworks</u>
As of January 2018, over 100 countries around the world have enacted comprehensive data protection legislation, and around 40 countries are in the process of enacting such laws.[13] A number of these laws are based on the European Directive 95/46/EC on data protection. They are so called Omnibus Laws written down in the constitution covering a number of areas.
Other countries may have privacy laws applying to certain areas and sectors, for example for children or health data, but do not have a comprehensive law on data protection (for example in the US).

In many countries around the world (in particular in Latin America), there exists a

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[13]   https://privacyinternational.org/report/2255/data-protection-guide-complete

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Constitutional right of "Habeas Data", similar to the German "Right to Informational Self Determination", which is designed to protect the data of an individual by granting them the right to access the information held about them, and providing for the individual concerned to submit a complaint to the court.

Currently the most advanced data protection law is the new EU General Data Protection Regulation (GDPR), enacted in 25 May 2018.
It requires companies and organizations to handle personal data of European citizens in the following way:

1. Limits collection of personal data. Only collect what is necessary to make tool/service function, billing purposes and required by law.
1. Need active consent in case of collecting additional personal data. When a company or organization wants to collect more data than is absolutely needed for legitimate use or legal compliance, they need to actively ask for consent of the data subject to collect and process this data.
2. Right to information on what personal data companies or organizations process and how they use it. In the case a company uses profiling techniques, you have a right to know what is in your profile.
3. Right to secure handling of your data: regulates that personal data should be stored and processed securely. If a company or organization has lost your data through a data breach, they have to inform the Data Protection Officer in 48 hours. If they lost 'sensitive' personal information they will also have to inform the user.
4. Right to access the personal data a company or organisation holds on you, and ask them to:
   a. Change or complete the data in case it is inaccurate.
   b. Delete your data if the data is no longer necessary
   c. Delete your data, if you initially gave more data than was necessary to run the tool or service.
5. With automated decisions, you have the right to explanation and human intervention.

2. How can risks to data protection arise?

Instruction:
Ask the participants what in their eyes are risks associated to the city not managing personal data properly. Maybe they have heard of any incidences. List down their answers.

Some of the ways this risk can arise is through personal information being:
- inaccurate, insufficient or out of date;
- excessive or irrelevant;
- kept for too long;
- data subject does not want their data to be disclosed to a specific third party;
- used in ways that the data subject finds unacceptable to or unexpected;

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- disclosed to those who the person it is about does not want to have it;
- used in ways that are unacceptable to or unexpected by the person it is about;
- or not kept securely.

This can lead to (1) risk to the safety, security and reputation of an individual, (2) compliance risk and (3) risk to the institution.

Background info:

When cities and municipalities collect, process and share Personal Identifiable Data it is important to think through the potential harms and consequences that can come from poor data handling. Once risk are identified the data processor can identify actions which can prevent or mitigate these risks. For this training we categorize the risks on three levels: risks to the individual, risk to the department and risk to the institution.

(1) Risks to the individual
Harm can present itself in different ways. Sometimes it will be tangible and quantifiable, for example financial loss or losing a job. At other times it will be less defined, for example damage to personal relationships and social standing arising from disclosure of confidential or sensitive information. Sometimes harm might still be real even if it is not obvious, for example the fear of identity theft that comes from knowing that the security of information could be compromised. There is also harm which goes beyond the immediate impact on individuals. The harm arising from use of personal information may be imperceptible or inconsequential to individuals, but cumulative and substantial in its impact on society. It might for example contribute to a loss of personal autonomy or dignity or exacerbate fears of excessive surveillance.

(2) Risk to the department
In some countries the data protection legislation treats public institution the same as private institutions. So depending on your national data protection legislation a public institution might be subjected to warnings and fees when not properly managing Personal Identifiable Data. Even in countries where the data protection regulation does not govern public institutions a department who's data management does not comply to to the internal city or municipality data management guidelines might experience negative consequences.

(3) Risk for the institution
Next to the risk to the individual and the risk to the department it is important have a broader understanding of harms. In a time of continuous data processing, automated decision-making, and the spread of data-driven business models, urban practitioners have to understand that mismanagement of personal data can erode trust of citizens in public institutions. Another risk is that the use of unreliable data (bias in data) can decrease efficiency of the project, lead to miss allocation of resource or wrong implementation of the project.

Responsibility as cities
In the previous slide we talked about risks. Risk to the individual, compliance risks and risk to the institutions. Ask the participants if they can:

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- Think of any risks associated to the above mentioned personal data being shared or opened;
- Or if they know of any cases where data was shared, opened or hacked and if there were any negative consequences either to the individual, or to the organization (for example the public losing trust in the organization, bad press or the organization being fined or charged for not keeping personal information safe).
- Trainers gives a country specific example, that illustrates risks of not responsibly managing city data. Note: If you do not have an example, use of the examples below.

- Trainers explain why risk associated to data might not always be tangible. There is
    1. usually time in between the collection of data and the potential negative consequences,
    2. difficult to move from one datapoint to a datasets, and how specific groups can be identified and targeted in a dataset. Specific groups that are at risk of being identified depends on the local context, but think of journalists, women, ethnic minorities, people with a physical or mental disability etc.,
    3. data collected that seems innocent today might get more sensitive over time. A regime change, data falling in the wrong hands, or data being connected with other dataset, could increase the risk to certain individuals and groups.
- Conclude, that responsible data handling goes beyond compliance, it also touches upon ethics and social values / norms and technological standards. This is particularly the case for cities where citizens have certain expectations and their trust is needed in order for services to work well.

Background information[14]

Example on data leaks from Mexico:

Uber Data Breach

In 2017 it was revealed that in 2016 Uber paid hackers $100,000 to keep a massive data breach that exposed personal data from around 57 million accounts worldwide secret. In Mexico this case gained publicity because the Mexican National Institute of Transparency, Access to Information and Protection of Personal Data (INAI) asked Uber for information on the number of "Mexican users, drivers and employees" that have been affected. The institute also asked Uber for information on the measures the company is taking to mitigate the damage and protect clients' information.[15] The information has however not yet been provided.

Voter Registration Data[16]

In 2015, a database containing voter registration records was published online, exposing the

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[14] The project "State of Privacy" run by the British NGO Privacy International offers a detailed information about cases of surveillance and data protection incidents from a number of country. https://privacyinternational.org/type-resource/state-privacy

[15] https://www.reuters.com/article/us-mexico-uber/mexican-authorities-seek-information-from-uber-about-data-breach-idUSKBN1DQ0TT

[16] https://privacyinternational.org/state-privacy/1006/state-privacy-mexico#dataprotection

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personal information of 93.4 million Mexican citizens. The records contained the individuals' name, photograph, complete address, date of birth, last names of their parents, occupation and their unique voting credential code.

Example of data leaks from India:

User data from Indian Railways[17]

In May 2016 it was reported that the ticket-booking website of Indian Railways had been hacked and personal data of around 10 million customers was feared to have been stolen from the servers of the e-ticketing portal. It was reported that IRCTC officials also feared that personal details including phone numbers, date of birth and other such details of its customers had been sold on a CD for Rs 15,000. The Indian Railways Catering and Tourism Corporation denied that their website had been hacked, and claimed that they had not received any indication that a data breach had taken place.

Malware in Payment Systems[18]

In October 2016, malware reportedly introduced in systems of Hitachi Payment Services enabled criminals to steal financial information of customers of a number of banking institutions including Visa, MasterCard, ICICI Bank, Axis Bank and YES Bank. As many as 3.2 million cards were compromised as a result of the breach.

Anonymization - theory vs reality

To mitigate risks cities turn to anonymization of datasets. When we take a closer look at this practice we see this is very challenging.

- Provide an example of an open anonymized dataset on city level which was used to re-identify people (see below)
- *Trainers prompt:* The trainer opens up the example of a data set, and explains that this is an extract of a data set downloaded from an open data portal from a city. The data set contains the data on public bicycle usage from one months in 2016.
    - Ask the participants if they think that the data is anonymized or pseudonymized
    - Now, look at user number 64 (highlighted in the data set), go through the data of the user, and ask participants what they can find out about the person looking at the data (they might mention gender, age etc.); ask them if they can see from the data which bike station is likely to be close to where he lives
    - Explain that from a quick look at the hours (when was the bicycle used) it seems like "ID 18" is likely to be where he lives, while "ID 54" could be where he works.
    - Now, hint participants to 4th and 9th of November 2016. 4th of November of this year in fact was a Friday, the 9th was a Wednesday. They might realize that the user on these days shows an untypical pattern; and that it seems like he spent the night at "ID 187". There are many explanations, why, 187 could be close to a club or a bar, a friend's house, or it could be close to the address of a woman he stayed at.

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[17]   https://privacyinternational.org/state-privacy/1002/state-privacy-india
[18]   https://privacyinternational.org/state-privacy/1002/state-privacy-india

- If for example I am the wife of user number 64 and I work at that local government that published the data, or I am a data expert that looks into the data, it might be easy for me to identify my partner in the data set (because I know his age, the bicycle stations he frequently uses and his routines, i.e. at what time does he leave the house). It could be that exactly during that time from Thursday 3rd onwards I had to visit my sick mother out of town.
  - Explain that this is very hypothetical and of course not necessarily a likely scenario; however, it shows that data sets that at a first sight don't seem to prevail any relevant information about individuals, can easily give a richer insight than you initially thought.
  - Also explain that the data in this data set is only pseudonymised and not anonymized. But that even in anonymised data it has been possible for experts to identify individuals.
- Problem with anonymization are:
  - Difficult to anonymize as removing Personal Identifiable Information still allows computers to reveal pattern in the Non Personal Identifiable information, with the risk of re-identification of individuals.
  - When people speak of anonymization of data, it is usually pseudonymization (explain the difference as described in the box)
  - Datasets do not exist in a vacuum, they can be correlated with other datasets, with the risk of re-identification of individuals.
- To highlight the latter challenge the trainer can briefly explain the NY city data case (see box).

Background information

Examples of open data which was used to identify individuals:

- After the release of anonymous taxi data in New York, hackers were able to identify the salary of taxi drivers, the places of residence of individual passengers and the movement patterns of celebrities, such as movie star Bradley Cooper (see slide) by crossing the data with other information, in that case with paparazzi photos of celebrities entering taxis from that same day in 2013.[19] The data revealed that in Brad Cooper's case, he took the cab to Greenwich Village, possibly to have dinner at Melibea, and that he paid $10.50, with *no recorded tip*. Note that this data base has been published on the bases of an FOI request.
- The public transport company Transport for London published data on the use of public bicycles, which could be de-anonymized and allowed the creation of movement patterns of individual cyclists.[20]
- On an Australian Open Data portal - anonymized data - on prescription was published. The University Melbourne showed that linking these data with other data sets allowed

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[19]   https://research.neustar.biz/2014/09/15/riding-with-the-starspassenger-privacy-in-the-nyc-taxicab-dataset

[20]   http://qz.com/199209/londons-bike-share-program-unwittinglyrevealed-its-cyclists-movements-for-the-world-to-see

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conclusions to be drawn on individual doctors.[21]

Data anonymization
When a dataset is anonymised, the identifiers are removed, obscured, aggregated or altered to prevent identification. The term "identifiers" is often misunderstood to simply mean formal identifiers such as the name, address or, for example, the CURP number. But, identifiers could in principle include any piece of information; what is identifying will depend on context. For instance, if a group of individuals is known to contain only one woman, then the gender will be identifying for the woman (and gender is usually not classified as a direct identifier). Identifiers can also be constructed out of combinations of attributes (for example, consider a "sixteen year old widow" or a "15 year old male University Student" or a "female Bangladeshi bank manager living in Thurso").
There are different ways in which datasets can be modified and identifiers can be removed:

(1) Anonymization:
Through the process of anonymization, data is changed to such an extent that it can no longer be assigned to a person. Anonymised data does not fall under the area of data protection law. Anonymisation has long been considered a secure solution for securely publishing data of individuals, however, incidents are increasing where people could be re-identified in data records.

(2) Pseudonymization:
Pseudonymization replaces a feature in one record with another. The natural person can therefore still be identified relatively easily. According to European law, pseudonymised data remains within the scope of data protection legislation. According to most other law, including the US law, pseudonymised data is currently not defined as personal data.

(3) Aggregation:
Aggregation is an anonymisation procedure in which persons are summarized after a generalization of characteristic values (eg by the interval value "20-25 years" when specifying the age). Data can then be presented as individual data or presented in a consolidated form listing the averages (all persons in this age group).

Privacy and data protection vs open data
Privacy, data protection, open data and freedom of information request sometimes get conflated. We already looked at these concepts, but it is important to note that it is not a zero sum game. Governments and cities have to balance their open data mandate and Freedom of Information compliance with their responsibility to protect their citizens from harm. Cover the below points:

- As shown above there is the risk that individuals are re-identified in an open dataset.
- There have been incidences where privacy and data protection have been used as an argument against opening up data that has great public value. Decisions on why data is not opened up hence needs to be made transparent. These discussion are not new. In

[21]   https://www.zdnet.com/article/re-identification-possible-with-australian-de-identified-medicare-and-pbs-open-data/

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the course of FOI data protection has always part of the debate when it involved personal data.
- Note, that countries have different approaches, while in European legislation the right to data protection is historically more enshrined, in the US and LATAM the right to information has been more reflected in law. Nevertheless, boths rights theoretically are perceived as equally relevant and non-hierarchical.[22]

Therefore, we are now focusing on frameworks that provide a responsible way of handling data.

Section III: Data handling

Instruction:
There are different approaches to integrate responsible data management in cities technology projects, the most commonly used methodologies are privacy impact assessment, privacy by design, participatory design and consent. In this part of the workshop will we go more in depth into privacy impact assessment and consent but we briefly want to mention privacy by design and participatory design.

Background information

Privacy by Design:
Privacy by Design is an approach that enables you to translate concepts of data protection into the design, implementation and operation of an app or a data system. This approach is beneficial when working with developers to create an app or technology system.

Participatory design:
Is an approach that focuses on working together with all stakeholders (citizens, city officials, developers, and others) from the beginning to the end of the technology project to include all voices, concerns and opinions.

In this training we will now take a closer look at
1. Privacy Impact Assessment
1. Consent

1. Privacy Impact Assessment

Instruction:
A Privacy Impact Assessment (PIA) is a process which assists organisations in identifying and minimising privacy risks. Conducting a PIA involves working with people within the organisation, with partner organisations and with the people affected to identify and reduce privacy risks. The PIA will help to ensure that potential problems are identified at an early stage, when addressing them will often be simpler and less costly. In fact, a PIA can help you to make your project better

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[22]   Janssen, K.; Hugelier, S. (2013). Open Data: A New Battle in an Old War? In: Hildebrand et al.: Digital Enlightenment Yearbook 2013. The Value of Personal Data; S.192.

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and more cost-efficient, because gaining a detailed understanding of how personal information is managed is likely to uncover areas for process improvement.

Ideally the PIA is conducted in the designing stage of a process, once an overall idea of the project and its objectives exists. It may be conducted by the project management team with support from the data protection and data management experts.

Trainer explains the six steps that need to be taken into account, and explains that the exercise of the process map (parts that participants worked on before break, and parts they will work on later) covers many of the questions addressed in a PIA.

However, in a new project it is recommended to go through all the questions posed by the PIA, as listed in the template that will be handed out to the participants at the end of the workshop.

When explaining the different phases of the PIA the trainer uses one of the applications or solutions brought forward by the participants to exemplify the different questions:

- First step: Explanation of the project; trainer explains that this step has already been covered by the groups in the first session of the group session
- Second step: Identify data characteristics, relevant questions are for example
  - Which data will be collected?
  - What kind of datasets will be processed?
  - How sensitive is the data (refer again to the data categories discussed earlier, but also to data from children)?
  - What are the benefits to using this data versus the risk associated to this data? Who benefits and who is at risk?.?
- Third step: Analyse data management characteristics
  - (A) What's the nature of processing?
    - How will you collect and process the data?
    - Will you be sharing the data with anyone? What is the legal basis of sharing data? How likely is it that this third party will treat this data responsibly and with the same standards as you? Will you be opening up the data for a wider public?
    - Where and how will the data be stored? (i.e. as raw data, in modified form), Which security measures are in place? How will the data be deleted?
  - (B) What's the scope of processing?
    - How much data will you be collecting and using? How often? How long will you keep it? How many in geographical area are affected?
  - (C) What's the context of processing?
    - What is the nature of your relationship with the individuals? How much control will they have? Would they expect you to use their data in this way?
    - Are there prior concerns over this type of processing or security flaws? Do you know of cases where this data has been misused? Are there any current issues of public concern that you should factor in?
- Fourth step: Assess proportionality and necessity
  - What do you aim to achieve with the data processing? What is your lawful basis for processing?
  - How will you ensure data quality and data minimisation?
  - Who will benefit in which way from the data processing?

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- How much ownership do citizens have over the project and to which extend will citizens see the value of the project?
- How do you plan to inform them that their data was collected?
- What additional measures will you take to help to support their rights?
- If applicable, what measures do you take to ensure processors / third parties comply?
- If applicable, how do you safeguard any international transfers?

- Fifth step: Consult experts

  Explain that this and the following step will be covered in the third part of the process map.
  - Who else do you need to involve within your organisation?
  - Do you plan to consult (external) information security or data protection experts, or any other experts? If not, why?
  - Do you plan to involve civil society or seek citizen's view? If not, why?

- Sixth step: Establish long-term measures

  This step should be part of a cities mitigation and contingency plan when developing technology projects.
  - How will you document security incidents?
  - What is you mitigation plan? What are the different risks that could occur? Which measures will you take in case a risk occurs? Who will be responsible for the response mechanisms?
  - How will you be communicating your decisions on data collection, processing and publishing?
  - Define a date when the project and the data involved will be reviewed again

2. Consent

Instruction:

The trainer can ask how many people have read the Terms of Service or read a Privacy Policy before clicking "I agree". If any of the participants have read one ask them if:
- Was it understandable?
- Has it changed their mind about using the tool or service etc.?
- If it did not change their mind, why not?

If none of the participants read any of the Terms of Services or Privacy Policies, ask them why not?

The trainers ask the participants that when thinking of this specific GIZ project, where we are developing a user app: what would a good consent request look like?
Note down their answers on a flipchart.

Explain, best practices in asking for consent, and generally explain good practice in proactive communication towards citizens, referring to proactive communication about envisioned data practices. Examples from around the world show that if citizens feel sufficiently informed and involved in decisions about their data they are also more likely to "forgive" if something goes wrong. But to achieve this, communication has to go beyond the legal language of a consent form.

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Good practice on asking for consent

Remind participants that they are not the private sector, but that they provide a service to the public and the application was build to generate public value; getting consent is not ticking a box but openly involving citizens in the functionalities and objectives of the application

Provide clear, accessible and reliable information to the user on the data collection, processing and publishing process. This should include information about:

- Which data the app collects
- The purpose of data collection
- Who will have access to the data?
- Which data will be made public?
- Examples of other datasets the user data can be connected with
- How long the data will be stored
- If the user can use the app without providing data
- If and how the user can access, changed or delete their data
- The contact point for any questions related to privacy and data protection

Ideally, this information should also be accessible in the application and on the homepage of the service.

Section IV Closing

Questions:
Answer questions from the audience. In the interest of time, park questions that are to specific and tell the participant that you can talk about it after the workshop. Or when there are too many questions, refer them to the handouts and online materials (in the last slide).

Resources:
Provide the participants with the handout that directs them to resources on privacy and data protection.

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II. Annex: Materials

The following documents and files can be found - either as PDF files or if they need local adaption as WORD or PPT documents - attached to the document.

Presentations

- Presentation of Module I (offering 90 min and 120 min version)
- Presentation of Module II (210 min)
- Excel File to be presented during Module II

Handouts

Handouts for Module I

- Glossary and Definitions (for citizens)*
- Resources to Protect your Privacy*
- Decision Making Framework (version with example?)

Handouts for Module II

- Glossary and Definitions (for city staff)*
- Privacy Impact Assessment Template
- How to ask for consent and communicate proactively
- Risk/Value Assessment (in small scale)

Material

- Decision Making Framework for Module I (1 Page to be printed on DIN A4)
- Process Map for Module II (4 Pages, to be printed in DIN A2)

*these handouts need adoption with the country specific information before each workshop.

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Manual: Designing and implementing a citizen-centered innovation process using agile methodologies

Experiences gained and lessons learned from ICT-A

Peru

Global Program „ICT-based Adaptation to Climate Change in Cities" (ICT-A)

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4.3

Manual: Designing and implementing a citizen-centred innovation process using agile methodologies

Experiences gained and lessons learned from ICT-A Peru

![giz logo]

Why a manual?

We live in a global world that prevents us from acting in a global way.
We see that everything we do is interrelated and that every decision and action we take directly or indirectly influences others as well as ourselves.
We know and feel that the challenges we face are not just complex, but unparalleled.
Now more than ever, we need to work together in a creative way to find innovative solutions because the challenges are also new.

For some time now, in order to drive forward processes for managing this complexity, methods and formats have been sought and trialled that go to the heart of the above-mentioned challenges.

Who is the manual for?

The manual is for:
- People interested in or tasked with designing, supporting and accompanying processes for the co-creation of innovative solutions to complex problems, which involve the evaluation of ideas and experiences from unconventional perspectives.
- Groups, institutions, organisations or companies that are faced with the challenge of designing services and projects with social impacts in line with the wants and needs of their 'clients' and that need to bring in and closely collaborate with people – ranging from experts to users – who perceive the issues in different ways and are thus in need of co-creative methods.

The initial idea is established:
working using innovative and co-creative methods

Every intervention that involves interaction with others requires a format. The format will always depend on the actors, their routines and rules, their positions or the hierarchies within the team, the topic and the number of people involved, among other things.

This is even more true when the topics and situations involved are highly complex. A case in point is ICT-based Adaptation to Climate Change in Cities (ICT-A), which aims to contextualise and trial digital solutions that engage citizens in the co-creation of capacities for urban resilience.

Guiding questions:

What are the ideas and thinking when it comes to determining the kind of 'event' that would be most suitable for the purpose?

Which situations and/or challenges indicate the need to use citizen-centred innovation processes that incorporate agile methodologies?

What are the reasons and grounds for preferring the use of agile methodologies?

Thoughts on agile methodologies

Agile methodologies, such as Design Thinking, SCRUM and others, are grounded in theory and are the subject of much debate in this field's community of experts. For our part, when deciding whether or not to adopt this method, we should approach these by asking:

What do we want to do?
How do we want to do it?
Why do we want to do it?
What results do we expect?

[Image text: Why…and why…and why…]

In this way, I will be able to choose which of these principles and values I want to focus on and which I can be more flexible with.

As always, there is a difference between theory and practice, which means that, at every opportunity and in each specific case, the following questions need to be asked:

What ... do we want to rework in an innovative way, change, optimise, solve, etc.?

For what reason or for whom, and why? What is the outcome or output? Whom is it directed at or who will use it? Etc.

How do we want to achieve an outcome that is sustainable, accepted, relevant, etc.?

These questions help to frame within the specific context of our work the topics that need to be discussed and agreed upon with the key actors.

Guiding questions:

What do or could the principles mean for my project or for the actors or partners involved?

What is the context (cultural, social, organisational, etc.) like for working 'without hierarchy' and trusting in the self-organisation of teams?

Which topics or values require special attention or prior activities and experience?

To what extent are the key actors willing to or is there the confidence to work with these principles and commit to a process?

A method is a tool for supporting a process and is nothing more than that. The method itself is neither a central feature nor the objective.

For this reason, it is first necessary to define the problem or challenge, analyse previous unsuccessful attempts and formulate assumptions about what is required. Following this initial consideration, it can then be determined whether, for example:

- the data for bringing into focus and defining the problem are still lacking;
- there are capacities or processes that still do not exist, are emerging, are unsuitable or are not sufficiently identified;
- key actors have yet to be identified, or information is lacking on who is responsible for addressing the challenge or on what routines and forms of cooperation are common in the context of the problem in question.

Starting a process

Checklist

At the beginning of a process, the team should consider the following actions:

- Determine the format and method that are appropriate for achieving the expected outcomes in the case in question.
- Identify and quantify resources in order to perform a cost–benefit analysis.
- Determine, from both a technical and administrative perspective, the duration of the preparation stage and the implementation stage involving the key actors.
- Develop terms of reference and initiate the tendering and contracting process.

Preliminary internal reflection processes

The decision to opt for a particular methodology – regardless of whether it is agile or not – always requires a process of internal reflection. While as individuals it is not easy to make the reasons for our decisions explicit, when working in a team it is very important to transparently develop the ideas and assumptions underpinning our choices of methodology. Therefore, it is always helpful for those responsible for a project, outcome or output to write down their expectations and ideas regarding their reasons and motivations for choosing a method.

[Image text: Why…and why…and why…]

Guiding questions:

- Why am I keen for a Design Thinking method to be the right approach for my process, group or subject, or why do I think it will be? In what way do I expect it to be different from a conventional workshop?
- What is the link between the method and the expected impacts?

- How much time do I have for preparation and implementation? What outcomes do I expect from the workshop?
- What next steps are required to make use of the outcomes of the workshop?
- What experience do I, my team and my partner have with these methods?
- How can I obtain more information on whether this method is suitable or not for meeting my expectations and conditions? Ascertain what is specifically required in terms of time, space and materials.
- Who do I have to share this idea with beforehand to be able to make the decision?
- What general project framework and general contextual framework do I have to bear in mind?

Consult people in similar situations who have experience in using the method in question.

Find an expert in the method and discuss it with them in advance.

Watch a live design-thinking workshop (participate in person or via a video-stream of the event).

Starting internal preparations

Every event and method requires preparation time. The features and requirements of the design-thinking approach call for preparation that is sufficient to meet its needs.

If it is decided to implement a design-thinking process, the team of facilitators must be given sufficient time to think the process through with the client and the partner and, in so doing, to flexibly adapt its objectives, schedule and procedure to the circumstances and expectations of those involved.

Tips

To create an environment that promotes working in a flexible and unconventional way, provide:

- ample space,
- enough light,
- non-standard furniture,
- boards for pinning up documents and posters,
- materials designed to promote creative working.

Identifying resources

The resources for carrying out an event must always be appropriate for the processes required by the method in relation to achieving the expected outcomes and outputs. For example, rather than bringing a group of 80 participants somewhere to exchange ideas, it may be more efficient and cost-effective to work with focus groups thus obviating the need for trips that will require more time and money.

When planning an event, special attention must therefore be paid to the resources and to ensuring that they are adapted to local conditions.

Guiding questions:

- *To deliver the event, how many people or companies are needed?*

- *Are there people in my or the partner's team with the required skills and knowledge, thus removing the need to recruit external consultants?*

In the event that I have skilled individuals in my work team:

- *What role do I want them to play or think they should play and why?*
- *What indicates that I or my team are facilitators?*
- *Do I want to define or think that I should define my role in the process in advance or is it better to adapt my role flexibly as needs arise?*

Scheduling dates

A realistic time frame needs to be set for completing each planning process.

At least three months are needed for the preparatory steps prior to running a design-thinking event. Setting a specific date for an event of this kind therefore involves the following:

- Acknowledging the duration of internal technical and administrative processes.
- Having the permissions and expected resources in place.
- Understanding participants' and actors' realities and contexts:
    - holidays and special events (FIFA World Cup, Christmas and other religious festivals, etc.),
    - specific periods in which work commitments are greater (e.g. when submitting accounts, evaluating partners' projects, planning, undertaking important visits),

- elections, structural changes affecting the principal actors.
  - Calculating upfront the expected duration of the event:
    - Is it a process spanning several weeks or months or a workshop lasting a few days?
    - Will the workshop run for two or five days?

Support and contracting

For each intervention in the implementation process of a design-thinking event, those responsible must identify the degree and types of support necessary or useful. This support may be in the areas of facilitation, logistics, communications, administrative processes, and so on.

If external support is necessary, proceed by drawing up terms of reference for outsourcing the event facilitation, issue a call for tenders and select bids.

Consider and decide on the following:

- Are you looking to contract a company or individual advisors? What are the advantages and disadvantages?

- The terms of reference describe the coordination and communication tasks that the external contractors are expected to undertake. In the case of a company, the work is based on assumptions that have been formulated and integrated internally in the structure and processes of the organisation.
  However, whether working with a company or a group of independent experts, it is always necessary to clarify tasks, roles and responsibilities as well as expectations.

- The dynamics of a process that brings in consultancy or facilitation demand a high level of flexibility, reflection and monitoring, because the team (from advisors and external and internal facilitators to clients themselves) is required to make adjustments and changes during the process that cannot be planned for in advance.

- The terms of reference are like a photo capturing the process at the point when they are drawn up. They are therefore are only able to reflect the 'reality' of that particular moment, based on the experiences and assumptions of the process underway or intended at that time.

- Even so, in light of the fact that subsequent adjustments will be necessary, the contracting party should develop and communicate a vision of the process in advance in order to define the activities that it wants to and can delegate and the quality criteria that the contractor must meet, such as compliance with the standards of the contracting party.

- At the beginning of a collaboration, it is necessary to brief the contractor to ensure parties are made equally aware of the abilities and limitations of each team member, be they internal or external.

- Identifying and recruiting support staff and structures for the event, such as for communications, logistics, catering, etc.

Guiding questions:

Is there a support structure in place either within or outside the project? What is this and what is it for? What people do we need? In cases where a company is contracted, ask:

Do they already have the infrastructure in place and will they take charge of all the organisational aspects? Will the company be able to meet the dynamic and organisational needs of the event?

Are any integrated, comprehensive services on offer? Looking at the detail, what support do we need?

What services should the support team provide to assist the facilitation work so that their human resources and skills are allocated according to the contents of the process? For example, at the end of a five-day workshop, instead of worrying about attendee lists, packing up workshop equipment and materials and organising the venue, the team of facilitators may find it more useful to dedicate this time to reflecting on the dynamics, outcomes, next steps and lessons learned.

- Before the workshop, put together an initial calculation of the preparatory days:
    - Does the organisation or the partner have the required infrastructure? If yes, why? If no, why not? What is it and isn't it useful for?
    - Are there support staff in the organisation or not?

Designing workshops, interventions

Checklist

- ✓ Submit documents and information prepared for the team of facilitators
- ✓ Organise and prepare an initial work meeting with the team of advisors with the aim of
  - o briefing the team of facilitators
  - o explicitly clarifying expectations and expected outcomes/outputs
- ✓ Get the team of advisors to present in due time a design of the process and the workshop
- ✓ Discuss and agree on the design and the interventions with the advisor/s

Submitting documents and information

To improve the efficiency of the facilitation team, the client must refrain from issuing the team members with every single document associated with the project, and instead prioritise and structure the information that the team actually needs to know.

Guiding questions:

What general information is essential for the facilitators?

What information about the process, the actors, potential participants, the client and their context needs to be supplied?

What details should they know in order to understand and support the process well, should they include as part of the intervention design and should they bear in mind during the workshop itself?

What are the client's motivations for and assumptions around initiating a process using an innovative co-creation method?

What information exists on people's expectations and perspectives as to how the outcomes will be used in future and who will use them (the client, the partner, key actors, etc.)? Based on this, determine the level of

quality required for the outputs and how complete they must be when they are submitted to these parties for their use.

Are there any other related processes that are being developed in parallel with or following the workshop? What information should be reported before, during and after the workshop and to whom should it be reported? Whom else do you need to coordinate with apart from the client and their processes?

It always helps if the client issues at the outset a fairly complete set of documents. This should have a catalogue structure listing the information that the facilitators will find in each document. These prioritised and catalogued documents help with the organisation of the first meeting between the team of facilitators and the client.

Tip:

What other comprehensible and genuinely useful information does the team of facilitators need in advance to ensure that the first meeting and exchange with the client is productive and thorough?

For example, if you expect the team of facilitators to arrive at the first meeting with their own assumptions and initial proposals already prepared, in advance of the meeting they will need to be provided with files containing the following information:

- A short summary of the process and its context from the client's perspective, which examines in depth and updates the information contained in the terms of reference.
- Some basic information about the project and its planning and about the key actors in this context and their relationships with one another and with the project processes.
- Project evaluations, context analyses, etc., where it is appropriate to share them.
- Documentation of the work meetings and/or previous workshops associated with the process and the topic.

Briefing, meeting with the team of facilitators

Once recruited, the facilitators as method and process experts must be provided with the conditions that enable them to link their skills and experience to the specific context.

Not only do the facilitators have to know the expected outcome, they also need to have an understanding of the context and the relevant background information.

Based on the information mentioned in the previous section, an initial meeting is held between the client and the team of facilitators.

From the client's point of view it would be useful, along with the meeting invitation, to provide a guide, a draft schedule and the expectations regarding the outcomes of the meeting. Similarly, it would be useful to set out what the team of facilitators should bring with them as input to that meeting (assumptions, initial proposal, work schedule, expectations regarding support, needs for other information and questions).

> Example:
> - Welcome
> - Presenting/introducing the participants
> - In relation to the terms of reference:
>   - Presentation of the client's expectations regarding the quality of the expected outcomes and of the process itself as the responsibility of the team of facilitators.
>   - Depiction and evaluation of processes and products that already exist.
>   - Initial ideas regarding the pre-conditions and what is required for the planned workshop.
>
> - Revising the process from the point of view of the team of facilitators:
>   - Questions and clarifications regarding the existing information received.
>   - Questions about and requests for information that is still lacking.
>   - Description and presentation of initial ideas for a possible procedure.
>
> - Closing the meeting, with agreements on:
>   - Next steps.

- Roles, responsibilities, interim outputs, and topics/guidelines for team–client cooperation and coordination.
- Questions and topics that remain open and to be resolved.
- Tentative schedule for the subsequent preparatory activities, including the phasing and times for reflection and the internal monitoring of progress.

Supplementary guidance

Success factors for teams of facilitators

- Clear coordination – roles
- Confidence in and knowledge of the skills and interests of the team members
- Generation of team spirit (among facilitators, with the client's team and with the partner)
- Thinking time
- Scheduling and follow-up, continual updating
- Distribution of tasks and reflection/evaluation
- Interim check to ascertain the degree to which the team's and the client's expectations are being met
- Saving and managing information, knowledge and processes
- Setting up communication channels with the client and external parties (other advisors, the media, etc.)
- Possibly having a master of ceremonies

Success factors for optimal cooperation with the client

- Defining the client's expectations and roles during the workshop (e.g. active/passive role, participant/observer, etc.)
- Ongoing feedback and reflection on the client's expectations
- Immediate evaluation of the process, detailing progress and deviations from the plan
- Providing the client with appropriate advice on an ongoing basis through observations and reflections on the process
- Working with the client to jointly establish periods for interim reflection on the process

Preparatory support processes

Depending on the process and its complexity, some types of support can be implemented from the preparatory stage. This helps to reduce any worries and stress and to ensure that important elements of the preparation are not forgotten.

(1) Design of the process and schedule

Process design involves more than just drawing up a schedule. What makes it different?

- A schedule helps to systematise and order tasks and deadlines, ensuring that the different actors are informed and know what they need to do when.

- When designing a process, the required outcomes and a strategy for reaching and achieving these outcomes must be carefully thought through. Based on a recent process design, a schedule can be drawn up that ensures activities are carried out at the right time.

To develop the process design, it is necessary to have a strategy that is clear in terms of its consideration of the context, the actors and the expected outcomes and impacts. A strategy is invariably more than 'an activity' and involves the 'set of interventions at different levels' needed to achieve the required outcomes and impacts.

For example, one strategy could be to collect (through interviews, focus group meetings, etc.) and analyse data to promote digital solutions.

Another could be to work directly with the beneficiaries/users to identify and design digital solution prototypes, which are then developed by subject matter experts.

- Would it be beneficial to collect data beforehand? From whom could the data be collected and how? What would the upsides or downsides of this be, and what positive or negative effects would the decision have? Would it be useful to hold preliminary interviews with municipal or district authorities?
- What impacts could involving users from the outset have on the engagement with and sustainability of the digital solutions? What opportunities does this method present in relation to actor communication and the development of support processes (e.g. roles, responsibilities, channels for cooperation on updating, maintenance, etc.)?

Supplementary information

Process design using overlapping interventions

When designing a process that contains different approaches, actors and methods, those managing it will need to be highly attentive and be aware of the issues involved. In situations where interventions interface with other processes, it is necessary to plan well and to act as transparently as possible.

The key actors who add value to the process and the interim outcomes (i.e. the team responsible for the process and the team/representatives of the partner) need to understand and agree on the overall process. The ability to describe the final outcome, divided into two or three components, and clarify it with the subjects of the process forms part of the advisory work.

An example (albeit somewhat specific) is provided by ICT-A Peru, where two methods were defined with only one objective, namely: during the pilot phase, have digital solutions in place for the neighbourhoods most affected by the 2017 floods.

Metodo	Actores claves	Productos/resultados directos	Productos/resultados indirectos
Design Thinking Sprint	**Municipalidad Trujillo:** como contraparte y institution responsable para prevenciones antes, durante, despues inunandaciones **Alcaldes vecinales y otros representantes :** clarificar sus perspectivas y necesidades	Ideas y primer prototipos Ideas y resultados intermedios que independiente del Hackathon	Cooperacion y vias de comunicación entre MPT – Alcaldes vecinales Cambio de perspectiva como experiencia que une en el futuro y da una base para otros desafios y una cooperacion
Para concretizar ideas y elaborar primer prototipos			
Sobrepasos: Comunicación fluido entre los diferentes equipos de facilitadores	Participacion de los actores claves en el Hackathon (presentacion de los retos; respuestas y detalles para los participantes, otro)	Criterios de resultados/ productos de DTSprint para que sirverian como base para el Hackathon	
Hackathon – Adaptaton			
Para elaborar soluciones digitales a base de los retos/ideas de los resultados del Destign Thinking	**Estudiantes, jovenes** de varias careras, profesiones para desarrollar soluciones concretas **Municipalidad Trujillo** para asegurar que los resultados premiados cuentan con criterios para ser aplicable para la municipalidad en corto tiempo **Alcaldes Vecinales** como representantes del Dtsprint (traslado de los retos, informaciones, contexto) y	1 – 3 soluciones digitales para la fase piloto	Soluciones que podrian ser retomado/de interes para el MPT 1er encuentro de grupos vinculados a temas digitales para intercambio y procesos en el futuro

When designing a process, it is necessary to clarify and capture all the processes and their actors in order to clearly determine the interfaces and ultimately achieve a coherent outcome that incorporates the required synergies.

Schedule

When drawing up the schedule, it is also important to check that the appropriate participants can attend the workshop and to work to ensure that they are able to attend.

How can you ensure that those whom you need to participate do so?

Guiding questions:
- Which institution/s is/are being invited?
- What are the specifics regarding logos, language, brands?
- How far in advance should the invitations be sent out? What kind of confirmation is required and by when? Is it necessary to visit certain actors in person to ensure that they will attend? What is the partner's role in the invitation process?
- What information do attendees need in advance? How does it work in the context in question?
- Etc.

What routines or dynamics need to be included or discontinued during the workshop?

What are the outcomes and impacts in the short, medium and long term?

Regarding the workshop itself, how significant is it and what support does it have for achieving impacts and for the process itself?

Etc.

(2) Outline of workshop

All conferences, meetings and workshops, regardless of whether they last for one day or several, need an outline. From our experience, and due to 'routine' processes, we usually do not do this in our day-to-day work. Even so, it would be interesting to reflect on whether or not work meetings, their dynamics and the outcomes they achieve are satisfactory. In some cases, it could help to prepare in advance using an outline.

Having an outline is invariably a success factor in the delivery of a fulfilling workshop, because everyone involved is better informed and knows when it is their turn to do something or broach a topic. It also ensures that nothing is forgotten, since the devil is in the detail as to whether something is successful or not.

The level of detail to be provided in the outline depends on the people who will be using it and what they need. There is no model format. To give an example, below are the first couple of pages of a design thinking workshop outline, which is sufficient to coordinate the project's four facilitators and two members:

TIC-A arquitectura y agenda   Design Thinking Sprint Trujillo/Perú   Fecha:20.04.2018 16:00 pm

Design Thinking Sprint

Lugar: Trujillo, 21 y 22 de abril 2018
Equipo facilitadores: Jose Miguel Abad (Colombia), Andrea Heisel (Alemania,), Irene Ocampos (Brasil)
Equipo GIZ: Teresa Kerber (Alemania), German Lizarzaburu (Perú), Constanze Riedle (Alemania)

Dia sabado, 21 de abril 2018 9.30 – 17.30 hrs
Bienvenida e Introducción

hora	¿qué?	Preguntas guías	¿cómo?, aclaraciones, observacione,s etc.	¿Quién?	Materiales/ Preparativos
07.30	Llegada al local			equipo	
08.30	Hora oficial del Design Thinking Sprint, inicio con desayuno.		Horario de la invitación oficial por TIC-A/GIZ Instalación del equipo		Poster bienvenido Lista de asistencia con datos (importante para formar grupos-desde 20/04) Escribir en afiche integrantes de cada grupo (20/04) • G1: IO • G2: JMA • G3: AH
09.30 a.m. 7m	Inicio / Bienvenida	Importante: primera oportunidad para que la contraparte demuestra su interés y compromiso por el tema y las acciones	En el contexto peruano tenemos que calcular que empezamos recién a las 9.45 Palabras de saludo y bienvenida - Sr. Alcalde o Fernando Rojas (Teniente Alcalde) (5 minutos por reloj: avisar a Fernando)	MPT	Oportunidad de Fernando! Pedir a Fernando incluir valoración de la parte pública de la presencia de usuarios para generar en forma conjunta ideas (más allá de sensores) Compromiso de la municipalidad en el seguimiento a los resultados del taller
		GIZ palabras de bienvenida	Presentación de GIZ y el Programa Global TIC-A	German	• Powerpoint • Poster "digital principales" • Poster "Desafíos para la adaptación de cambios
'20	Presentaciones de Programa TIC-A	Visibilidad y informaciones básicas/contexto del taller			

hora	¿qué?	Preguntas guías	¿cómo?, aclaraciones, observaciones etc.	¿Quién?	Materiales/ Preparativos
			Presentación: Principios Estratégicos de TIC-A, ejemplos, unas palabras sobre design thinking y presentación del equipo de moderadores ¿Por qué tomaron decisión DT? (principios generales) 5´preguntas de aclaración	Teresa	climáticos para ciudades" □ Presentación moderadores, C.Riedle, Hackathon (Escuelab), Lucia, etc. JMA: □ Ojo: instrucciones generales de organización y chequear trabajo de Lucía y su equipo □ Controlar calidad de fotos (hora del almuerzo, final de la tarde) CR: □ Chequea con Escuelab (Kiko) insumos y atender preguntas de necesidades para Hackathon □ Ojo: rol de observador! Aclarar a Kiko y a grupos TK: □ Hablar con TK para control de catering Moderadores: □ Presentaciones, apoyo, manejo de computadora/proyector
'15	Introducción a los objetivos y los dinámicas a través del método	¿Cuántas informaciones sobre el método necesitan los participantes? ¿Cómo elevar la motivación y sinceridad para participar en los 1,5 días?	Introducción □ objetivos para los dos días (3 objetivos) □ Dinámicas de los dos días/método „Design Thinking" – co-creatividad, etc. (tiempo restringido, aguantar de no terminar 100 %, etc.) □ Trabajar en grupos mixtos -		Presentación powerpoint IO y AH trabajan en la presentación Creatividad, salir rutinas No es un taller de intercambio y que se habla, sino que hay algo para ver, tocar, sentir

Implementing and delivering a workshop

Preparatory days on site

For a workshop to be successful, prior to delivery it is important to provide the team of facilitators with some time on site so they can check and assess the conditions of the context in which they will be working, understand first-hand the views and expectations of the partners and other relevant actors, visit and assess the standard and features of the location where the workshop is taking place and determine the venue access arrangements for the team of facilitators and participants.

Armed with this first-hand information, the team will find it easier to think through and adjust the workshop outline. The team should always work on the assumption that a plan B is needed.

Having visited the workshop venue, the team will be able to plan how to use the event space for plenaries and group work, how to arrange the seating, and where to store materials and equipment, serve food and set up spaces for informal interactions among participants, etc.

Example

Work out the details of the event and allocate responsibilities:

Coordinating and interacting with support persons

For example:
- With communications officers
  - Determine which points in the outline and which workshop outcomes need to be captured (photo or video).
  - Depending on the intended use of the material captured, indicate the level of quality required.
  - Define the structure tasked with organising the photography and videography.
- With administrative support staff
  - Define and agree on what material needs to be where and when and any other support needed.
- With catering staff, be they in-house staff provided by the workshop venue or staff provided by the client or partner.
- With technical support officers (i.e. those tasked with managing audio-visual displays, computers, Skype and other applications).

Check the availability and quality of the materials in advance and find solutions in due time.

Identify the points where synergies and linkages exist and forge the connections with other initiatives and actors, such as
- programmes provided by the partner or other national or international organisations, and
- other actors (society, organisations, etc.).

Evaluating the process and the collaborative work

The event's spirit of formality and time commitment should also define its closing session. Maintaining this spirit may prove taxing, given that facilitators and clients may be exhausted by this point.

At the end of such an intensive and profound collaboration, it is useful to consider and agree responses to the following questions:
- Have we achieved satisfactory processes and outcomes?
- What lessons have we learned?
- What would the next steps be? What topics or actions remain to be addressed?
- What is expected of the facilitators? For example, what is needed regarding the documentation of outcomes and what document format would be useful?

(Determine this according to whom you want to document the outcomes for and why).

- What was the collaborative work like between the team of consultants and the client/partner?
- Which of our assumptions have been shown to be true and which have not?

Summary of TinkerLabs' Deliverables

4.4

Design Thinking Process ICT-A India: Summary of Deliverables

TinkerLabs' Approach :

- Phase 1: Defining Problem-Opportunity Space
  - Secondary Research
  - Primary Research
  - Research synthesis
  - Problem Framing (Problem-opportunity mapping)

- Phase 2: Ideation, Testing and Iterating
  - Sprint 1.0
  - Sprint 2.0

- Phase 3: Hand over and Documentation
  - Documentation

Design Thinking Process
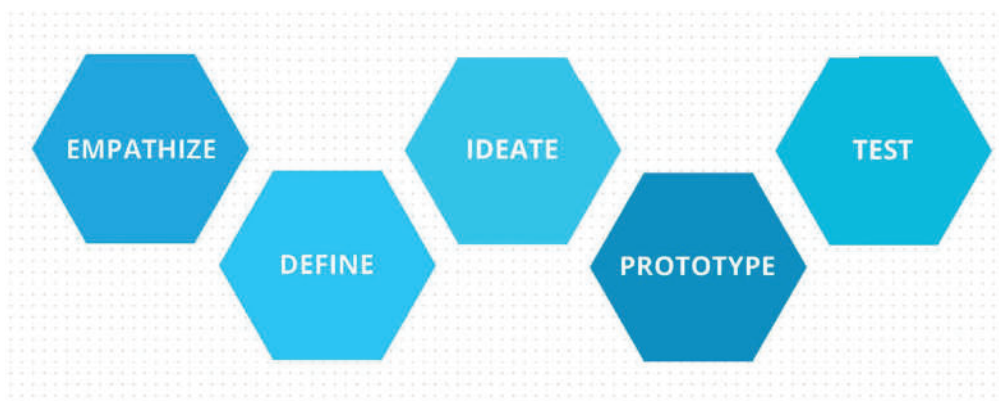
Problem Opportunity space identified: Flood Prevention

Key insights through Design Research:
- Citizens litter drains - key to floods
- BMC has limited resources to identify and clean key blockages in drains before the monsoon

Problem Statement:

" How might we help the Municipal officials know the drain status in Nayapalli and Satabdinagar areas as live and as dynamic as possible so that they can optimize their resource deployment? "

End to End Solution

CROWD REPORTING
- Reporting on current status of the drain
- Target group: 15-24 years student volunteers
- Gamification: City Saviors will get rewards for reporting

Real Time

GEO INFORMATION SYSTEM
- Base Data
- Drain network with critical spots
- Vulnerability Maps
- Hydrological model to predict water logging

Static

INPUT

ANALYSIS SYSTEM
Model to optimize maintenance/ cleaning of drainage network

- Information on drainage status
- Ranking of critical spots for intervention based on hydrological models & vulnerability assessment
- Integration of crowd sourced data

OUTPUT

BMC SUPERVISOR
- Recommendation for controlling critical spots

BMC DASHBOARD
- Prioritization of location for cleaning/maintenance

VOLUNTEERS
- Rewards for reporting

Deliverables delivered by TinkerLabs

- Report : Secondary research summary and primary research design

- Report : Primary research synthesis and problem opportunity space mapping

- Presentation for Sprint 1.0 : Primary research synthesis summarized for Sprint 1.0

- Report : Sprint 1.0

- Write up : Summary of the end to end digital solution

- Write up : Gamification concept details

- Report : Sprint 2.0

- Handover of prototypes (mock ups) / user flows to Sparc and GIZ

- Report : Final report

Key Learnings and improvements suggested

Kick off
- An awareness workshop on DT recommended to be done for senior stakeholders- this would help them know the methodology and their expected contribution
- We could create some pseudo designations like Innovation champion or Design Thinking champion or evangelist etc. for them, give them some kits, request them to join a whatsapp group etc.

Research Phase
- Technology and operational strategy and roadmap could be made available upfront. This could help us (1) avoid any duplication of efforts and (2) understand the scalability and relatability of our solution in the larger scheme of things that Smart City could be planning

Ideation, Prototype and Testing
- The project leads and senior staff of the technical development partner agency could get involved earlier, from the beginning of Sprint 1 itself
- Possibly, 2-3 shortlisted development agencies could be involved in sprint 1, and then get selected basis their contribution in sprint 1
- GIZ could pay these agencies some token amount if needed for this

Pilot

- DT agency could be included in stakeholder testing during pilot

Aesthetics of conduct

- Involving government officials and other stakeholders could happen in a more informal fashion, setting up a stage in a hotel, conference room etc. may not be the right setting for sprints.

- We could set up a temp working lab, where all research ideas and protos are curated and working sessions and sprints are held

The Internet of Trees/ Árbol IoT

Open Technology for Urban Woodland Mapping

IMPLEMENTATION GUIDE

Árbol IOT
EL INTERNET DE LOS ÁRBOLES

4.5

Arbol IoT, Open Technology for Urban Woodland Mapping: Implementation Guide. ICT-A Mexico

Árbol IoT is a platform developed in the city of Guadalajara by the   Metropolitan Institute of Development Planning and Management (IMEPLAN)   and the German Agency for International Cooperation, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)   This tool was designed to help other cities in Mexico and other parts of the world recognize the importance of urban woodland areas and the benefits they can provide to their municipalities, and thus the tool can be used to allow them to bring forward policies that promote urban sustainability   and make complementary adaptation strategies to face climate change.

"Árbol IoT", helps governments map urban woodland areas through a participatory process: using a mobile app, a web platform, and the possibility to integrate environmental sensors. This technological development was created to be shared, as long as its use adheres to the main principles related to the use of open source software, data protection, transfer model and the app's general purpose, all these principles are described within this guide.

This document belongs to IMEPLAN, and was created by demand of the agency GIZ, in collaboration with IMEPLAN and Sarape Social.

Guadalajara, Jalisco, México.
June, 2020

On behalf of:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

INTERNATIONAL CLIMATE INITIATIVE (IKI)

In cooperation with:

Federal Ministry
of the Interior, Building
and Community

of the Federal Republic of Germany

imeplan Instituto de Planeación y Gestión del Desarrollo
DEL ÁREA METROPOLITANA DE **GUADALAJARA**

Árbol IOT EL INTERNET DE LOS ÁRBOLE

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Index

3

I. Purpose of this guide

The following guide aims at illustrating the process of implementing Árbol IoT, an open source technology for urban woodland management, as a strategy for climate change adaptation.

This document is complemented by the platform's website (see attachment 3: Toolbox), where we include a description of the platform, as well as technical information and an installation guide.

1.1. Who is this guide for?

Institutions, organizations or local governments worldwide; interested in incorporating a technological tool to their adaptation strategies towards climate change, and who are willing to start a transfer process for this civic technology.

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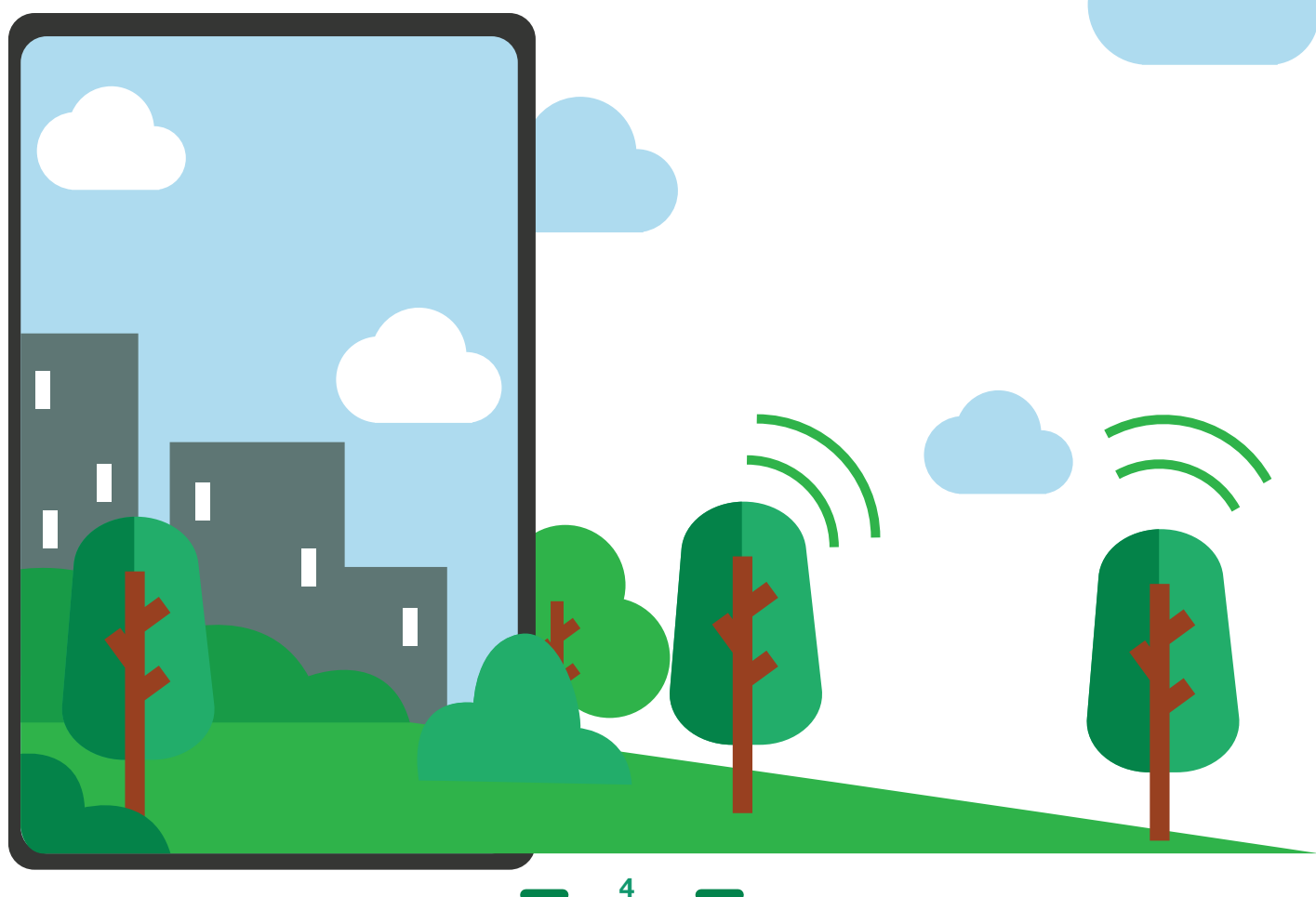
II. Background

In 2017, the agency for International Cooperation, **GIZ**[17], through its **Information and Communication Technologies for the Adaptation to Climate Change in Cities Program (TIC-A)** gained interest in forming a cooperative alliance with a local municipality in Mexico to design and develop the first version of a digital solution to face the challenge that climate change poses in cities. Since its origins, GIZ determined that this digital solution would be implemented in two cities throughout 2017 and 2019.

The process that was followed to design, scale and transfer the platform is described next in three different stages.

During its first stage, the local government of Guadalajara sent a formal document to **GIZ,** manifesting its interest in being the main actor in this cooperation, and in **September 2017 a cooperation agreement was signed between Guadalajara's government and GIZ**, in which it was determined that the Guadalajara's Governmental Innovation Directorate would be the coordinating and operating entity of this cooperation. The project was very ambitious, as Guadalajara is Mexico's second largest city, with a population of 5 million.

Once Guadalajara's government identified its urban woodland areas as a key element in the development of adaptation strategies for climate change, it was agreed upon that this digital solution would be a tool focused in data collection and information generation to improve urban woodland management and aid the design and implementation of climate change countermeasures. The process of conceptualizing, designing, developing and prototyping the platform was started, making Guadalajara's municipality the first to develop and implement this technology.
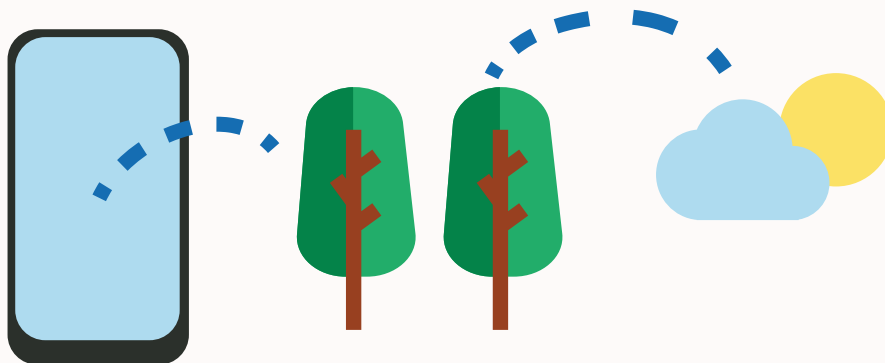
Subsequently, during a second stage, (following up on the interest of **GIZ** to scale the technology to another city of Guadalajara's Metropolitan Area, the **Metropolitan Institute of Development Planning and Management (IMEPLAN)**[18] as a main and strategical actor for implementing Árbol IoT in another municipalities of the metropolis, as it is an Institution that acts

17   GIZ: German Agency for International Cooperation, provides technical aid to developing countries on various topics, like sustainability, technologies, etc.
18   IMEPLAN: decentralized public organization, inter-municipal, with legal personality, own equity, with technical and managerial autonomy in the exercise of its powers. Promotes effective metropolitan management through evaluation in the provision of public services and municipal functions in Guadalajara's Metropolitan Area (AMG), and where appropriate, the analysis and recommendations for their convergence. Constitutes a key element during the long term implementation of the decentralized planning process, with technical autonomy, from an integral perspective; with emphasis on development planning and land use, risk management and systematization of metropolitan information. Its constitution as an autonomous technical body aims to reinforce the management of strategic projects and economical resources to improve the provision of public services on a metropolitan scale. (IMEPLAN, 2020).

— **5** —

as a technical secretary of the model of metropolitan governance[19] established by law, and articulates the 9 local governments (town halls) that compose Guadalajara's Metropolitan Area (AMG): Guadalajara, Zapopan, San Pedro Tlaquepaque, Tonalá, Tlajomulco de Zúñiga, El Salto, Juanacatlán, Ixtlahuacán de los Membrillos and Zapotlanejo; put together, they concentrate a total of 4,427,618 inhabitants (INEGI, 2011).

Due to its powers, it was contemplated that **IMEPLAN** would facilitate the technology's scaling[20] to the rest of the municipalities that conform Guadalajara's Metropolitan Area in the future, since it has the capacities to coordinate all actors involved in order to guide the implementation process of the platform in other local governments. Along the same lines, it is worth noting its capability to coordinate projects that require cooperation between different governmental organisms.

During this stage, Guadalajara's town hall yields the ownership rights of the platform to IMEPLAN, thus formally giving it the faculty to scale the project with the rest of the local municipalities, as well as transfer Árbol IoT to other cities, nationally and worldwide. On March 17, 2019, **an agreement of cooperation was made between the program TIC-** of **GIZ** and **IMEPLAN**, so both can carry out activities to strengthen the climate resilience of Guadalajara's Metropolitan Area (AMG). Through the design and implementation of digital utilities.

Once the platform was transferred to IMEPLAN, it was identified that Zapopan's government was a municipality that met all technical requirements to start the implementation immediately, and in 2019 another agreement was signed between Zapopan's government and IMEPLAN for the implementation of the platform in this municipality. During this stage it was necessary to engage in an improvement process for the platform; errors were corrected and adjustments were made to different components to adapt this technology to the specific needs and the local context of the city of Zapopan. It is worth noting that this process was fully supported by the technical advisory of both Guadalajara's municipality and GIZ.

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19   To know more about IMEPLAN's governance model, click the following link: http://www.ime-plan.mx/

20   It is worth mentioning that in the context of this document, reference is made to scaling the platform by extending their installation and use in different local governments of the AMG (Guadalajara's Metropolitan Area), and transfer of the platform to the transfer made by GIZ and Guadalajara to IMEPLAN, and the possibility of transferring the platform to other local governments in Mexico and worldwide

6

In 2020, during the third stage, both IMEPLAN and GIZ found the need to facilitate tools for scaling and transferring Árbol IoT between local governments, on both national and international levels. It is considered that facilitating digital transfer mechanisms helps reduce the digital gap that exists between different governments inside the country and around the world.

Based on this implementation experience, and after identifying the need to build tools to ease the transfer of Árbol IoT between governmental entities, the next guide was made:

To know more about the process, the actors involved and their roles, see Attachment 1 of Local Transfer on Guadalajara's Metropolitan Area (AMG).

7

Arbol IoT, Open Technology for Urban Woodland Mapping: Implementation Guide. ICT-A Mexico | 187
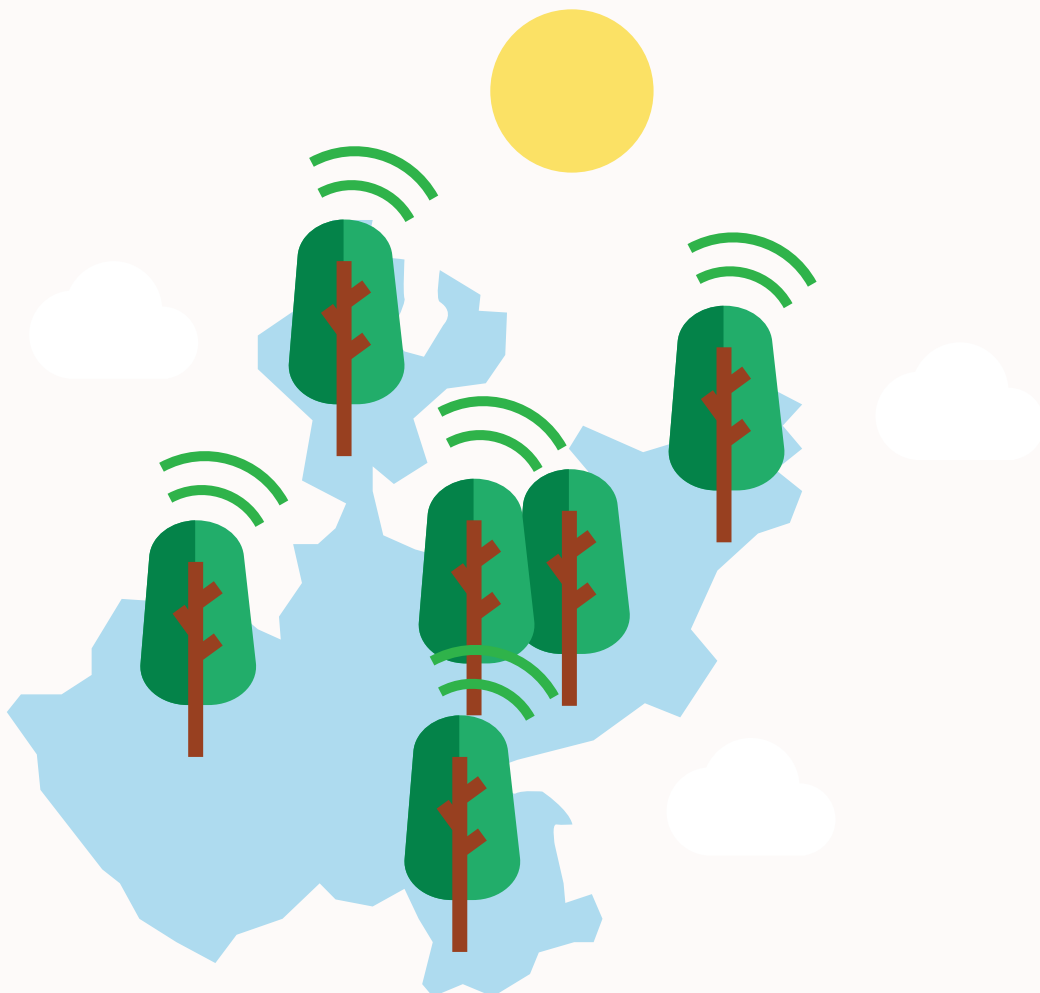
III. Platform's description and Features

3.1. Purpose of the software platform, Árbol IoT, as a resource for urban woodlands management and climate planning

Árbol IoT is developed collaboratively between citizens, civil society organizations, government, private sector and academia. A technological tool conceived for the contribution to the global agenda objectives related to climate change adaptation stemming from local action. **Through its implementation, it seeks to contribute to the achievement of goals established by international agendas,** such as the Agenda for Sustainable Development of 2030, The Paris Agreement, New Urbana Agenda, as well as the Global Partnership for Effective Development Co-operation.

The urban woodlands, a key element in a city's green infrastructure, it is one of the most effective adaptation measures to face climate change due to its rainwater infiltration properties, soil retention, particle elimination and its capabilities to reduce global temperature.

The concept of **green infrastructure**[17] has recently appeared on governmental agendas, r**epresenting a milestone in urban planning** that is increasingly giving importance to our natural environment, **considering the mitigation and adaptation to climate change as a main benefit.** It is worth mentioning that green infrastructure is constituted as a system where the human and environmental spheres interact, the latter being one of the main supports for the development and life quality of human beings by providing eco-systemic services that are crucial for the proper functioning of urban dynamics.

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17   According to Benedict and McMahon (2002, in Vásquez, 2016) green infrastructure can be defined as "an interconnected web of green spaces that preserves the values and functions associated with natural ecosystems and provides benefits to human populations"

8

III

In the particular case of the strategies for climate change, two main aspects are found. One makes reference to mitigation, while the other makes reference to **adaptation of cities to face climate change.** The latter aspect implies a growth in the resilience of cities and **ineluctably involves citizens,** as it requires adjustments in the wat natural and social components interact.

The implementation and use of the Platform Árbol IoT, is of great utility for urban, environmental and climate planning of cities, as it allows for:

1. Knowing data regarding urban woodlands (tree census and inventories, with their geospatial location, characteristics and their ecological benefits).

2. Managing trees based on data entered by users about the state and conditions of the trees.

3. Promoting the appropriation of urban woodlands and their respective care by the community.

In Summary, it is a technological tool that enables citizen involvement in the development of data-based strategies for adaptation to climate change. It should be noted that, given the platform's attributes and purpose, this tool is at the intersection between adaptation to climate change, digital innovation and urban development. As part of the program TIC-A of la GIZ, it develops, contextualizes and tests digital solutions that make citizens participate in the co-creation of their cities to improve their resilience.

Next, the platform's value proposal will be described, as well as its main technical details.

3.2. General functions and attributes of the platform.

Árbol IoT is a technological, gamified[17] solution, composed by a mobile app, web application and set of sensors IoT (Internet of Things) focused on the resolution of the next strategical objectives:
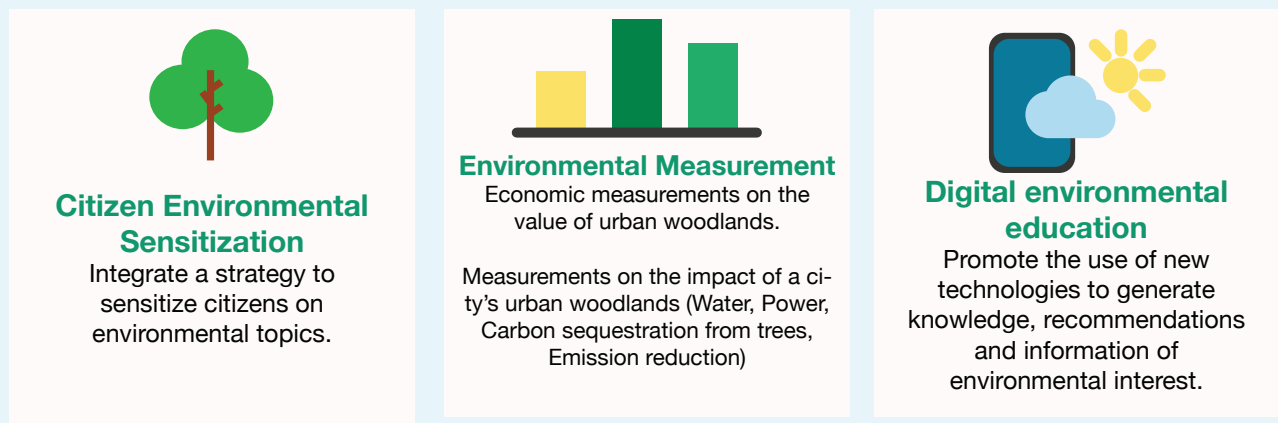
Citizen Environmental Sensitization
Integrate a strategy to sensitize citizens on environmental topics.

Environmental Measurement
Economic measurements on the value of urban woodlands.

Measurements on the impact of a city's urban woodlands (Water, Power, Carbon sequestration from trees, Emission reduction)

Digital environmental education
Promote the use of new technologies to generate knowledge, recommendations and information of environmental interest.

Image 1. "Strategical Objectives of Árbol IoT". Source: Árbol IoT.

The platform collects data of urban woodlands and shows the ecological benefits[18] that they bring, like energy saving, water collection (runoff avoided) and carbon capture, as well as external measurements that can be added via IoT (Internet of Things). **The visualization of this information is presented through an interactive map** showing the information of each tree and the ecological benefits of the woodlands as a whole.

Regarding differentiation and value proposal of this platform, it is of the utmost importance to note **the relevance of citizen involvement to provide information about the trees, through gamification of the user experience.** This strategy facilitates user interaction and allows them to acquire **environmental related knowledge** with the support of experts and certified arborists, this will be achieved through the validation of collected information

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17   Gamification: "Gamification can be defined as the act of using game design elements (GDE) in non-game contexts, such as social networks, e-health, e-commerce, and educational systems, to motivate, persuade, and/or engage people towards an attitude or behavior" in summary, "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems. (Kapp, 2012).

18   The platform uses the open source algorithms "OpenTreeMap" to calculate the ecological benefit trees bring; this algorithm is based on the "ITree Streets" algorithm.

10

where users obtain "green points" through their interactions. It also promotes tree planting as an adaptation mechanism for climate change and incentivizes commitment and awareness of the importance of caring for trees by citizens. On the same line, it is a civic technology that promotes democratization of knowledge, in which citizens can participate in data gathering for urban woodlands management.

In addition, it is an open government tool that allows efficient and effective citizen involvement in the care of urban woodlands.

3.3 Technologies and services.

The platform is made of three main components, that will be described next:

Árbol IoT Web
Interactive Map where you can view the city's tree inventory, their ecological benefits and the administration of modules and content already on the platform.

It is a complementary element to the mobile application, and its main function is to visualize data, in a way that it allows to filter and download information. Users can access Árbol IoT web without a registration.
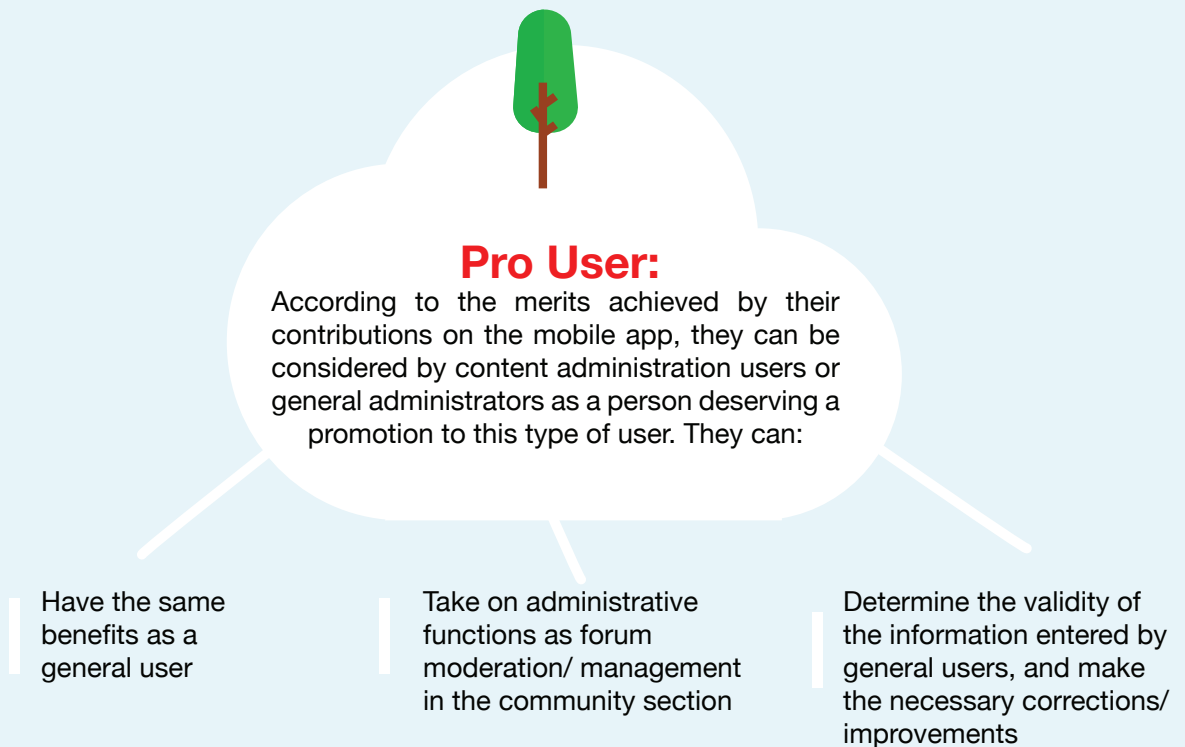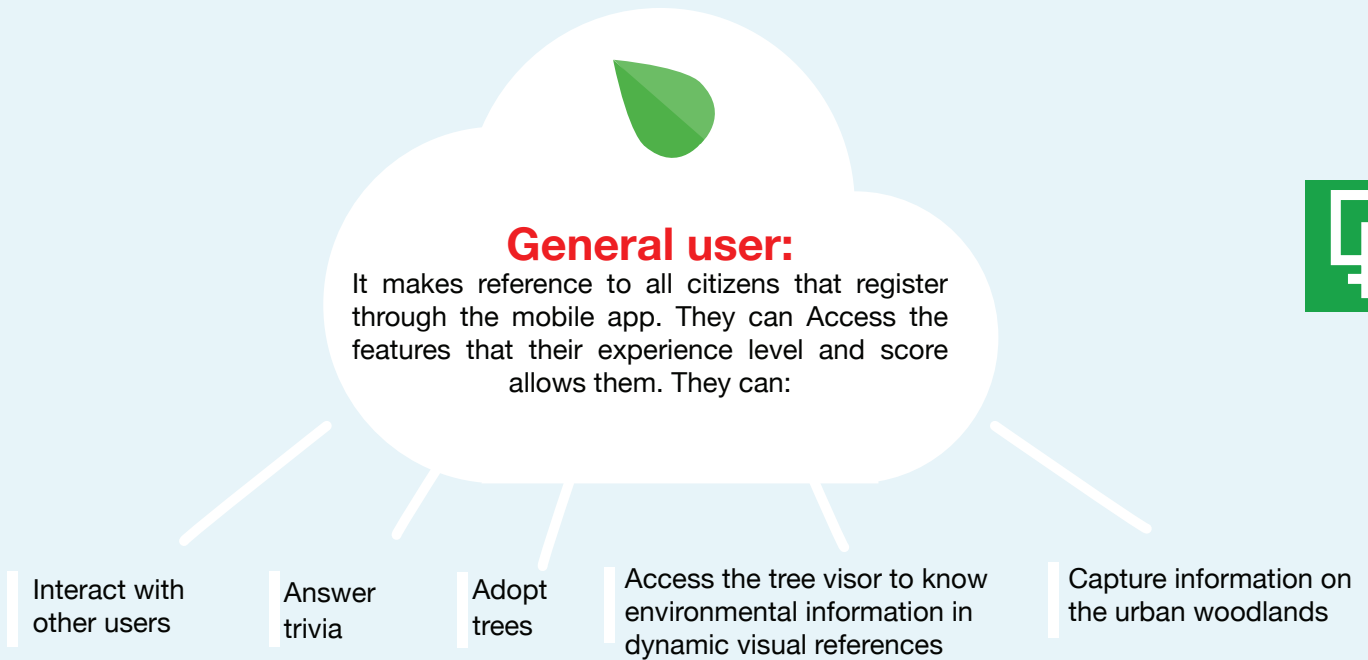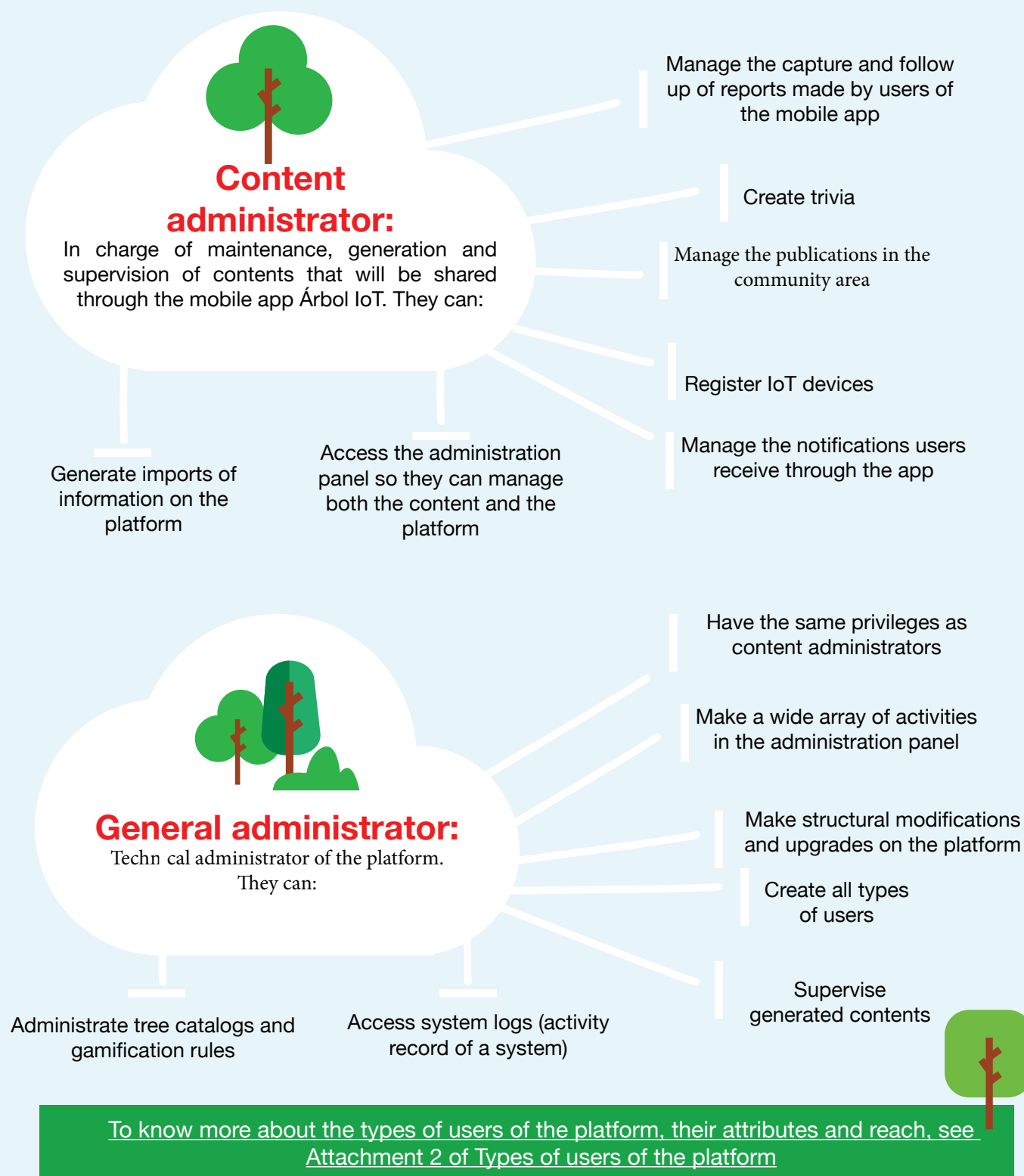
Mobile App

The mobile app integrates recreational tools and techniques where, through the interaction with the different functions users can obtain rewards based on intrinsic and extrinsic motivations.

There are four different types of users (also referred to as roles inside the platform), who will be described next, including their main reach. The users of the mobile app are the same that the ones for Árbol IoT Web

11

Citizen Users:

General user:

It makes reference to all citizens that register through the mobile app. They can Access the features that their experience level and score allows them. They can:

Interact with other users

Answer trivia

Adopt trees

Access the tree visor to know environmental information in dynamic visual references

Capture information on the urban woodlands

Pro User:

According to the merits achieved by their contributions on the mobile app, they can be considered by content administration users or general administrators as a person deserving a promotion to this type of user. They can:

Have the same benefits as a general user

Take on administrative functions as forum moderation/ management in the community section

Determine the validity of the information entered by general users, and make the necessary corrections/ improvements

12

Users designed by the organization responsible for the project:

Content administrator:

In charge of maintenance, generation and supervision of contents that will be shared through the mobile app Árbol IoT. They can:

Manage the capture and follow up of reports made by users of the mobile app

Create trivia

Manage the publications in the community area

Register IoT devices

Manage the notifications users receive through the app

Generate imports of information on the platform

Access the administration panel so they can manage both the content and the platform

General administrator:

Techn cal administrator of the platform. They can:

Have the same privileges as content administrators

Make a wide array of activities in the administration panel

Make structural modifications and upgrades on the platform

Create all types of users

Supervise generated contents

Administrate tree catalogs and gamification rules

Access system logs (activity record of a system)

To know more about the types of users of the platform, their attributes and reach, see Attachment 2 of Types of users of the platform

13

Technological architecture of the solution

Next, technologies used in the technological solution, Árbol IoT 2.0 and its architecture are shown:

Image 2. "Technologies and services of Árbol IoT". Source: Árbol IoT.

To know more about the descriptions of each of the technologies used, check the Árbol IoT website in Attachment 3: Toolbox

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3.4. Platform's specialized features

In general, the platform fulfills two main functions, integration of preexisting data and information generation. Both functions will be described next:

Integration of preexisting data: Refers to all data integrated into the platform. Among them are the following: Canopy coverage, location, number of trees, built environment and land surface. Also, it is possible to add other types of data via sensors (Internet of Things), including data on air pollution, noise, UV radiation and climate information such as temperature and humidity.

The Platform is capable of integrating data coming from different sources. In addition to data integration through sensors (Internet of Things), the platform enables the inclusion of data through **crowdsourcing**, that implies the process of outsourcing a job to a group of people. In this context, i**t makes reference to citizen participation in data collection** about the trees to input it on the database of the platform.

On the other hand, data introduced into this software platform can be gathered by other methods like **existing trees inventories** or **remote sensing[17]**. It is of importance noting that this form of data gathering and input is not built into the platform, so it requires an adaptation of the data so they can be introduced into the platform.

On the case of the city of Guadalajara, information was collected through remote sensing using LIDAR (Laser Imaging Detection and Ranging) technology, that allows the creation of a point cloud image of the existing urban woodlands. On the metropolitan level, there was an incorporation of information from the Metropolitan Forest Management Program (POFMET, according to its initials in Spanish[18]) that coordinated the Trust for the management of the Forest Development Program

17   Remote sensing: Is the technique of acquiring data from the earth's Surface through sensors installed on space platforms. The Electromagnetic interactions between the terrain and the sensor generates an array of data that can be processed to obtain data that can be interpreted and studied. (National Geographic Institute of Spain, s/f).
18   To know more about POFMET visit the following link: https://mapsfiprodefo.net/3liz/index.php/view/map/?repository=pofmet&project=POFMET

15

(FIPRODEFO, according to its initials in Spanish) of the state of Jalisco and in the municipality of Zapopan information of was incorporated through a existing trees inventory.

Information generation: represents all the information that is generated from the analysis of collected data. Some examples of information that can be obtained are: Tree pathologies and plagues, infrastructural analysis, species diversity, tree photographs, diameter at breast height, canopy diameter, root health diagnostics and planting conditions, as well as illegal logging reports.

16

Optional monitoring feature through IoT sensors

As it was previously mentioned, the platform can be fed from environmental variables monitored and provided by IoT devices, be it DIY[17] devices or professional devices; they can both be connected to Árbol IoT and be visualized through the boards and base layers included in this technological tool.

Árbol IoT 2.0[18] considers the following environmental variables:
- Temperature
- Humidity
- Environmental noise
- Suspended Particles 2.5μ
- Suspended Particles 10μ
- NOX gases (Nitric oxide (NO) and Nitrogen dioxide (NO2)

---

17   The DIY environmental sensor is a microcontroller based on the Arduino technology, designed to process data from humidity, temperature, noise, UV radiation and particulate matter sensors. This uses a SigFox card, technology designed for data transmission between IoT oriented devices.

18   The latest release of the platform, as a result of the implementation of the platform in the municipality of Zapopan.

The next diagram shows a visual representation of this main features:
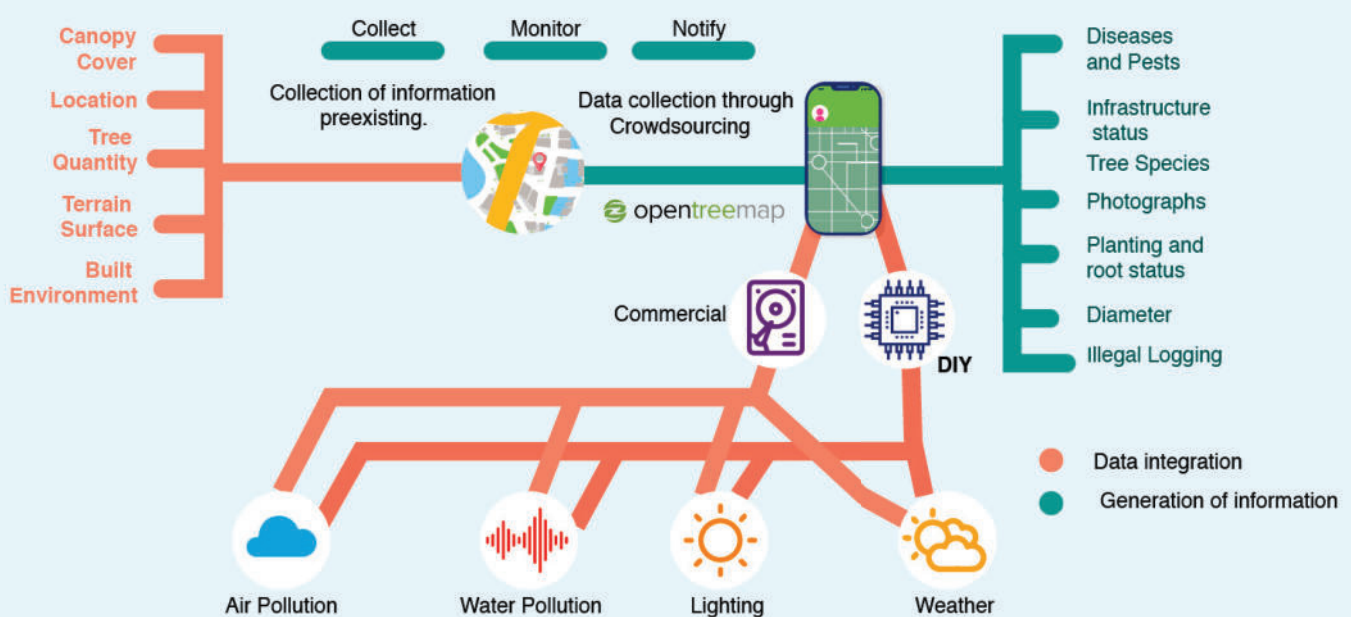
Image 3. "Features of the Platform Árbol IoT". Source: Árbol IoT.

17

3.5. Minimum installation requirements

There are two kinds of requirements to install this platform, one makes reference to technological infrastructure and the other to necessary knowledge. In respect to the latter, one must take into account that the human capital required to develop the platform need to have a set of specific technical knowledge and skills, so it is possible that local governments and institutions will employ external actors to adapt the platform to their needs.

Next, the minimum requirements will be explained in detail.

Technological infrastructure

Server
Operating System (OS): Ubuntu / Latest Version.
RAM: 8 GB - 16 GB.
Hard Drive: Minimum of 100 GB.
SSH Account: With root privileges to install libraries, dependencies and applications.
Processor: 4 cores
Ports: 80, 8080, 443, 9443.

Domain
A definition of a domain is required to access the web platform. This should be defined by the institution receiving the platform.

HTTPS Certificate
Generation of a HHTPS certificate is required for the server, this is a fundamental requisite to ensure the safety of the use of this services from mobile applications.

Google Play Store & App Store Access
Access credentials for app publication in Play Store/ App Store.

18

Other requirements
Computer with OSX, compatible with the last version of xCode (mandatory for compiling the Apps).

Internet
Symmetric dedicated internet: Of at least a /30 to have at least one public IP address available to broadcast the app and users can connect to Árbol IoT platform from the internet.

Bandwidth for application use:
Will depend on the number of users using the platform simultaneously, the average requirement is between 10 a 20 Mbps expecting a low to moderate user load.

Human Resources

App Developer / Administrator, with knowledge on base technologies related to application mounting: Docker / Angular / React native / Nginx / Spring / Geo-server / Minio / Postgresql / Postgis.

React Native Developer, with expertise in publishing and compiling iOS and Android applications.

Infrastructure maintenance technicians (both for server maintenance and maintenance on sensors used in conjunction with Árbol IoT).

IV. Transfer model for Árbol IoT

4.1. Terms of use of the source code of the Árbol IoT App

Árbol IoT's source code is developed with Open Source tools and is under management and protection of IMEPLAN. It's disposition towards a third party would be through **formal request addressed to the Institute,** who is responsible of the transfer process.

The app will be shared under the principle of constant evolution and collaboration, however, the use of its source code will be subject to the following provisions:

1 On each modified version of the app, there should be mention of the collaboration between IMEPLAN and GIZ.

2 The use of the app for profit, be it for a natural or legal person, directly or indirectly, is strictly prohibited.

3 Any use of the application and who will be the direct responsible of using/modifying the code should be notified to IMEPLAN beforehand.

4 IMEPLAN will keep logs regarding all modifications and updates made to the source code in order to establish the terms of use and monitor versioning.

5 The release for use of the source code is regulated by the General Public License (GP) emitted by the GNU[19].

6 The GPL license is based on international copyright laws, which guarantees the legal coverage for the software.

7 IMEPLAN holds no responsibility for the misuse of the source code, including both mechanical parts and software, nor does it offer guarantees about the code, including mechanical parts and software.

8 IMEPLAN can publicly denounce misuse of the platform by account of the recipient of the transfer.

IMEPLAN will be held responsible for documenting and sharing the source code in a public, accessible place and accompany it with adequate documentation to facilitate their reusability or adaptation by third parties. Adding to this, it will evaluate the code for possible areas of improvement and assign an appropriate open license to it.

19 To know more about the GNU, consult the following link: https://www.gnu.org/licenses/

20

4.2. Transfer Model Process

The application's transfer will be effectuated individually and independently by each actor. The process implied on the formal transfer model of the platform will be explained next:

The transfer process will start with a formal request addressed to IMEPLAN, which will include justification of said request, and the expected goals and purpose of the use of the code and the platform.

Subsequently, **the request will be evaluated by IMEPLAN** and in case of proceeding, the applicant will be notified of the request's approval; if not accepted, a notification will be issued stating the reasons that led to such determination.

In case of approval, the applicant will receive a form to gather all necessary information to the proposal for a legal instrument that formalizes the collaboration. At this point it will be included, but not limited to, the participation in areas of Sustainability and Climate change, International Cooperation, Juridical and Information Technologies.

The departments responsible for managing the transfer requests according to their origin, both national or international will be described next :

The International Cooperation department will be the one responsible for managing the platform transfer request applications with international actors, as well as requesting information about the platform implementation to the recipient, to monitor that the platform is used with strict adherence to what is established in the section: "Terms of Use of the source code of the application called Árbol IoT".

The Sustainability and Climate Change department will be responsible of managing the platform transfer request applications with national actors, as well as requesting information about the platform implementation to the recipient, to monitor that the platform is used with strict adherence to what is established in the section: "Terms of Use of the source code of the application called Árbol IoT". Likewise, this department will be in charge of following up on the questions that may be presented on behalf of the platform recipients, as long as they fall inside the technical capabilities of the sustainability and climate change are of IMEPLAN.

21

IV
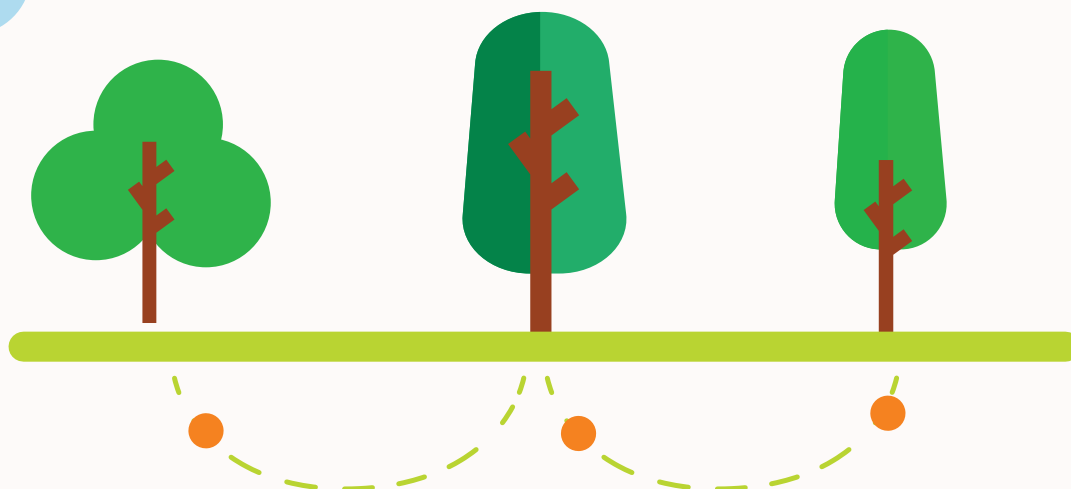
Once the transfer request is approved by IMEPLAN, T**he Legal Department will be responsible for registering the transfer under the legal structure of an agreement or letter of commitment.** As well as to safeguard the laws and goals under which the platform was crated. The characteristics of the **agreement** between stakeholders will depend on the qualities of the information that will the shared as a result of the transfer (i.e.; information shared in real time requires treatment and classification). Adding to this, the responsibilities and roles of the stakeholders will be explicitly stated, as well as the legal commitment of the proper use of the data that the applicant of the transfer of this technology will undertake. All data management process must be done with adherence to norms and regulations applicable on the territory that Árbol IoT is being implemented.

After formal collaboration is established, **the Information Technology department will be responsible of providing the source code, implementation and user manuals** attending to the terms and conditions determined on the legal instrument (an agreement or letter of commitment). Likewise, it will follow up on any question presented at them, as long as they fall inside the technical capabilities of IMEPLAN's Information Technology department.

Once the transfer process is being executed, t**he applicant must provide IMEPLAN with evidence of how the tool is being implemented and used,** so it can keep record of the Árbol IoT platforms that are online, which will be under protection of the Information Technology department.

Lastly, it is imperative that **in case the applicant makes modifications to the source code of the Árbol IoT platform, it will be notified to IMEPLAN** with the aim of following GNU's philosophy and feeding the update and improvements plant. All this with the purpose of making the platform a tool that always has the latest technology.

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For the transfer model to be successful, the following steps are required:

1

Make a formal request to use the platform to IMEPLAN by the applicant. Must Include:
- Goals
- Justification
- Purpose/use of the source code

2

IMEPLAN will evaluate the request
If it does NOT proceed: IMEPLAN will determine the reasons behind the denial of the request.
If it proceeds: IMEPLAN will notify the applicant of the approval of the request.

Departments of IMEPLAN that will manage the request:
IInternational: International Cooperation l department
National: Sustainability and Climate Change department

3

IMEPLAN sends the applicant a form to collect the necessary information to make the proposal of the legal instrument that will formalize the collaboration.

4

Register of the transfer under the structure of a legal agreement or letter of commitment.

6

The applicant must provide IMEPLAN with evidence of the use and implementation of Árbol IoT.

5

The Information Technology department will provide the source code, implementation and user manuals.

The departments of IMEPLAN that will help attending questions during the implementation process:
- Sustainability and Climate Change Department
- Information Technology Department

7

The applicant must notify IMEPLAN if modifications to the platform's source code are made.

8

In any collaboration, all propriety and copyrights that IMEPLAN indicates must be mentioned.

23

4.3. Data Protection.

Starting from the transfer model of the platform and its source code, the applicant interested in its implementation must guarantee proper use of the information (the moment is put online), in conformity with the legal dispositions applicable on the country that the operation is being effectuated, and attending to the nature of the applicant, in case that said difference is under regulation (both private and public).

In Mexico's specific case, it must adhere to the Federal Law of Personal Data Protection under Possession of Individuals, when it comes to the private sector and The General Law of Personal Data Protection in Possession of Obliged Subjects and its local norms, when it comes to the public sector.

Between the main provisions are the existence and communication of the data privacy notice to the public, duly completed in accordance with the regulations on the matter, and the guarantee of ARCO rights (Access, Rectification, Cancelation or Opposition).

It must be considered that the Privacy Notice Includes the data requested to citizens to be able to use the platform, which are the following:

- Full Name
- E-mail
- Residence neighborhood
- Profile picture

For your consideration, the application recurrently accesses the device's location to show reports and maps, but does not store the information.

Lastly, it must be considered that the information is an input and will always present different challenges, so the requirement to upgrade or adjust the information processing systems in the transfer process of the platform to different national and international instants is a possibility.

24

4.4. Best Practice regarding open source software and copyrights

The platform Árbol IoT s an open source software, which means that the code is open for other developers to make adjustments and improvements according to the specific needs of the local governments or the organism recipient of the technology. It is also possible to be used to make a different development parting for its code. Although it is a free software, there are some conditions and considerations for its use, so it must comply with the aforementioned "Terms of Use of the source code of the application called Árbol IoT".

It is also necessary to give credit to the authors of Árbol IoT. To accomplish this, it is imperative to recognize the copyrights and property rights of the works as IMEPLAN dictates; all improvements and modifications will be recognized and registered as derived works.

There are also international recommendations regarding the use of open source software that will be helpful for implementing Árbol IoT. Check the suggested resource for "Best Practice regarding open source software" in Attachment 3; Toolbox.
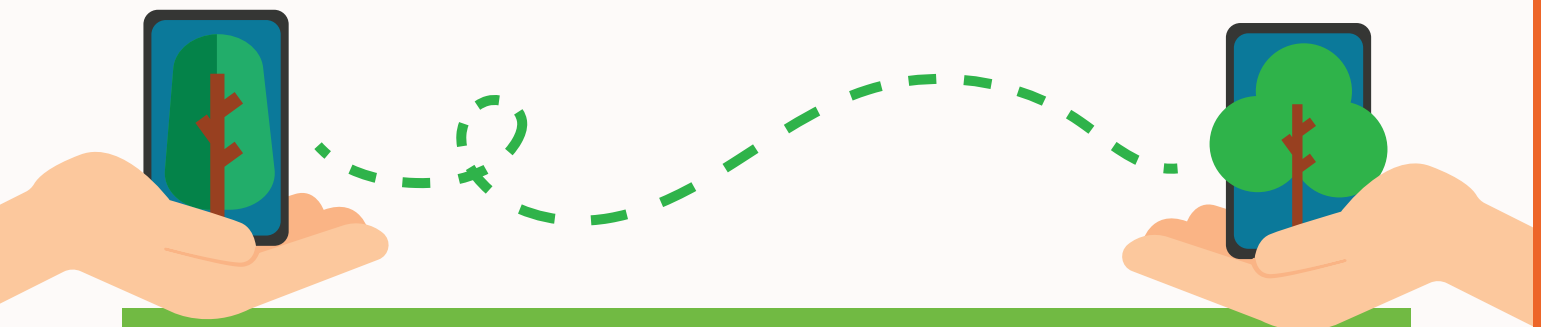
Considerations

- Do we understand that while implementing Árbol IoT we make a commitment for fair data use?
- Is our legal team acknowledged enough for the treatment and classification of the different types of information?
- Do we know the implications of data management under an open data policy?

Activity List

- Formal platform transfer request to IMEPLAN.
- Signing of the agreement
- Generation of a protocol of treatment of information (collection, classification, storage, distribution).
- Privacy notice for the platform.
- Training all personnel involved in the implementation of the platform about the treatment and classification of the information.

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V. V. Implementation stages for Árbol IoT

The stages presented next make reference of the route to follow once the transfer of technology is approved by IMEPLAN described in the Transfer Model, which imply a formal request for the transfer process of the platform to IMEPLAN, establishing the instances responsible of the platform and the signing of agreements between the applicant and IMEPLAN. Likewise, an adequate process of treatment of information, that would allow an implementation of Árbol IoT that complies with all the legal provisions. For this, it is imperative to consider the process described in **section IV of the Transfer Model beforehand.**

Furthermore, before the implementation, it is necessary for the local governments to establish a participation and coordination scheme with their coordination, direction and/or technical areas. Its involvement will be on a strategic, tactical or operative level depending on the stage of the project and its correspondent activities.

The following departments that, due to their characteristics and attributions, must participate in the process can be (but are not limited to):

- **Environmental Direction** - Direction / Urban Woodlands / Climate Change / Air quality / Parks and gardens.

- **Planning and territory management departments.**
- **Innovation (Technological)** - Direction / Project Development / Infrastructure (servers).
- **Citizen Participation** - Direction / Zonal Coordination/ Citizen participation.
- **Communication -** Direction / Zonal Coordination / Citizen participation.
- **Legal Department.**
- **Department that established the connection for the transfer,** when available**.**

26

V

The 5 stages required for the implementation are the following:

1 Identification:
Gather technical data to make an assessment of current information regarding the city's urban woodlands, and determine which information is missing, allowing for good climate planning by filling the missing data.

2 Diagnostics:
Evaluate the current situation regarding capabilities, elements, organisms and technical requirements needed for the implementation.

3 Planning:
Establish a plan of action considering the resources and alignment of the team assigned to the implementation.

4 Starting up the platform:
Installation of the platform, corrections and software changes to improve usability and applicability.

5 Launch:
Release of the platform to the public, implementing the periodic maintenance and data monitoring.

Each stage has a brief description, a list of considerations in a guide written in question and answer format, that will provide the basic information needed for its development, and a list of general minimum tasks.

27

5.1. Stage

1. Identification

Data gathering and information generation.

Although the climate change situation has a worldwide reach, each city or metropolitan area has specific characteristics that need to be measured.

Because of this, the first step is gather all technical information of the city to know the missing information required for climate planning. During this stage it is recommended to consider the goals of the local governments in respect to adaptation to climate change so they can be aligned to the integration of the platform.

Considerations

- Which have been the previous efforts related to the topic?
- Do we have an urban woodlands management plan?
- Do we know the land-use and zoning plans?
- Do we know if out city or municipality has pre-existing goals regarding climate change?
- Do we have information on risk maps?
- Is there a Climate Risk Analysis?
- Do we have the minimum requirements for the installation of the platform?

Activity List

- Gather any existing information that can help climate planning.
- Identify which are the data and generation of information needs in the municipality.
- Make an up to date tree inventory when the information is available.
- Gather data from the environmental monitoring network (historical data).
- Generate the required communication mechanisms between the actors involved in the process.

28

5.2. Stage

Diagnostics

Identification and evaluation of available resources

Once the recipient organization's needs are determined, the next step will be to evaluate if the required technological infrastructure is available; as well as the personnel that will implement and give long term maintenance to the platform, including the development of future improvements.

It will be necessary to check minimum technical requirements that Árbol IoT needs for its implementation, which can be consulted in the section: minimum requirements for the installation.

I If the local government already has a planning or coordination organism (with similar functions and attributes like IMEPLAN), this can be considered as a viable option to take the lead the transfer and implementation of the platform, to ease access to the platform to other local governments interested in this tool.

It is also important to consider the users of the information, that are comprised by both the planning teams of the local governments and regular citizens. In both cases it is recommended to consider the needs and interests of the users to design an environment that is friendly for both types of users.

Considerations

- Does the local government have a planning o coordination organism?
- What are the storage options for the platform?
- Which spaces/instruments can help the coordination?
- Who are the end users of the platform?

Activity List

- Analyze the infrastructure which is institutionally available; they can be planning instruments, agreements, governmental agencies.
- Identify available human resources and their technical skills.
- Identify current and future needs regarding key instruments about the topic, for the development of both the platform and the institution.

29
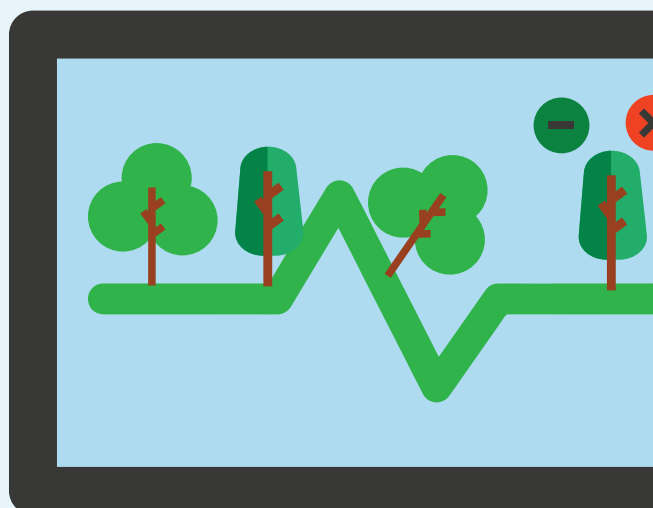
5.3. Stage 3. Planning

Work Plan Construction

This stage is undoubtedly the most relevant of the whole process, since the success of the whole project depends on this stage. For this reason, it is important to build possible implementation scenarios, on which the pros and cons of each choice can be observed, allowing for better planning. During this stage, it is important to take into account all available resources, both financial and human, and both in the medium and long term, so the sustainability of the platform can be guaranteed.

Another factor to consider during this stage, is the alignment of the team in charge and the users to the interior of the institution requesting the transfer. A highly relevant factor of success in technology transfers is the rate of appropriation of the technology, so it is very important that all the people involved see the platform as a basic tool for city planning.

Considerations

- What's the Budget necessary to maintain the platform through time? (consider future upgrades and improvements).
- What are our available options to fund the project?
- Who will advise the implementation team?
- How can we align the project to the city's own goals?

Activity List

- Establish a chronogram with realistic, achievable dates.
- Make a plan or route of action for the nest stages of implementation of the platform.

30
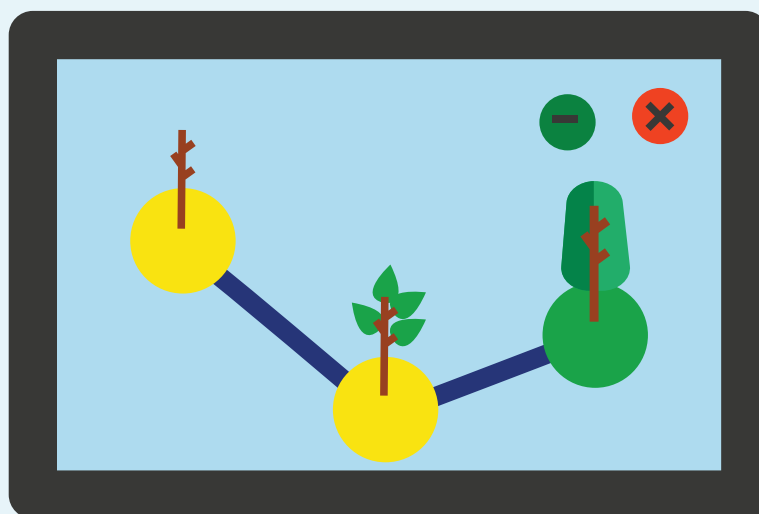
5.4. Stage

# 4. Starting up the platform

Installation of the platform.

Once the work plan is done and those in charge are defined, the moment to install la platform arrives. It should be considered that it is possible to request the support of the software developers to assist the installation process.

The local developer teams have to coordinate constantly to make adaptations to the code. It is recommended **to pay special attention to user experience** to make sure it is friendly and appealing.

On the other hand, the local government or recipient of the technology must make a compilation of the **existing databases regarding their urban woodlands.** For the specific case of existing geospatial data, a process of selection of relevant information as well as standardization (homologation of the information).

Once the **homologation of the information** is completed, the data can be used to feed the platform. This will result in a visualization of all the existent/registered urban woodlands of the municipality.

After the installation of the platform, **testing** will be necessary to evaluate its correct operation. This imply multiple testing on part of the developer team **to find system errors and correct them.** Furthermore, it implies the addition of new features identified during the previous stages of the implementation of the platform to improve usability and applicability. This is a technically demanding task, so the development team made a microsite with the description of the proper functioning of the whole system to ease the process.

Check the microsite of the platform in attachment 2; Toolbox.

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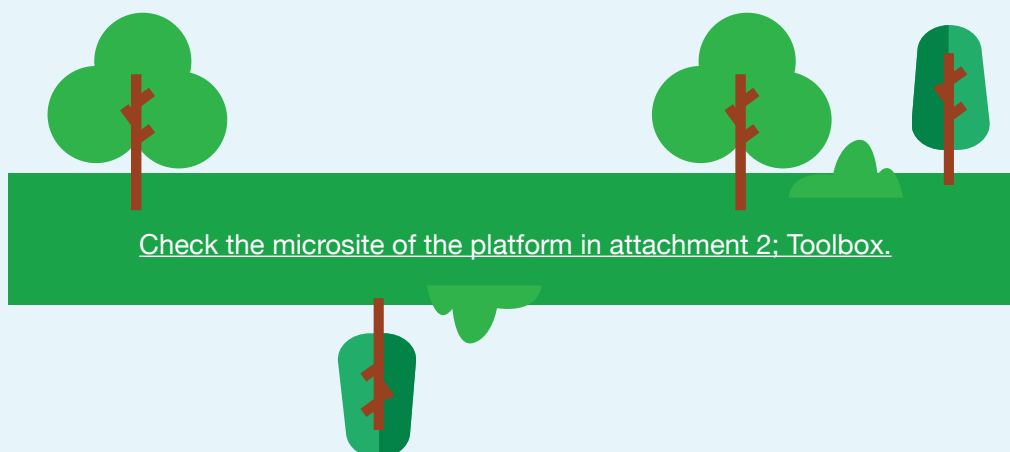
It is recommended to create maintenance plan that will be implemented periodically once use of the platform is commenced.

Considerations

- Which will be the main adaptations for the platform?
- Is it possible to make improvements on the platform?
- If there is no current data on the urban woodlands, which will be the method employed to gather the information? (The platform Árbol IoT is functional without preexisting data, however, it is recommended to integrate the city's urban woodlands data to take full advantage of the platform).
- How much testing will be done before the release?
- Which will be the selected maintenance plan?

Activity List

- Run the necessary testing to ensure correct operation of the platform.
- Design a testing drill to evaluate the performance and functionality of the platform.
- Focus on user experience.
- Generate the platform's appearance (design).
- Notify IMEPLAN when modifications to the source code are made.
- Create the maintenance plan for the platform.

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5.5. Stage

5. Launch

Introduction to the public

Once the platform is installed, the platform will be released to the public and a periodic maintenance plan will be implemented, apart from the fata monitoring that users generates. Each of these elements are to be described next:

Approval and launch

Once testing is completed and the correct operation of the platform is ensured, the project is released to the public. The involvement of the communication departments is crucial, as public launch is imperative to generate momentum inside the population, this translates to data input as it is generated by users.

Lastly, once the platform is operational, two main periodic activities must be performed to maintain the system.

Monitoring

It is important to keep track of the data generated on the platform, so the specialized personnel (like environmentalists or arborists) must validate the information uploaded by citizens.

Maintenance

Software maintenance is one of the stages on the Life Cycle of System Development, and involves changes to the software **to improve errors and dependencies found during normal use,** as well as the addition of new features to improve usability and applicability.

Considerations

- Which will be the theme for the launch campaign of the platform?
- Who is in charge of the launch?

Activity List
- Chronogram of activities previous to the launch.
- Generate the platform's narrative.
- Identify and prepare the communication channels for public launch.
- Coordinate with the different actors to agree on and support the launch.
- Implement the platform's maintenance plan periodically.
- Expert validation of the information uploaded to the platform.

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Attachments

Attachment 1. Local transfer in Guadalajara's Metropolitan Area (AMG)

As it was previously mentioned under the section of preceding information, for the case of Guadalajara's **Metropolitan Area** (AMG), and the agency GIZ. Afterwards, Guadalajara's municipality yielded the platform's right to IMEPLAN, and IMEPLAN facilitated the scaling of the platform to Zapopan's local government.

IMEPLAN is the actor promoting the platform de Árbol IoT in local governments inside the AMG and worldwide, as it has the technical resources and infrastructure to provide access to the platform.

Diagnostics.

On a first instance, by request of the agency GIZ, diagnostics where run with the goal of assessing the current situation with local governments conforming the AMG, mainly on the areas of Environment and Technology. During this process, resources available to each of these areas of all the municipalities were identified, including human resources, technological infrastructure, as well as the institutional capabilities to maintain the model, and the necessary elements for the transfer model and stages for implementation for Árbol IoT proposed in this guide were identified.

Challenges

Next, the main challenges for the transfer the platform are explained in detail, so they can be accounted for by the next recipient of the platform Árbol IoT:

- Achieve the expansion and transfer of the platform to all local governments of the AMG.
- Socialize the platform and reach good citizen participation that would allow to take full advantage of the information capturing potential that the citizens can provide.
- Have data storage capabilities for the data generated by the application, although the minimum requirements do not call for great storage requirements, it is necessary to have some storage space for future growth of the platform.
- That those involved share information regarding possible improvements identified for the platform.
- That actors participating in the transfer share their learning.
- The integration of the modifications to the code by different actors (modifications that are deemed necessary to adapt the code according to the specific needs of different actors).
- Most municipalities don't have the technical profile to take full advantage of the data generated by the platform.

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Attachment

Roles and Actors.

The institutional actors involved and the roles they had during development and transfer of the platform will be described next.

GIZ:
The German Agency for International Cooperation has been involved since the conceptualization and development of the platform in conjunction with the local government of Guadalajara, to the centralization of the platform to IMEPLAN, and during the scaling made to Zapopan's local government once the platform was put under the management of IMEPLAN. I Its involvement takes part in the Information and Communication Technologies for the Adaptation to Climate Change in Cities Program (TIC-A), a project that develops, contextualizes and tests digital solutions that make citizens participate in the co-creation of their cities to improve their resilience (GIZ, s/f).

One of its main functions has been the strengthening of the capabilities of the institutions involved, centered on public servants on the matter of digital management, from the design of clear, simple processes and the creation of tools to facilitate the transfer process.

IMEPLAN:
A technical organism specialized in urban/environmental planning. Generally, this types of organisms usually have the necessary technical capabilities to coordinate the implementation of a project of this type; capabilities that the local governments lack.

For the case of the AMG, this actor is IMEPLAN, public organism, decentralized and intergovernmental (between 9 local governments) that will be spearheading a model of metropolitan governance under which complex projects are implemented in a coordinated matter and with huge scaling potential. Part of the tasks of IMEPLAN is the design, safeguard and promote projects of this nature inside the AMG. Furthermore, it possesses the capabilities to facilitate transfer on an international level.
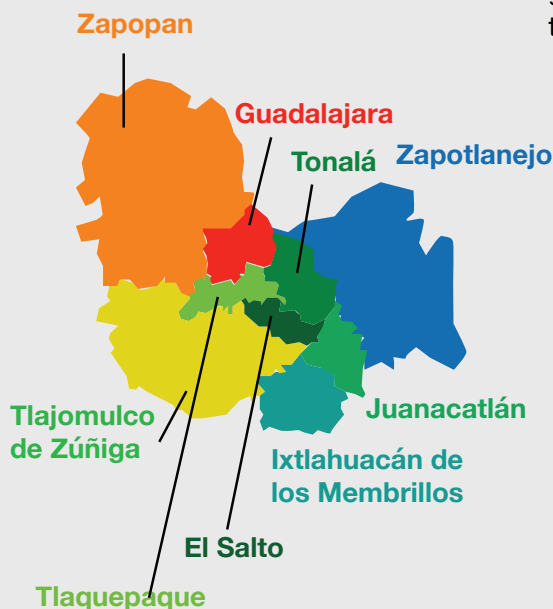
It has been assigned a central **and active role** in the transfer process of the platform, since request for the use of the platform should be addressed to the MEPLAN, and it will provide the necessary tools and guidance for the implementation of the platform, as long as it is within its institutional capabilities.

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Attachment

Local governments

The direct recipients of the application, responsible for defining and operating the implementation process of the application in their territory. In the instance of the AMG, two local governments have implemented the platform: Guadalajara and Zapopan. This process involved a great variety of actors, on local, metropolitan, and state governments.

Guadalajara: the capital city has a specific role in the transfer process of the platform, since it was the municipality pioneering in the conceptualization, development and prototyping of the first version of the platform. Guadalajara's experience on the subject is crucial for the process, and it gave guidance and recommendations during the transfer of the platform from IMEPLAN to the government of Zapopan.

Zopopan:

Zapopan
Guadalajara
Tonalá **Zapotlanejo**
Tlajomulco de Zúñiga
Juanacatlán
Ixtlahuacán de los Membrillos
El Salto
Tlaquepaque

Zapopan: main actor in the platform's transfer process, since this was the second municipality implementing the platform. It coordinated the adaptation of the platform according to its needs, thus creating the second version of the platform. The 4 main adaptations are the following:

- Improving user's experience in two different aspects appearance and usability.
- Improvements on data visualization.
- Changes on the component of the augmented reality and is given the attribute to be able to make measurements on the trees.
- A tree adoption function is added to improve citizen participation.

The rest of the municipalities of the AMG: Tlajomulco de Zúñiga, Tlaquepaque, El Salto, Juanacatlán, Zapotlanejo, Ixtlahuacán de los Membrillos and Tonalá. The local governments are interested in implementing the platform, however, they currently lack the necessary capabilities to carry on the implementation immediately. Their openness and participation in the diagnostics was incredibly useful for the development of the transfer model and the implementation stages proposed in this document.

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Attachment 2. Types of user of the platform.

On the next section, the different types of users of the platform Árbol IoT will be described, a list of the main attributes and accessible visualization for each user will be included.

General User
Makes reference to any citizen that registers through the mobile app.

Activities

- Access the features that their experience level and score allows.
- Check their commitments and achievements.
- Connect with other users, making posts in the community section and commenting in other people's posts, so a community can be created between users of the platform and learning and participation between users is encouraged.
- Capture and edit information on the urban woodlands through an exploration map.
- Answer trivia, to promote digital education, investigation and acquisition of new knowledge through trivia questions.
- Adopt trees, each adopted tree is transformed into a digital tree that is in close relationship with the physical tree, thus requiring care, status updates and photos for its maintenance.

Access to the following visualizations

- Environmental Information in dynamic visualizations.
- Visualization of the urban woodlands for a specific geographical context.
- Infographic report on the user contribution to the environment, this is calculated through the user interactions and actions made inside the app.
- Infographic report on the ecological benefits of the urban woodlands for a specific geographical context.

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Pro User

According to the merits achieved by their contributions inside the mobile app, a user can be promoted by the admin users to this type of user.

Activities

- Perform the same activities that a regular user can.
- Validate information, and make the necessary corrections.
- Create multiple choice trivia.
- Promote general users to Pro users, as well as remove Pro user's attributions.
- More interaction with the community section, like closing a post so no further comments can be added, or mark a user's post as a featured/stickied post.
- Access the activity repository, so a user changelog can be made.

Access to the following visualizations

- Access the same visualizations available to general users.

Users reserved for the people responsible for the implementation and follow up of de Árbol IoT

Content administrator

People assigned by the organization responsible for the project's maintenance, generation and content monitoring.

Activities

- Perform the same activities that a Pro user can.
- Access the administration panel to manage the content inside the platform.

The main activities that this type of user can perform related to content and platform administration are the following:

Content administration:

- Urban woodlands: register and edit the species of trees common in the geographical area where Árbol IoT is being implemented. This content works in close relationship with the tree catalog.
- Geographical limit: register and edit the geographical areas in which the rest of the users will be able to search.
- Reports: Manage the capture and follow up of reports made by users of the mobile app, assigning people responsible for following up on these reports and update their status as open or closed, the latter applying in case the report has been attended.

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- Trivia: Manage the content related to trivia, whose questions will be available to the users of the mobile app IoT. Unlike the section on creating trivia for Pro users, this section allows for managing a question individually instead of packages of five.
Community: Manage posts on the community section, feature/sticky users and Pro users posts, as well as habilitating/closing the comment section on a post.
- Notifications: Manage the notifications users receive trough the mobile app. They can decide whether the notification appears in the foreground as an alert inside the mobile app or decide whether the notification appears on the background, as well as the creation of said notifications. It also includes the creation and management of the notifications that users receive through the mobile app once they enter the configured geographical polygon.
- Sensors and Measurements: this section allows for the registration of the IoT devices collecting information on the environment (in case they employ these type of devices). Then information on the devices is logged (information like ID, name, la latitude, longitude and the date of the last synchronization is) .
- Measurement: this section allows to make a copy of the original frame received from SigfoxCloud

Management of the platform:

- Imports: Perform imports of the information regarding tree type, species and geographical limits from different sources of preexisting databases.
- Species selection assistant: They facilitate the registration of urban woodlands to all types of users. The content administration user has the capability to add information sections to this assistant.

Access to the following visualizations

- Access the same visualizations available to all users.
Species catalog, access the un-editable information display, this visualization is not available to the public.
- Geographical limits catalog: Access the information display, this visualization is not available to the public.
- Report tracking compendium, access the un-editable information display, this visualization is not available to the public.
- Community section post compendium.
- Notification compendium
- Registered IoT devices compendium
- Results tab on imports

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Attachment

General Administrator
User assigned as a general technical administrator.

Activities

- As its the case with content administrator users, general administrator users can access the administration panel, with the distinction that they can perform a wider array of tasks that content administrators.

- All possible activities for this type of user, related to content and platform management will be described next.

Content administration:

- Perform the same activities that a content administrator can.
- White pages: Manage contents of information pages inside the platform.
- Blocks: Manage information on the "Branding" section (where the logos of the responsible instances appear), "Secondary menu" and "footnotes".
- Reports: Manage the capture and follow up of reports made by users of the mobile app.
- This user type can add tags to classify the different types of reports (i.e.: danger, fallen tree, branches, etc.).
- Community: Manage tags shown to categorize the posts in the community section. They also have the attribute to manage user likes on the community posts.
- Graphic resources for gamification: Manage all graphic resources necessary for the mobile app Árbol IoT
- Achievements: Manage the type of achievements that users can receive while using the mobile app Árbol IoT (i.e.: novice caregiver, expert caregiver).
  Score scaling: Manage the score scale used by the mobile app Árbol IoT.
- Gamification rules: Manage gamification rules used by the mobile app Árbol IoT, it is required to define which activities would be awarded score points and the quantity of the score points assigned to each activity.
- Tutorials: Manage the different tutorials that can be released through the gamification rules and which in turn are shown to users of the mobile app Árbol IoT.
- Gamification profiles: Manage everything related to game dynamics of the app, levels, achievements and user score.
- Score profiles: Manage the score profiles, profile created when the user registers to the mobile app Árbol IoT and that has the purpose of logging the user scores achieved through the app.
- User achievements: Manage user achievements inside the mobile app Árbol IoT.
- User adoptions: Manage tree adoptions made by users on the mobile app Árbol IoT
- Followers: Manage the relationship between users of the mobile app Árbol IoT (who is following who).
- Entity metadata: Manage events performed between entity interaction, this information is for system use.

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Platform management

- Advanced platform settings: the advanced platform settings are reserved for this type of user.
- User management: the admin can create administration accounts to assign and manage each type of user.
- Audits: Filter information by date range on the login event list detected by the system.
- Entity audits: Selects the entity to be audited and the number of results to be visualized. This audit refers to modifications on the contents made by users.
- Logs: Access system logs (system activity logs).
- Custom information slots: add more characteristics to take into account to obtain more data on the city's urban woodlands

Access to the following visualizations

- Access the same visualizations available to content administrators.
- Added blocks compendium.
- Added white pages compendium
- Community section likes compendium.
- Gamification resources compendium
- Achievements compendium.
- Gamification rules compendium.
- Tutorial compendium
- Gamification and core profile compendium.
- User achievments compendium
- Tree adoption compendium.
- Entity metadata compendium.
- Compendium on user interactions/relationship inside the mobile app Árbol IoT.
- Metrics of the app.
- Sheet with the health status of the solution.
- Login events tab.
- Compendium on user content modifications.
- Log on and off tab.
- Custom settings tab.
- API, list of REST services used by the platform and the mobile app Árbol IoT.
- Repository activity, user changelog to keep record on user data changes related to the city's urban woodlands.
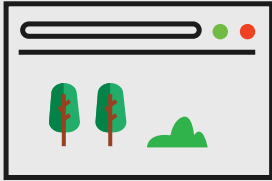
> To know more about the functions and reach of each type of user of the platform, check the user guides for each type of user, including in the website of the platform Árbol IoT available in attachment 3: Toolbox

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Attachment 3. Toolbox

On this section, the information and tools that will facilitate the implementation process of the platform.

Website of the platform Árbol IoT:
IInformation relevant for all implementation stages

On this website, detailed information about the the platform will be included, as well as the description of the operation of the system, design, development, and information relevant for its installation..
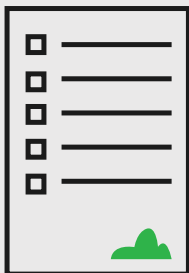
https://arbol-iot-docs.readthedocs.io/es/latest/

Best practice in open source software use
Information relevant for all implementation stages

To know more about best practice related open source software use, consult the following source:

https://opensource.guide/

Maintenance plan suggested for Árbol IoT
Information relevant for stage 5: Adaptation

As it was previously mentioned, maintenance implies constant action; and can be comprised in different types of maintenance schemes, which are the following:

- **Software upgrades:** In relation with performance, flexibility, reusability, etc., or implementation of new requirements.
- **Adaptive:** Adaptation of the software to changes in their technological environment (new hardware, different database management system, change in the operating system, etc. ...).
- **Corrective:** Correction of reported errors.
- **Preventive:** Facilitate future system maintenance (verify preconditions, redundancies, improve legibility. .

The backup frequency suggested for Árbol IoT is the following:

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- Backup virtual image of the platform:
  Frequency: 7 days.
  Historical: 2 copies.

- Databases:
  Frequency: 7 days.
  Historical: 2 copies.

- It is suggested to consult the following resource on the definition and measurement of software maintenance:

  IEEE Std 14764-2006, Standard for Software Engineering — Software Life Cycle Processes — Maintenance, available for purchase in the following link:

  https://www.iso.org/obp/ui/#iso:std:iso-iec:14764:ed-2:en

Acronyms and Glossary

Acronyms
It is understood that the following acronyms represent:

IMEPLAN: Metropolitan Institute of Development Planning and Management

GIZ: German International Cooperation Agency (according to its German acronym: Deutsche Gesellschaft für Internationale Zusammenarbeit).

AMG: Guadalajara's Metropolitan Area.

TIC-A: Information and Communication Technologies for the Adaptation to Climate Change in Cities Program (of GIZ). This Project develops, contextualizes and launches digital solutions that make citizens participate in the co-creation of their cities to improve their resilience.

GNU: The name «GNU» is a recursive Acronym of «GNU is NOT Unix». GNU is an operating system that is free software.

Glossary
For the effects of this document, it is understood that:

Adaptation to climate change: The Intergovernmental Panel on Climate Change (IPCC), defines adaptation as "initiatives and measures aimed towards reducing vulnerability of human and natural systems for the real or expected effects of climate change" (National Institute of Ecology and Climate Change, 2018).

Árbol IoT: Árbol IoT is a platform developed by Guadalajara's Metropolitan Area, with full support of the Metropolitan Institute of Development Planning and Management

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(IMEPLAN) and the International Cooperation Agency (GIZ, according to its German acronym). It is a gamified solution, composed by a mobile app, a web application and a conduction of IoT sensor (optional), focused on the accomplishment of the following strategical goals: citizen environmental conscientiousness, measurements and digital environmental education. This tool was created with the purpose of helping other cities in Mexico and worldwide benefit from its features to improve their communities.

Crowdsourcing: 'the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call' (Jeff Howe, "the act of crowdsourcing", June 2006, Wired Magazine). "Innovation in the model of crowdsourcing relies on opening a community, integrated by an indefinite number of individuals, tasks traditionally performed by employees or suppliers. This community, individually or in teams, performs each of these tasks and sometimes even receives some kind of gratification or remuneration" (Kosonen, 2014, in Leyva, Pastrana, Peña y Fernández, 2016).

DIY Devices (Do It Yourself): Low cost devices. For these instruments, reference material is provided (i.e. List of required items to build the device, and general recommendations for its proper use)

Tree canopy: The crowns of nearby trees form the canopy of a forest. The term canopy refers to when branches of the aboveground portion of nearby trees combine in way that a habitat is formed within. Canopy cover is understood as the percentage of the surface of an ecosystem that is below the canopy; it is also called tree cover. (Comisión Nacional Forestal (s/f).

The Internet of Things: IoT, "The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition" (Internet Society, 2015).

Implementation stages of Árbol IoT: The 5 stages needed for the implementation of the platform, once the formal request of use of the platform was made to IMEPLAN.

Gamification: "Gamification consists in using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems. "The goal is to take advantage of people´s psychological predisposition to participate in games to engage people and improve their behavior. This approach applied to educational environment has a promising road ahead" (Kapp, 2012)

Open government: "It is understood as a management and production scheme of public policies aimed at the attention and collaborative solution of public problems based on a plural collegiate and, in whose work, transparency and citizen participation converge as basic criteria, seeking to promote an environment of accountability and social innovation" (Sistema Nacional de Transparencia, 2016).

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Green Infrastructure: According to Benedict and McMahon (2002, in Vásquez, 2016) can be defined as "an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health and quality of life for communities and people". A concept that "reconciles urban growth with social protection and well-being, such as, climate regulation, air purification, noise reduction, a safe haven for native species, providing recreational spaces, leisure and contact with nature" (Vásquez, 2016).

Transfer model of Árbol IoT: A proposal by IMEPLAN so actors interested can Access this technology. Involves making an agreement with IMEPLAN, the transmission of the relevant information (manual, code, etc.) and punctual advice.

Open Source Software: "means software that respects users' freedom and community. Roughly, it means that the users have the freedom to run, copy, distribute, study, change and improve the software. Thus, "free software" is a matter of liberty, not price. To understand the concept, you should think of "free" as in "free speech," not as in "free beer". We sometimes call it "libre software," borrowing the French or Spanish word for "free" as in freedom, to show we do not mean the software is gratis." (GNU, 2020).

Civic technology: "Refers to technology developed with the purpose of facilitating the relationship between citizen and their governments. The term civic tech alludes to, in its general form, to any technology that helps mediate civic actions of citizens and can be promoted by public initiative for the improvement of the governments and its interactions with citizens, or be promoted by the private sector leveraging emerging conversations in is specific context. It is about offering technological means to the service of the citizens in societies that need a boost in information and openness" (Laboratorio de la Ciudad de México, 2018).

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Attachment

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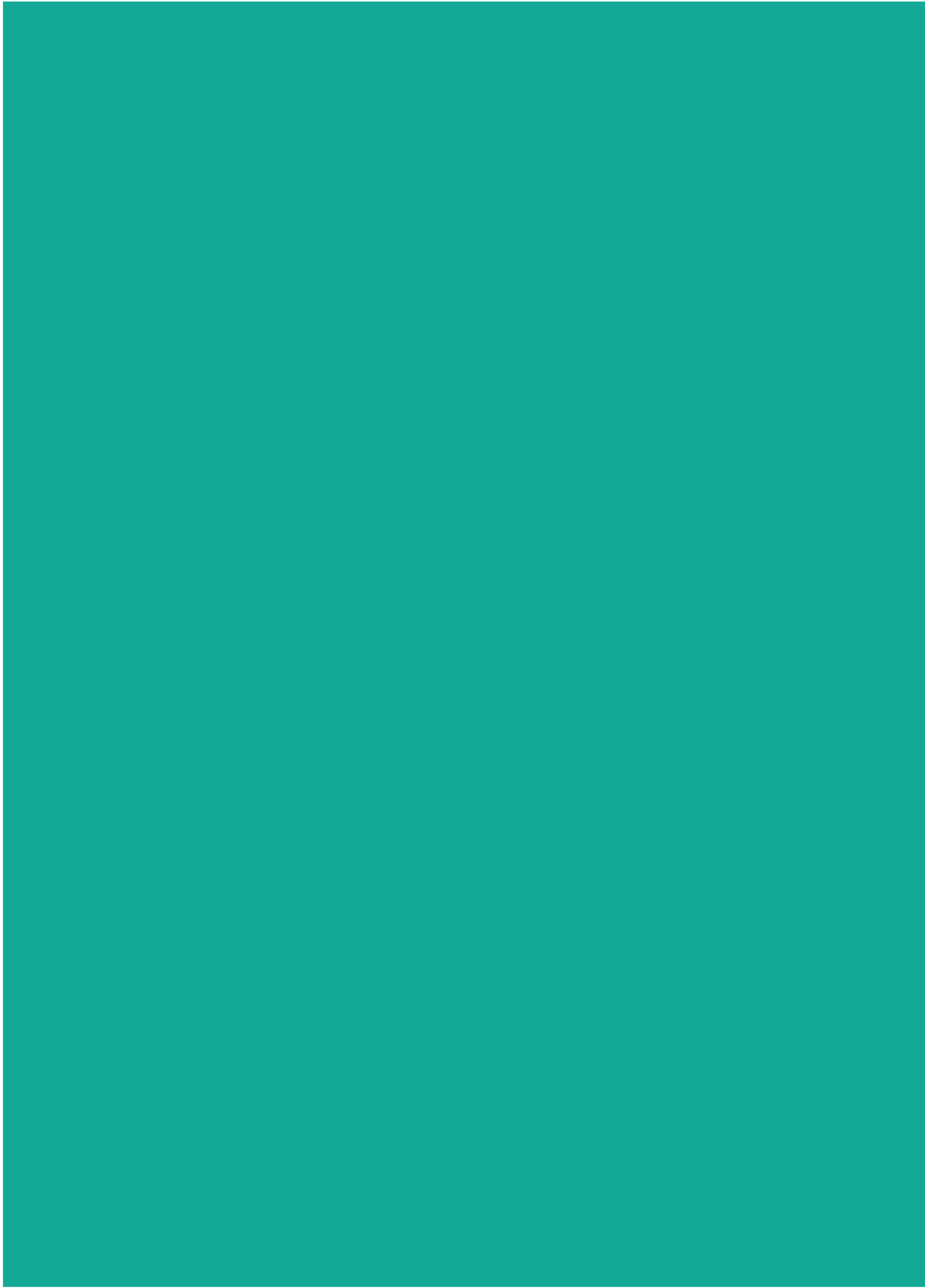Instituto Geográfico Nacional de España (s/f). Teledetección: Recovered from: https://www.ign.es/web/resources/docs/IGNCnig/OBS-Teledeteccion.pdf

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