Smart Cities and Territories Maturity Model

This document is a preliminary version that presents the conclusions of the Smart Cities and Territories co-creation exercise carried out on December 2019, in which more than 100 representatives from Universities, Industry and the Government participated. As a result of this workshop, a proposal for a Model for Measuring and Evaluating Smart Cities and Territories emerged, which addressed the following issues:

- Concept of Smart Cities and Territories.
- Scope of the Maturity Model of Smart Cities and Territories.
- Components of the Maturity Model of Smart Cities and Territories.

1. Smart City Concept

The analysis of different models of smart cities showed that, although there are different definitions of smart city, the vast majority of them converge towards a broader and more ambitious concept than simply strengthening a digital dimension of the city, and propose a greater scope in relation to concepts such as sustainability, efficiency, citizen participation, innovation, governance and social inclusion. All this is applied to the different areas of daily life in any city, such as energy efficiency, urban planning, mobility, environment, public safety and the circular economy, among others.

From the collaborative work developed in the exercise, the following definition was generated:

"A city or territory is smart to the extent that it orients its actions towards sustainability and inclusion, and connects and adapts to the challenges and expectations of the people who live there in order to guarantee the common welfare. In addition, it generates an environment of collaboration, innovation and constant communication with all the actors and institutions that make it up, and

where technologies serve as tools that leverage social, economic and environmental transformation".[1]

2. What is a maturity model?

A maturity model is a tool that allows the identification of the levels through which a person, organization or city advances towards the achievement of a final objective, allowing the measuring of that process continuously and establishing a roadmap starting from scratch to reach the desired state or stage.

It turns out to be a very useful tool in the context of smart cities and territories, since by considering the local context, it particularizes the situation of each city and, therefore, establishes a differentiated roadmap. Likewise, given that these initiatives are planned in the medium and long term, it is necessary to generate specific indicators that allow them to be targeted in the right way.

3. Features of the Smart Cities and Territories Maturity Model

The following premises were applied when creating the model:
- First the citizen, through access to reliable and quality public services, and the satisfaction of their needs in a smart and integral way.
- Inclusion and transparency in communication with citizens.
- Generation of value in the acquisition of adequate infrastructure.
- Efficiency in the use of resources.
- Sustainability of projects.
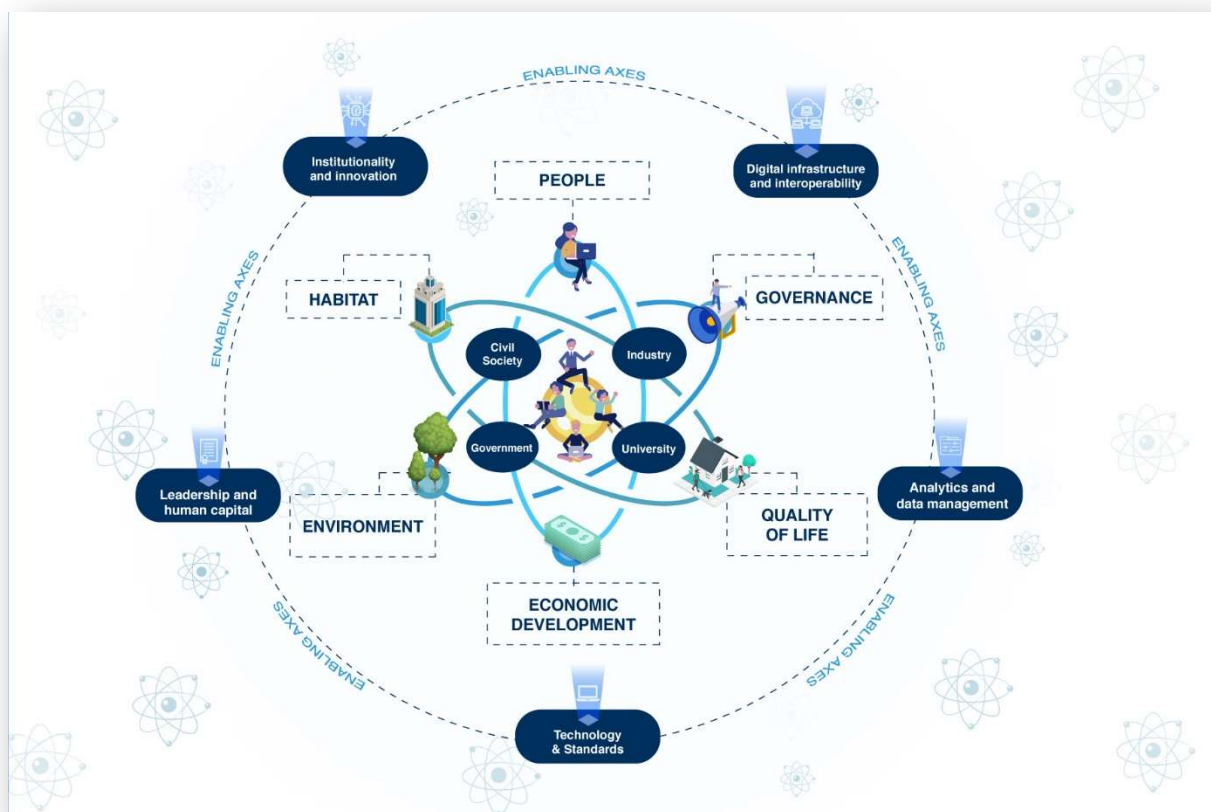- Integral, interoperable and scalable IT solutions that use open technologies and have high availability.

In the Maturity Model, the city-territory structure is defined by six dimensions and five enabling axes.

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[1] Definition developed in the Smart Cities Co-Creation Workshop. 6th December 2019

Image 1. Smart Cities and Territories Maturity Model

3.1 Dimensions

Dimensions are the areas created by the Maturity Model to group the functional areas of a city or territory, where progress can be made through the design and application of smart city or territory initiatives.

Each of the six dimensions can be measured to identify levels of perception and concrete outcomes.

- **Governance:** includes public policy, processes and mechanisms that enable interaction and secure participation between those who govern and those who are governed in a way that favors decision-making and greater efficiency, transparency and collaboration.
- **Environment:** includes all aspects related to sustainable management and environmental risks, as well as the protection and conservation of natural resources.
- **Habitat:** includes all the physical and structural characteristics that make it possible to generate the right setting for people to live satisfactorily in a city or territory.
- **Quality of life:** includes all aspects that facilitate and favor interaction and safe inclusion between people and the economic, social, health and welfare areas, among others, to adequately and satisfactorily satisfy people's needs.
- **People:** includes all aspects that favor the self-development of the inhabitants of the city or territory.
- **Economic development:** includes all actions towards the strengthening of productivity, competitiveness, sustainability and the industry itself.

3.2 Enabling Axes

The enabling axes are basic and transversal aspects or elements that must be considered when promoting a smart city and/or territory initiative, regardless of the dimension in which they are located. The enabling axes show that a smart city or territory initiative goes beyond a reflection of technological incorporation in the city. They reflect the set of capabilities that must be developed in the city or territory.

- **Institutionality and innovation:** includes the measurement of the elements related to the organization of human activities in the city and/or territory, the management of innovation and knowledge within the entities, the smart city, and territory, as well as the regulatory and financial conditions for the formulation and implementation of the initiatives.

- **Digital infrastructure and interoperability:** this axis measures everything related to the development, deployment and management of technological infrastructure of networks and communications for the interaction between the different agents of the city ecosystem. It also ensures that products and services from unequal providers can exchange information and work together.

- **Leadership and human capital:** this axis analyses elements related to leadership and the strengthening of the human capital of entities for the development of smart cities and territories initiatives, in addition to the set of knowledge and skills that allow a safe and efficient use of information and communication technologies.

- **Technology and standards:** includes aspects such as the incorporation, implementation and management of connectivity, new technologies and standards for the resolution of needs and challenges of the city or territory.

- **Analytics and data management:** this axis analyses the capacities related to public information ready to be used, analyzed and exploited by citizens, the academic sector, the private sector and public entities to solve social problems, improve decision-making processes and generate wealth.

4. Evaluation Structure for the Smart Cities and Territories Maturity Model

The Maturity Model of Smart Cities and Territories proposed in the co-creation exercise is based on three measuring criteria:

- **Perception measurement:**

The objective of the perception measurement is to know, through a survey exercise, the opinion that the citizens have about the actions that a city develops around the dimensions and sub-dimensions of the Maturity Model. It is based on a questionnaire that includes a set of statements that must be answered with a perception scale between one and six, one being the rating of greatest disagreement with the statement proposed, and six the highest scale in which the respondent is in complete agreement with the statement.

- **Results measurement:**

This component of the model is consolidated into a series of indicators that give an overview of the current status of the city or territory, in each of its dimensions and sub-dimensions, based on the compilation of real information and data of the city.

- **Capacity measurement:**

This component corresponds to the measurement with respect to the capacities of the entity in each of the enabling axes of the Maturity Model. In order to verify these capacities, a self-diagnosis has been designed so that the country's public entities -especially those that currently or potentially generate initiatives or solutions for the development of smart cities and territories- can identify the level of maturity in each enabling axis. Once the tool is applied, the entity will be able to generate new capacities or strengthen them through the implementation of specific action plans.

Perception measurement					
Level 1	Level 2	Level 3	Level 4	Level 5	Level 6

The citizens perceive that the indicators of the dimensions of the city are worsening.	The citizens do not perceive any progress in the indicators of the dimensions of the city.	Citizens perceive a slight improvement in the indicators.	Citizens perceive progress, but it does not directly impact their quality of life.	The citizens perceive an improvement in the indicators of the dimensions of the city.	The citizens perceive that the indicators of the dimensions of the city improve ostensibly.

Results measurement					
Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
The indicators show a deterioration from the baseline.	There is no progress on the performance indicators. The indicators remain the same as in the baseline.	Progress on performance indicators is incipient. They do not manage to solve the problems in a convincing way.	Progress on performance indicators is substantial.	The progress of the performance indicators is above the average of the results of other cities.	The performance indicators are among the best in the country.

Capacity measurement					
Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**

Technology management is limited to support. IT initiatives are developed in isolation.	The IT leader is not involved. Initiatives are not focused on smart cities. Information systems are not integrated.	The initiatives are co-led by the IT leader and the area that must solve the problem. The initiatives function as silos.	Various areas of the entity are connected around the initiatives.	Other actors at the departmental, regional and national level are involved.	Processes of continuous improvement of the initiative are carried out.

The weighting of the results of the three measurements (perception, capacities and results) will allow the formulation of an index of Smart Cities and Territories.

5. Roadmap for the implementation of the Maturity Model

1. Define a strategy for the implementation of the Maturity Model:

    The entity must define how to apply the measurement tools of the Model. This is the right stage to empower the Maturity Model from the management level of the entity, who will give the approval for the Model to be socialized and to achieve the elaboration of a work plan around it.

    The Model can achieve an articulation with the different elements of territorial planning such as:

    -Departmental Development Plan
    -Municipal Development Plan
    -Land Management Plan, Basic Land Management Plan or Basic Land Management Scheme, as applicable

2. Socialize the Maturity Model with the different secretariats of the entity:

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This socialization of the Model should be guided by the IT leader. Each secretariat or organizational area of the entity should be assigned to one or more of the dimensions and sub-dimensions of the Model and should understand the cross-cutting nature of the enabling axes. The Model should be articulated with the strategic and action plans of each secretariat. If this articulation with the plans is not achieved, the Model runs the risk of not being implemented or of being implemented without the articulation with the other activities of the entity. Similarly, the three types of measurements should be socialized so that they are appropriated by each secretariat/area.

3. Knowing the digital transformation agenda:

The digital transformation agenda is the action points defined by the entity to produce changes by anticipating the use of ICT. This agenda must be defined by each area/secretariat of the entity to identify the needs in terms of enabling digital services, improving internal processes and strengthening citizen participation in decision-making processes, among others.

The areas or secretariats of the entity should be supported by the Maturity Model of Smart Cities and Territories to identify in which dimensions and sub-dimensions their digital transformation agendas are located. This will facilitate the entity's analysis of the different articulations that may arise between the agendas and the organizational areas that propose them.

The IT leader or CIO (Chief Information Officer) of the entity must play a strategic role in providing guidance on what is required by the different areas or secretariats. During the definition of the digital transformation agenda, the IT leader can propose the implementation of the capacities, perception and results measurements of the MinTIC's Smart Cities and Territories Maturity Model.

Once the strategic agenda is in place, the IT leader will be able to identify common factors in the smart city initiatives that each of the secretariats will execute. This recognition is important because it will help avoid duplicating efforts, and the common factors among the strategic agendas should be included in the smart cities and territories initiatives to be structured.

4. Implementation of measurements and establishment of a baseline for results and perception:

    In order to support the generation of the digital transformation agenda, the perception and results tools proposed in the Maturity Model should be used. The measurement of perception will make it possible to know what the opinion of the citizens is and the issues that they prioritize. On the other hand, the results measurement tool will allow the creation of a baseline on the indicators of all the dimensions proposed in the Smart Cities and Territories Maturity Model.

    It is important to note that the measurement of results can be implemented in its totality, but there must be indicators that are prioritized according to the goals of each area or secretariat socialized in their action plans.

5. Formulation of smart city initiatives:

    Based on the information obtained through the measuring tools (perception and results) and the prioritization carried out in the digital transformation agendas formulated by the different secretariats of the municipality, it will be possible to formulate smart cities and territories initiatives. The initiatives should seek to integrate the different agendas as much as possible.

    In order to review the technical guidelines to be incorporated in the formulation of the initiative, Annex 5, which proposes elements in the enabling axes of 'Digital Infrastructure and Interoperability' and 'Technologies and Standards', must be reviewed. The verification of these technological guidelines will allow the entity to make a technical follow up on the initiative.

    The IT leader must seek to coordinate with the private sector, the IT industry and other territorial entities when formulating the initiatives. In order to identify the minimum elements that an initiative should contain, the CANVAS tool use is recommended, which is available at the following link: http://estrategia.gobiernoenlinea.gov.co/623/articles-17464_recurso_38.pdf

    For the formulation of the initiatives, it is recommended to check the document 'Guidelines for developing smart cities and territories initiatives' of the Digital

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Government Division that can be found at the following link http://estrategia.gobiernoenlinea.gov.co/623/articles-17464_recurso_34.pdf

6. Strengthening of capacities:

Once the entity has defined its needs in terms of smart cities and territories, through the stated initiatives, it must review the skills that the areas involved have for the implementation of the same. That is why the Maturity Model of Smart Cities and Territories proposes the measurement of capacities to identify how well the entity is able to advance such activities.

7. Evaluation:

It is important to measure the impact of the initiative.

Finally, it is also advisable to apply for the Digital Government Seal of Excellence with the initiative. Obtaining the Seal of Excellence will guarantee that the initiative meets minimum quality requirements. The quality requirements for the award of the certification can be consulted at the following link: http://estrategia.gobiernoenlinea.gov.co/623/articles-17464_recurso_35.pdf and information on the Seal of Excellence and how to apply can be found at https://sellodeexcelencia.gov.co/.

6. FINAL RECOMMENDATIONS

Cities and territories are key drivers of economic growth, innovation, social progress, culture and, therefore, competitiveness. They are undoubtedly attractive for their ability to provide basic services, guarantee minimum quality of life and provide better conditions for business creativity and professional development.

The weighted average of the measurements of capacities, perception and results will allow the generation of the Smart Cities and Territories index. This measurement allows the city's stakeholders to obtain a comparative view of their own reality. Thanks to these analyses, it is possible to identify those elements

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that need to be optimized or to recognize relationships between the respective levels of maturity, which will make it possible to develop initiatives and make relevant strategic decisions.

Citizens are becoming one of the key players in the smart development of cities and territories. The role they play as users and demanders of urban and territorial services, together with their growing participation and interest in local and territorial management issues, gives them a leading role in the "smart" paradigm.

The achievement of an integrated and lasting territorial development requires a series of conditions that are favorable to innovation and to the knowledge economy, that requires the participation of local and regional actors (public and private) who have an in-depth knowledge of the different areas and the capacity to provide concrete and specific responses to the new challenges. This is why measurement is not specifically limited to the public entity but addresses all actors in the digital ecosystem.

The Model responds to the need of the territorial entities for technical guidelines to be able to define strategies for smart cities and territories, which is a priority of the National Government that was expressed in article 147 of Law 1955 of 2019 of the National Development Plan.

Entities should be attentive to other guidelines emerging from national authorities on smart cities and territories. In this sense, it should be noted that the leader of the Smart Cities policy in the country is the National Planning Department.

The Maturity Model for Smart Cities and Territories was formulated as a support tool to facilitate the progress of territorial entities in this area. The other initiatives generated around the Digital Government Policy also facilitate progress in the area of smart cities and territories.

In order to guarantee the correct implementation of the Model, the territorial entities may request the support of the consultants of the Digital Government Division of the MinTIC. This request can be made by e-mail to acompanamiento@mintic.gov.co