Advancing initial stages for the transformation of smart communities
Digital Transformation Roadmap
RIVNE

Index

Your Reference Roadmap

1. Your Maturity Level
2. Your Reference Roadmap

1

Your Maturity Level!

RIVNE Assessment Scores:

Digital Maturity (LORDIMAS Assessment)

Governance	Service Design	Data Management	Interoperability	Service Delivery	Technology	Networking
Digitally Purposeful	Digitally Emerging	Digitally Nascent	Digitally Reactive	Digitally Emerging	Digitally Reactive	Digitally Emerging

Technical Maturity (LORDIMAS Assessment, Strategy Assessment, IT Infrastructure Assessment)

Digital Strategy	IoT Devices	Local Digital Platform	Integration/ Interoperability	Data	Storage	Compute	Network	Infrastructure Security
✓ Under revision or refinement	3	✗	2	2	2	2	2	1

Caption: ✓ In place   ✗ Not in place   ① Not at all   ② Initial exploration   ③ Basic utilisation   ④ Advanced utilisation   ⑤ Outstanding utilisation

Nascent — Reactive — **Emerging** — Purposeful — Optimised — Native

DIGITALLY EMERGING
Overall Digital Maturity

Absent — Embryonic — Foundation — Seeker — Growth
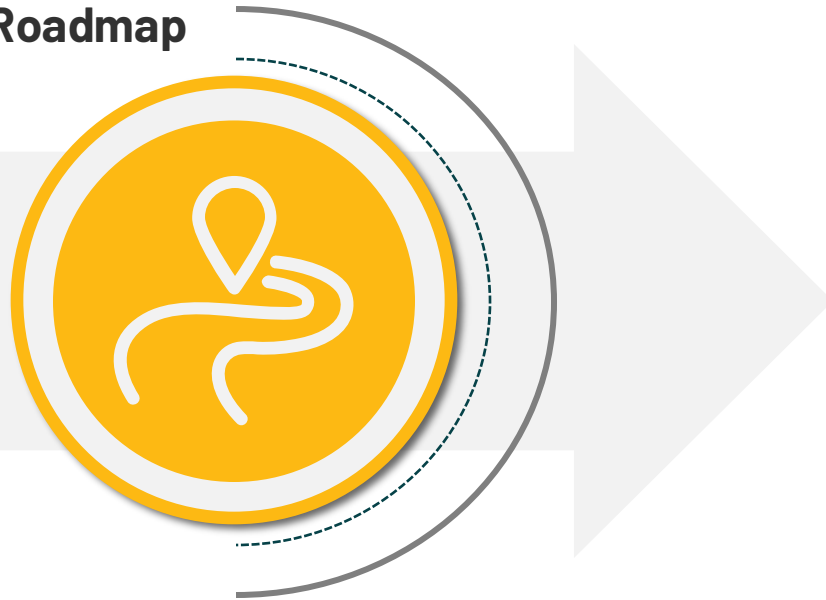
DIGITAL ABSENT
Technical Maturity

Key Considerations

- The Lordimas Assessment indicates that the community's maturity level is Digitally Emerging, reflecting low levels of digital transition

- The community is currently in a digital absent state, demonstrating limited technological capabilities. However, there is a noticeable willingness and/or political commitment to embark on a digital transformation journey, including the adoption of smart solutions

- Safety & Security, Energy & Environment, and Education are strategic sectors in terms of future investments in digitalisation for the community. It is crucial that the community targets its strategic sectors when planning the development of smart community solutions, namely a local digital platform and a local digital twin

- Currently, the major gaps the community faces in terms of its IT infrastructure lie in its Infrastructure Security and Integration/Interoperability capabilities

Note: The two maturity levels presented cover similar but somewhat different scopes of analysis, which may result in differences. The Digital Maturity results from LORDIMAS, while the Technical Maturity score is derived from the combined assessments used within the helpdesk's scope. The latter, along with its specific capabilities scores, forms the basis for the presented roadmap.

Your Reference Roadmap!

Roadmap's Critical Considerations Highlights

Reference Roadmap

The **reference roadmap outlines key milestones and best practices for a project**, providing a standardised framework for development and implementation, applicable to various scenarios as it remains use-case agnostic

The **time presented in the reference roadmap is an estimation**, which can vary depending on the structure of the general administration of each community and the availability of resources

The **roadmap does not consider the time needed for contract negotiations** and RFP discussions

The development of capabilities/ enablers may run in parallel because some capabilities and enablers, **while having interdependencies**, **do not strictly rely on each other's completion**

Device management, Integration/ Interoperability and data capabilities can be extended and enhanced whenever new devices or applications are introduced into the network

Whenever starting a new phase in the roadmap, there should be **a time to revisit and review the community's Overall Digital Strategy** to ensure the alignment with the community's current objectives and adaptability to evolving market dynamics
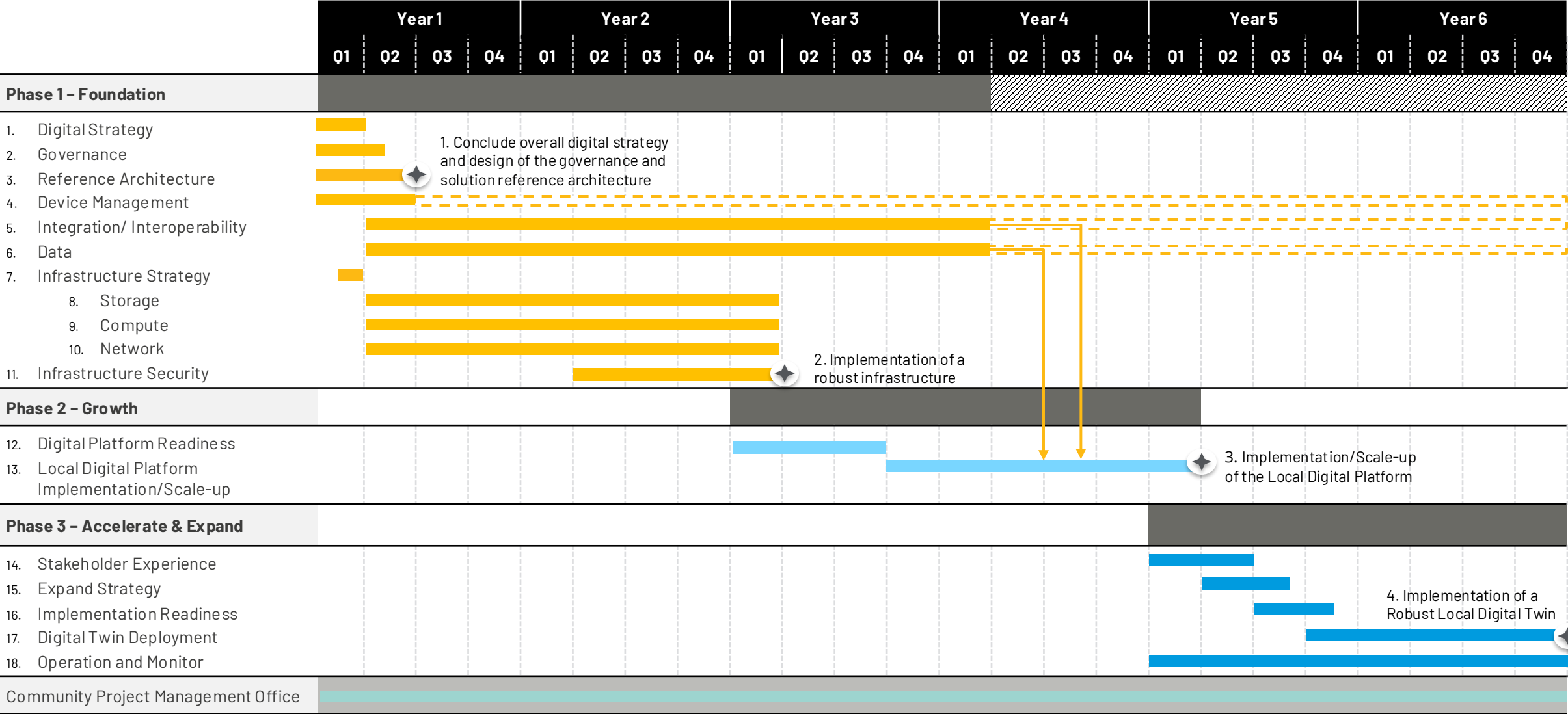
Reference Roadmap Deep dive

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1. Digital Strategy
2. Governance
3. Reference Architecture
4. Device Management
5. Integration/ Interoperability
6. Data
7. Infrastructure Strategy
8. Storage
9. Compute
10. Network
11. Infrastructure Security
12. Digital Platform Readiness
13. Local Digital Platform Implementation/Scale-up
14. Stakeholder Experience
15. Expand Strategy
16. Implementation Readiness
17. Digital Twin Deployment
18. Operation and Monitor
00. Community Project Management Office

Your Reference Roadmap!

		Year 1				Year 2				Year 3				Year 4				Year 5				Year 6			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Phase 1 – Foundation

1. Digital Strategy
2. Governance
3. Reference Architecture
4. Device Management
5. Integration/ Interoperability
6. Data
7. Infrastructure Strategy
8. Storage
9. Compute
10. Network
11. Infrastructure Security

1. Conclude overall digital strategy and design of the governance and solution reference architecture

2. Implementation of a robust infrastructure

Phase 2 – Growth

12. Digital Platform Readiness
13. Local Digital Platform Implementation/Scale-up

3. Implementation/Scale-up of the Local Digital Platform

Phase 3 – Accelerate & Expand

14. Stakeholder Experience
15. Expand Strategy
16. Implementation Readiness
17. Digital Twin Deployment
18. Operation and Monitor

4. Implementation of a Robust Local Digital Twin

Community Project Management Office

Note: The arrows represented in the reference roadmap illustrate that during the implementation of the local digital platform, both Integration/ interoperability and data capabilities should be addressed. It is essential to ensure the seamless concatenation of Integration/ interoperability and data collection within the local digital platform during its implementation

Caption: ● Phase   ✦ Milestone

Reference Roadmap Deep Dive | Initiatives

1 Digital Strategy

Digital Strategy Enabler refers to defining the digital vision, mission and requirements that the city wants to digitally achieve, strategically guiding the technological development. This enabler ensures that the city's technological investments align coherently with its long-term goals, contributing to a strategic and well-defined approach that fosters growth. This enabler is divided into 4 major sub-capabilities: Vision and Mission, Strategic Priorities, Action Plan, Financial and Digital Strategy.

☰ Main Initiatives (1/2)

Vision and Mission

- Review, refine, and formally establish the community's vision, which sets the long-term direction or aspiration of the community, and mission, which outlines the immediate purpose and approach to progress toward that vision, from strategic analysis methods such as SWOT analysis (strengths, weaknesses, opportunities, and threats) or PESTEL analysis (Political, Economic, Social, Technological, Environmental, and Legal) and dedicated discussion(s) with stakeholders

- Conduct, or review and refine, a gap analysis between the community's vision & mission and its current situation. These gaps represent the key challenges and obstacles that need to be addressed. Translate these challenges and obstacles in clear objectives as they will provide concrete steps and targets to move toward the realisation of the vision. This could involve social, economic, environmental, or technological barriers. For example, if the gap is related to high energy consumption, an objective could be to decrease the community's energy consumption by a certain percentage within a specific timeframe

Strategic Priorities

- Based on the defined vision and mission, select the key sectors (e.g., mobility or energy and environment) in which the community aims to make significant advancements. Within these sectors, define the key strategic priorities (e.g., energy managements) as this will guide the development of the digital infrastructure needed for a successful comprehensive local digital platform establishment

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

Not applicable

Reference Roadmap Deep Dive | Initiatives

1 **Digital Strategy**

Main Initiatives (2/2)

Action Plan

- Based on the selected strategic priorities, and existing projects' pipeline define a final digital transformation action plan by finetuning the provided roadmap. This includes refining the specific steps, timelines, responsibilities, and resources required to close the identified gaps to reach the defined objectives

Financial

- Perform a financial analysis (e.g., cost-benefit analysis and discussion of potential trade-offs) to ensure the steps are financially viable from both an execution perspective, as well as from a sustainability and maintenance perspective into the future

- Map potential external funding mechanisms to support the activities related to the development of the digital infrastructure over time. External sources may contribute to reduce the risk/uncertainty and decrease the costs of the project for the community. Examples may include EU or national grants, subsidies and tenders, agreements and joint collaborations with companies/technology providers through e.g., co-funding of solutions, Public-Private partnership models, reuse of open-source components made available by the LDT community, use of taxation revenues, loans, exchanging taxing rights for infrastructure of services provided by companies, among others. If needed, refine the action plan accordingly

Reference Roadmap Deep Dive | Initiatives

2 **Governance**

Governance Enabler is essential in the city's digital transformation process, focusing on stakeholder mapping, communication, performance measurement, and data governance. This capability plays a key role in guiding the city towards a unified and efficiently managed transition to a smart city.

Main Initiatives (1/2)

Stakeholder Engagement

- Identify the stakeholders that may be affected or can affect the community's vision for digital transformation (e.g., residents or citizens, utility providers, ICT companies, national governments, among other innovation ecosystem partners) to understand their concerns and manage their vision of the community's goals and ambitions

Change Management Strategy

- Define a change management strategy for the community by identifying the skills and knowledge required for the successful adoption of smart technologies. Based on this the community may decide to hire and/or upskill the workforce (e.g., training and certification plan) and/or work with external partners who can provide specialised/technical knowledge

Communication

- Define and design a communication strategy for engaging with key stakeholders according to their needs and preferences to ensure a clear and consistent message can be conveyed. Communicating about smart city initiatives helps educate the public about the benefits of new technologies. It encourages the adoption of smart solutions and fosters a culture of innovation within the community

Key Performance Indicators (KPIs)

- Establish a set of KPIs that will help measure the progress toward the smart city vision. For example: Reduction in energy consumption per capita. Regular monitoring and reporting of KPIs are essential to understanding the effectiveness of the strategy and making timely adjustments. Identify tools that will support the effective execution and monitoring of the smart city office activities through tools such as dashboards

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

1 *Digital Strategy*

2 **Governance**

Main Initiatives (2/2)
Data Governance Strategy

- Define a data governance strategy for the community by outlining the objectives, priorities, and scope of data management. Establish robust policies for data collection, storage, sharing, and privacy, ensuring compliance with relevant regulations and assign clear roles and responsibilities

Reference Roadmap Deep Dive | Initiatives

3 Reference Architecture

Reference Architecture refers to a standardised framework that provides guidelines, best practices, and a common structure for designing and implementing various city components. It provides a comprehensive framework that defines the relationships between the city's components, helping city planners, architects, and developers to make consistent and interoperable decisions when deploying smart technologies.

Main Initiatives

- Understand the main use cases / use case narratives to support on the Solution Reference Architecture

- Identify and clarify the purpose and context of the services to be provided based on the targeted use cases

- Establish ICT architecture components requirements to guarantee the quality and robustness of the solution architecture

- Establish clear and concise architecture principles that guide design choices (e.g. Ensure that different components and systems can work together seamlessly)

- Define the design of the Solution Reference Architecture based on the use cases and needs identified in previous steps. Inspiration can be also drawn from good international practices on reference architectures such as ITU's U4SSCC reference framework for a Smart Sustainable City management, Digital Twin Consortium, DUET (Digital Urban European Twins) project, FIWARE, GAIA-X and others

- Design the multi-layer architecture and necessary integrations with IoT devices, ICT infrastructure, city systems, open-data portals and multi-shared platforms

- Develop a plan for the ongoing management, maintenance and upgrade of the architecture throughout its lifecycle

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

1 *Digital Strategy*

Reference Roadmap Deep Dive | Initiatives

4 Device Management

Device Management Capability entails efficient deployment, maintenance, and integration of IoT devices to enhance overall operational efficiency within the smart city ecosystem. This capability can be divided into 3 major sub-capabilities: Device Management Strategy, Device Installation, and Device Platform.

Main Initiatives (1/2)

Device Management Strategy

- Define the requirements for your IoT Devices and Device Platform based on the strategic priorities and IT infrastructure strategy.

  - Factors to consider for the devices are: Requirements for storage, compute, material, updating, data processing, connectivity, interoperability, and security.

  - Factors to consider for the device platform are: Technical ease, scalability, flexibility, extensibility, simplicity, universality, security, cost, speed, visibility and support

- Identify and list the physical devices and infrastructure that could potentially be enriched with IoT sensors or connectivity, considering the different domains. This serves as the basis for determining which IoT devices can be implemented. Examples are street lights, waste bins, cameras, etc. Use this list, together with the strategic priorities, to select the IoT devices required to achieve the goals of the community

- List the possible IoT devices for the physical devices that are missing or inadequate, and score them according to the requirements

- Define the device lifecycle management framework design: Policies for registering, provisioning, authentication, configurating, maintaining, diagnosing, and removing IoT devices

- Identify the device management protocols and device communication APIs that will be used by the devices, in concordance with interoperability mechanisms defined in the IT Infrastructure strategy

- Define KPIs to determine the effectiveness of the implementation of the device management strategy

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *IoT devices*
- *IoT platform*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1 *Digital Strategy*

Reference Roadmap Deep Dive | Initiatives

4   **Device Management**

Main Initiatives (2/2)

Device Installation

- Acquire and implement the chosen IoT Devices based on the IoT strategy, strategic priorities and IT Infrastructure strategy

Device Management Platform

- Acquire and implement the chosen IoT Platform based on the IoT strategy, strategic priorities and IT Infrastructure strategy

5 Integration/ Interoperability

Integration/ Interoperability Capability refers to the community's ability to have seamless connectivity and collaboration among diverse devices, systems and services. It facilitates unified data exchange through standardised communication protocols and advocates for open standards adoption. It establishes a foundation for a connected, responsive, and sustainable urban environment

Main Initiatives (1/2)

Integration and Interoperability Strategy

- Define/ Review the strategy for integration and interoperability of the community data, devices, hardware and Software. This will include a view of the use of APIs, interoperability standards, frameworks and models, ways of ensuring interoperability will be used, the integration platforms, and governance of ensuring these are followed and adhered to. Incorporate compliance with the Minimal Interoperability Mechanisms in the strategy https://mims.oascities.org/

Technical Specifications

- Design the technical specifications for ensuring interoperability with current and future infrastructure, based on IT Infrastructure strategy and reference architecture. The main focus should be on determining a minimum level of interoperability, as close as possible to specifications already identified in the MIMs

Open Source

- Define an open source strategy to promote the use of open source Software within the community's initiatives. This will take the form of a high-level document that matches the objectives of the community to the use of the Software and the overall directives. It touches upon important questions such as where to use open source, what are the main objectives, and how will they be met. Develop policies to execute the strategy with regards to the discovery of Software, the review of it, the procurement, and the eventual use. Decide who is responsible for the execution of the strategy and the communication of it. This can be put under a senior official with oversight of the digital strategy or could be put under the smart city office in the context of this project. If the strategy is used across different IT projects, it would be wise to create a separate entity to oversee this work

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *Middleware Software (MW SW)*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1 *Digital Strategy*

3 *Reference Architecture*

Reference Roadmap Deep Dive | Initiatives

5 **Integration/ Interoperability**

Main Initiatives (2/2)

Open Standards

- Identify the principles and best practices for

    - Open Standards: Identify and adopt relevant standards and protocols for data exchange, communication, and interoperability that are open to everybody.

    - Compliance Assurance: Ensure that smart city solutions adhere to established standards to promote seamless integration. Open standards provide a common ground for interoperability among diverse systems. By aligning with existing open standards and actively participating in their development, the envisaged local digital platform and digital twin can seamlessly integrate with other open-source solutions and technologies. Examples include CEN, CENELEC, ETSI and ISO standards

Shared Data Models

- Design the principles and best practices for the adoption of a common data model for the community that standardises the representation of information across different applications. Ensure that is aligned with one of the main external common data models. Establish protocols for mapping and translating data between systems that may use different data structures. Integrate requirements for the use of shared data models into procurement guidelines and development specifications, aligning with MIM2 - Data models https://mims.oascities.org/mims/oasc-mim-2-data-models and capitalising on results/insights from EU project on Data Space for Smart and Sustainable Cities and communities https://www.ds4sscc.eu/

Open APIs

- Specify API high-level specifications requirements to enable consistent and secure communication between different smart city components. Emphasise the use of open APIs, such as RESTful web services, for their simplicity, scalability, and ease of integration. Clearly articulate how different modules or components of the future digital twin are expected to interact with each other and with external systems

Building Blocks

- Define the principles and best practices for using building blocks, such as microservices or containers, to improve modularity, interoperability, and cost efficiency for deploying similar services. This is based on the IT Infrastructure strategy and the strategic priorities. Develop a catalogue of the current building blocks and maintain it for future additions

Integration Software Implementation

- Invest in a robust middleware responsible for internal and external orchestration as well as integration, ensuring interoperable communication and exchange of required data and services with sources and consumers

Reference Roadmap Deep Dive | Initiatives

6 Data

Data Capability refers to the city's ability to effectively collect, process, manage, and utilise data from various sources and domains, including infrastructure, technologies and processes in place. This capability can be divided into 6 major sub-capabilities: Data Strategy, Data Governance, Data Collection & Management, Data Analysis, Data Centralisation and Data Retention & Backup.

Main Initiatives (1/2)

Data Strategy

• Design/ Review the Data Strategy which sets the approach for the acquisition, storage, management, sharing, usage and governance of data, in support of enhancing city digital services and improving quality of life for residents

Data Governance

• Review the Data Governance Principles and Framework in place, ensuring that is aligned with the city's ambition and data governance strategy

• Identify Governance Tools for managing and ensuring the policies and standards, quality, security and compliance of the data used and collected by the city

• Implement a Data Governance Tool for managing and ensuring the policies and standards, quality, security and compliance of the data used and collected by the city

Data Collection & Management

• Design Data Collection and Management Strategy, to ensure a systematic, organised, and purposeful handling of data

• Drive the community towards a more data-driven paradigm by modernising data collection methods, as well as implementing and improving the collection of the data sources, e.g., based on specific events, periodically, and considering the integration of real-time data collection. Real-time collection is one of the most important components for a smart city, since it helps the community to make informed, timely decisions, enhancing efficiency and the quality of decision-making

• Gradually increase the variety and quantity of data sources to enrich the community's information landscape and enhance the quality of insights that can be produced from an increasingly integrated view

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

• *Data governance tool*
• *Real-time data collection tools*
• *Real-time data analytics tool*
• *Data analytics tool (3D modeling services)*
• *Data backup tool*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1 *Digital Strategy*

3 *Reference Architecture*

7 *Infrastructure Strategy*

4 *Device Management*

Reference Roadmap Deep Dive | Initiatives

6 **Data**

≡ **Main Initiatives (2/2)**

Data Analysis

- Review the Data Analysis Strategy, ensuring that is aligned with the city's ambition

- Based on the Data Strategy, design the Data Analysis Framework to extract meaningful insights from data, enhancing decision-making, uncovering patterns, and driving informed business strategies

- Identify and implement a tool to support in the data analytics providing actionable insights, enhancing decision-making, optimising operations, and fostering innovation for better outcomes and improved efficiency

- Identify and implement KPIs for data capability and usage to ensure optimised data-driven decision-making, enhance organisational efficiency, and facilitate continuous improvement in leveraging data resources

Data Centralisation

- Implement data centralisation practices across the community's infrastructure enabling efficient coordination, real-time insights, and informed decision-making across various sectors, fostering sustainable development and improving overall functionality (e.g. Centralizing data from traffic cameras, sensors, and other sources to create a unified traffic management system)

Data Retention & Backup

- Review the Data Retention and Backup Strategy and Principles, ensuring that is aligned with the community's ambition

- Identify and implement Data Retention and Backup Principles to ensures the preservation of critical information, safeguarding against data loss, and facilitates recovery in the event of disruptions, enhancing overall data resilience and business continuity

- Identify and implement a Backup Tool to streamline and enhance the effectiveness of the community's data retention and backup strategy and principles

- Increase the variety and quantity of data sources that are covered by the community's data retention & backup approach, enhancing resilience, supports comprehensive analysis, and facilitates a more holistic understanding of urban dynamics

Reference Roadmap Deep Dive | Initiatives

7 Infrastructure Strategy

Infrastructure strategy refers to a comprehensive plan outlining the systematic deployment, optimisation, and maintenance of physical and digital components such as networks, storage, and compute resources, aligned with the city's goals to enhance efficiency, resilience, and technological innovation.

≡ Main Initiatives

- Create a comprehensive/integrated strategy for the community's Infrastructure Capabilities (Storage, Network and Compute) to optimise efficiency, enhance scalability, and ensure robust security measures, aligning with the city's technological objectives and future growth. The strategy should ensure all the requirements for the infrastructure capabilities are met. For Storage and Compute, it should be ensured cloud and/or on-premises requirements. For Network, requirements will need to be defined for its different components, such as capacity, effectiveness, adaptability, connectivity, coverage, reliability and redundancy

- Determine the objectives and use cases, and alignment with the infrastructure strategy, to envision the best way of using infrastructure capabilities where it is best suited

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1 *Digital Strategy*

Reference Roadmap Deep Dive | Initiatives

8 Storage

Storage Capability refers to the city's ability to securely and reliably store various types of data. This includes the physical and virtual components such as servers, databases, cloud storage, and other technologies that facilitate the retention and management of data. This capability can be divided into 2 major sub-capabilities: On-Premises and Cloud

☰ Main Initiatives (1/2)

Storage Strategy

- Develop a comprehensive storage policy both for on-premises and cloud infrastructure to establish clear guidelines and ensure efficient storage utilisation aligned with the community's ambition

On-Premises

- Implement on premises storage's measures (e.g., effectiveness, redundancy, scalability, low latency and/or adaptability) and ensure they are in alignment with the community's infrastructure strategic objectives

- Implement measures for achieving on-premises automatic storage management to enable storage optimisation

- Identify and implement a tool to facilitate on-premises automatic storage management to enable storage optimisation

- Implement tools for on-premises storage provisioning and cleanup to automate resource allocation and optimise storage utilisation

Cloud

- Implement cloud storage's measures (e.g., effectiveness, redundancy, scalability, low latency and/or adaptability) and ensure they are in alignment with the community's infrastructure strategic objectives

- Implement measures for achieving cloud automatic storage management to enable storage optimisation

- Identify and implement a tool to facilitate cloud automatic storage management to enable storage optimisation

- Implement tools for cloud storage provisioning and cleanup to automate resource allocation and optimise storage utilisation

Calendar Estimate

Year 1	Year 2	Year 3
Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4

Year 4	Year 5	Year 6
Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4

Procurement Objects*

- *On-Premises Automatic Storage Management tool*
- *On-Premises Storage Provisioning and Cleanup tool*
- *Cloud Automatic Storage Management tool*
- *Cloud Storage Provisioning and Cleanup tools*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1 *Digital Strategy*

3 *Reference Architecture*

7 *Infrastructure Strategy*

Reference Roadmap Deep Dive | Initiatives

(9) Compute

Compute refers to the processing power and capabilities of a system or network, including the hardware and software components responsible for performing calculations, running applications, and handling data. This capability can be divided into 2 major sub-capabilities: On-Premises and Cloud.

☰ Main Initiatives (1/2)

Computing Strategy

- Review and ensure that the infrastructure strategy is aligned with the community's ambition, especially regarding the cloud and/or on-premises computing capabilities
- Develop a comprehensive Computing Policy or Procedure(s) both for on premises and cloud computing infrastructure to establish clear guidelines and ensure efficient computing resource utilisation

On-Premises

- Implement on-premises computing measures (e.g., effectiveness, redundancy, scalability, and/or adaptability) and ensure they are in alignment with the community's infrastructure strategic objectives
- Implement measures for achieving on-premises automatic computing management to enable resource optimisation
- Identify and implement a tool to facilitate on-premises automatic compute management to enable resource optimisation
- Implement tools for on-premises computing provisioning and cleanup to automate and optimise resource allocation

Cloud

- Implement cloud computing measures (e.g., effectiveness, redundancy, scalability, and/or adaptability) and ensure they are in alignment with the community's infrastructure strategic objectives
- Implement measures for achieving cloud computing automatic management to enable resource optimisation
- Identify and implement a tool to facilitate cloud computing automatic management to enable resource optimisation
- Implement tools for cloud computing provisioning and cleanup to automate and optimise resource allocation

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Foundation	Growth	Accelerate & Expand

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *On-premises Computing measures Tool*
- *On-premises Automatic Computing Management Tool*
- *On-premises Computing Provisioning and Cleanup Tool*
- *Cloud Computing measures Tool*
- *Cloud Automatic Computing Management Tool*
- *Cloud Computing Provisioning and Cleanup Tool*
- *Advanced cloud technologies (IaaS)*
- *PaaS platforms (managed in a stack logic)*
- *SaaS software (managed in a stack logic)*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

- (1) *Digital Strategy*
- (3) *Reference Architecture*
- (7) *Infrastructure Strategy*

Reference Roadmap Deep Dive | Initiatives

9 **Compute**

Main Initiatives (2/2)

Cloud – Advanced Technologies

- Determine and implement the advanced cloud technologies (e.g., Edge computing, virtual machines, containers and serverless computing) more aligned with the community's ambition and strategic priorities. Take into consideration the key potential drivers of value from each advanced technology, namely:
    - Edge computing: Enables real-time processing with low latency, efficient handling of large data volumes, increased availability during network disruptions, and compliance with privacy and regulatory requirements
    - Virtualisation: Enables resource optimization, cost savings through shared resource utilization, improved flexibility in IT infrastructure, and enhanced security measures
    - Containers: Enable improved portability of applications, scalability for efficient resource utilization, efficiency gains in Software development and deployment, and agility in application lifecycle management
    - Serverless computing: Enables event-driven task execution, real-time analytics capabilities, cost efficiency in resource utilization, and automatic scaling for workload fluctuations

Reference Roadmap Deep Dive | Initiatives

10   Network

Network capability refers to the interconnected system of communication pathways that allow various components, devices, and systems to exchange information and data. This capability can be divided into 6 major sub-capabilities: Network Capacity & Effectiveness, Network Adaptability, Network Connectivity, Network Coverage, Network Reliability, Network Redundancy.

Main Initiatives (1/2)

Network Strategy

- Review and ensure that the Infrastructure strategy is aligned with the community's ambition, with particular focus on Network and its components (Capacity, Effectiveness, Adaptability, Connectivity, Coverage, Reliability and Redundancy)

Network Capacity & Effectiveness

- Review and ensure that the Network Capacity and Effectiveness and the respective strategy is aligned with the community's ambition and needs

- Implement a capacity monitoring tool to continuously assess network performance, identify potential bottlenecks, optimise resource allocation, and ensure the scalability of the infrastructure in alignment with the evolving demands of the smart city ecosystem

- Increase the network capacity and effectiveness to be able to sustain more than 1GB of traffic and/or more than 1000 Devices

Network Adaptability (1/2)

- Define a Network Adaptability Framework to establish systematic protocols for dynamically adjusting to changing conditions, integrating emerging technologies seamlessly, and ensuring the agile evolution of the network infrastructure to meet the evolving demands of a smart city

- Implement Network Scalability to accommodate a growing number of connected devices and users

- Implement Network Low Latency to ensure the minimal delay between the initiation of a process or request and the receipt of the corresponding response

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- Network
- Network capacity infrastructure hardware
- Network monitoring tool
- Public Wi fi

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

- **1**   *Digital Strategy*
- **3**   *Reference Architecture*
- **7**   *Infrastructure Strategy*

Reference Roadmap Deep Dive | Initiatives

10 **Network**

☰ Main Initiatives (2/2)

Network Adaptability (2/2)

- Implement high-speed connections within the network infrastructure to significantly enhance data transmission rates and support the seamless operation of bandwidth-intensive applications

Network Connectivity

- Implement community's public Wi-fi to promote widespread internet access, therefore enhancing connectivity for residents and visitors, facilitating real-time data exchange, and fostering the accessibility of smart services

- Implement a community's bandwidth to allow the transmission of data, therefore enhancing digital connectivity, supporting high-speed internet access, and facilitating the seamless operation of smart services

- Improve the quality of the community's public Wi-fi, gradually expanding the zones within the city that have this service and accessibility for all the residents

Network Coverage

- Review and ensure that the Network Coverage Strategy is aligned with the city's ambition and city's centre and suburbans are comprehensively covered by the network to guarantee seamless connectivity, support smart infrastructure and the full potential of the city's technological initiatives

- Increase and deploy a city-wide network covering all the remote and less densely populated areas

Network Reliability

- Implement a Network Reliability Process aligned with its respective strategy, to enhance emergency response capabilities and optimise functionality

Network Redundancy

- Implement a Network Redundancy Process aligned with its strategy to fortify the reliability and performance of the smart city's digital infrastructure

Reference Roadmap Deep Dive | Initiatives

11   Infrastructure Security

Infrastructure Security Capability refers to the city's ability to establish a robust and proactive security framework, safeguarding the city's ecosystem from potential cyber threats and enhancing overall resilience. This capability can be divided into 6 major sub-capabilities: Cybersecurity Policy, Plan, Monitor & Test, Security Advanced Measures, Security Segmentation, Privacy Compliance, and Disaster Recovery.

☰ Main Initiatives (1/2)

Cybersecurity Policy

- Review the Cybersecurity Strategy, the security and access control policies and the authentication federation tool in place, to ensure full compliance with the community's security approach and requirements

- Identify and implement a tool for authentication federation to streamline user authentication processes across the community

- Implement data protection and privacy policies safeguarding sensitive information, in line with EU GDPR and other relevant regulations and good practices

- Broaden the community's security policy framework by incorporating additional security policies such as Network Security Policy, Endpoints Security Policy, among others

Plan, Monitor & Test

- Formulate and implement a robust strategy for timely application of security patches, in order to enhance security and safeguard the community's digital assets

- Define and put in place effective investigating procedures that are crucial for promptly responding to security incidents, ensuring a rapid and informed mitigation response

- Establish real-time monitoring for city-wide security events to prevent, detect and respond promptly to potential cyber threats

- Implement a regular routine for conducting vulnerability assessments on the community's infrastructure to proactively identify and address potential security weaknesses

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *User authentication federation tool*
- *Cyber threat detection tool*
- *Middleware Software (MW SW)*
- *GDPR compliance tools*
- *Data Backup tool*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

- **1**   *Digital Strategy*
- **3**   *Reference Architecture*
- **4**   *Device Management*
- **6**   *Data*

Reference Roadmap Deep Dive | Initiatives

11 **Infrastructure Security**

Main Initiatives (2/2)

Security Advanced Measures

- Enhance the Security Advanced Measures through specific initiatives, such as deploying and utilising advanced threat mechanisms and implementing multi-layer security protocols

Security Segmentation

- Implement public subnet security policies to regulate and enhance the security of publicly accessible components
- Review the Security Segmentation Strategy, the Security Segmentation Framework and the private subnet policy in place, ensuring compliance with the community's security approach and requirements

Privacy Compliance

- Design a Privacy Compliance Strategy that stablishes regulatory standards to protect individuals' privacy within the community's digital operations
- Deploy privacy-enhancing technologies to implement strong encryption processes, strengthening the community's commitment to safeguarding individual privacy
- Extend GDPR compliance policies to ensure transparent data processing practices
- Implement tools to facilitate GDPR compliance, ensuring efficient and comprehensive adherence to GDPR regulations
- Implement GDPR monitoring policies and/or procedures to track and ensure regular compliance with data protection regulations

Disaster Recovery

- Design and implement a comprehensive Disaster Recovery Strategy to establish clear recovery objectives and restoration mechanisms
- Design and implement a robust Business Continuity Plan (BCP) to ensure effective communication and efficient incident response procedures
- Deploy an effective backup solution to safeguard critical data

Reference Roadmap Deep Dive | Initiatives

12 Digital Platform Readiness

Ensuring the readiness of the Digital Platform is a crucial step towards the full-scale implementation of the Local Digital Platform. This readiness establishes a strong and scalable foundation, enabling continuous improvements and adaptations as the city or community advances its digital transformation.
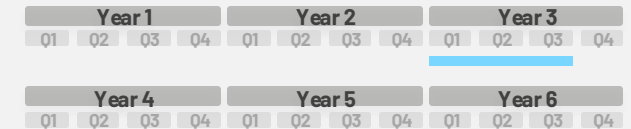
Main Initiatives

- Review and continuously improve the Core Capabilities (Integration, Data, Storage, Security, Network, Compute), to ensure readiness for the deployment of the Minimum Viable Product (MVP) of a Local Digital Platform

- Identify and select the Local Digital Platform, along with its specific strategic priorities, to be showcased through the MVP

- Ensure that the identified Local Digital Platform and use cases are aligned with the designed Reference Architecture

- Collect multi-source real-time/historical data to support the MVP deployment

- Develop a comprehensive plan outlining the key features, objectives, main stakeholders and interdependencies of the MVP

- Execute the plan by start deploying the Minimum Viable Product, incorporating essential functionalities

- Upload relevant data to evaluate and validate the performance and functionality of the MVP

- Engage stakeholders to capture feedback for a comprehensive review of the MVP's performance, usability and alignment with community's objectives

- Evaluate and assess the skills and knowledge required for the LDP deployment and if necessary, hire additional profiles, upskill the current workforce or work with external partners, all in line with the community's change management strategy

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *Local Digital platform*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

1	Digital Strategy	7	Infrastructure Strategy
2	Governance	8	Storage
3	Reference Architecture	9	Compute
4	Device Management	10	Network
5	Integration	11	Infrastructure Security
6	Data		

Reference Roadmap Deep Dive | Initiatives

13 Local Digital Platform Implementation/Scale-up

By leveraging the foundational capabilities and feedback from the MVP Digital Platform, the implementation process involves deploying and integrating a comprehensive technological infrastructure designed to support various digital services, applications, and data-driven functionalities across the city.

Main Initiatives

- Implement the Local Digital Platform by scaling up the MVP, ensuring the deployment of expanded capabilities and improved features
- Leverage the foundational capabilities, especially data and integration, to ensure a continuous evolution of the capabilities and integration with the local digital platform

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

12 *Digital Platform Readiness*

Reference Roadmap Deep Dive | Initiatives

14 **Stakeholder Experience**

Stakeholder Experience Capability establishes operational mechanisms for regular user feedback, fostering a collaborative and iterative approach to ensure ongoing improvement of the digital platform in alignment with user needs and expectations.

Main Initiatives

- Choose appropriate channels and gather user feedback to understand how the local digital platform is performing in real-world scenarios (e.g., beta-testing version). Analyse the feedback to identify areas of improvement. Prioritise action items and implement the necessary changes or updates to the local digital platform to ensure that the most critical improvements are addressed. Inform users about the implemented changes by highlighting how their feedback has influenced improvements and establish mechanisms for users to share their feedback regularly to enable continuous improvement of the local digital platform

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

1 *Digital Strategy*

13 *Local Digital Platform Implementation/Scale-up*

Reference Roadmap Deep Dive | Initiatives

15 Expand Strategy

Expand Strategy Enabler aims to define the city goals on implementing a local digital twin and identify the use cases the city wants to prioritise.

Main Initiatives

- Refine the community's digital vision and ambition in the context local digital twins, having a strategic direction that aligns stakeholders, guides technology investments, and enables communities to harness the full potential of digital twin capabilities for sustainable and resilient urban development. This definition will allow the leverage of advanced technologies to enhance urban planning, optimise resource management, improve citizen services, and foster innovation

- Analyse the gap between the revised vision & mission and the community's current situation. These gaps represent the key challenges and obstacles that need to be addressed. Translate these challenges and obstacles in clear objectives as they will provide concrete steps and targets to move toward the realisation of the vision. This could involve social, economic, environmental, or technological barriers

- Define potential local digital twin use cases, where the focus should be leveraging the local digital platform in place. These use cases should be in line with the community's strategic priorities (e.g., energy management) and should be prioritised to understand Business and User Requirements. Moreover, the digital services should be as well prioritised and selected the most valuable one(s) for implementation

- Based on the selected use case(s), create a detailed action plan for the implementation of the local digital twin, outlining specific milestones, technology requirements, stakeholder collaborations, and key performance indicators to ensure a systematic and successful integration into the city's infrastructure and decision-making processes

- Perform a financial analysis to ensure the steps are financially viable from both an execution perspective, as well as from a maintenance perspective into the future. Analyse any potential external sources of funding, such as available grants or subsidies, to decrease the risk and the costs of the local digital twin project for the community. If needed, refine the action plan accordingly

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

1 *Digital Strategy*

13 *Local Digital Platform Implementation/Scale-up*

Reference Roadmap Deep Dive | Initiatives

16 Implementation Readiness

Implementation Readiness Capability ensures the city is prepared for the successful deployment of the Local Digital Twin. It involves a thorough review of the alignment with expansion strategy and Reference Architecture, as well as key foundational capabilities such as Integration, Data, Processing, Storage, Network, and Compute.

Main Initiatives (1/2)

- Review and validate the alignment of the deployed Local Digital Platform with the community's expansion strategy, ensuring it is prepared to be leveraged for the deployment of a Local Digital Twin

- Review and validate the alignment and fit of the Local Digital Twin with the designed Reference Architecture, ensuring optimal fit of the Local Digital Twin within the community's technological landscape

- Review the Integration capability focusing on identifying and defining robust standards and protocols for seamless data integration between the Local Digital Twin and various city components

- Review the Data capability, focusing on ensuring the existence of Open Data Source(s) to provide essential information and data, enabling the Local Digital Twin to craft a realistic and dynamic portrayal of the physical world

- Review the Data Analysis capabilities (e.g., data cleaning, data visualization, among others), verifying that the community has the required tools and infrastructure in place to support effective visualisation within the Local Digital Twin

- Review the Data Processing methods in place within the city, ensuring it has access to techniques that harness the power of advanced analytics (e.g., artificial intelligence, machine learning, big data analytics among others)

- Review real-time data collection methods, ensuring that the city possesses the necessary capabilities to enable real-time visualisation within the Local Digital Twin

- Review the Storage capability focusing on ensuring scalability and sufficient capacity to meet the evolving storage needs of the Local Digital Twin

- Review and continuously improve the Network capability, emphasizing the need for a reliable and efficient network infrastructure to support the connectivity requirements of the Local Digital Twin

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

1 *Digital Strategy*

13 *Local Digital Platform Implementation/Scale-up*

15 *Expand Strategy*

Reference Roadmap Deep Dive | Initiatives

16 **Implementation Readiness**

☰ **Main Initiatives (2/2)**

- Review and continuously improve the Compute capability, ensuring that the city possesses the scalability and computational capacity necessary for the optimal functioning of the Local Digital Twin

- Review the advanced cloud computing methods (e.g., containers, virtual machines, among others) in place, ensuring they are aligned with the community's ambition and that the city has access to high levels of computing power, essential for processing large quantities of data

- Review and continuously improve the Security capability to safeguard the Local Digital Twin, emphasising the importance of robust security measures in the face of evolving threats

- Review the existing cybersecurity policies, with a specific focus on the access control policies and the data protection policies, ensuring an ethical and compliant usage of data by the Local Digital Twin

Reference Roadmap Deep Dive | Initiatives

17 Digital Twin Deployment

The Digital Twin Deployment Enabler encompasses the development of the Digital Twin, from the Experimental Local Digital Twin with historical data and foundational functionalities to a more progressed Digital Twin with real-time data and AI/ML integration, aligned with the city's objectives through continuous updates.

☰ Main Initiatives (1/2)

- Based on the existing Local Digital Platform and on the designed Expansion Strategy, introduce an Experimental Local Digital Twin to explore initial functionalities and scenarios that fulfils the community's strategic objectives, needs and prioritised use cases

- Leverage the existing data models and incorporate them into the Experimental Local Digital Twin enabling the collection, preparation and handling of mainly historical data to experiment and refine objectives, before implementing on a larger scale

- Ensure that the necessary historical data needed to empower the Local Digital Twin is accessible and ready for use

- Perform tests to the Local Digital Twin to evaluate and validate its performance and foundational functionalities (e.g., data collection and preparation, among others)

- Based on the performed tests, evolve the Local Digital Twin to comprehensively track and understand the dynamics of data flow

- Define and empower the Local Digital Twin with reporting and visualization methods to enable users to visualise and interpret the generated insights

- Implement robust standards and protocols for data exchange, integrating the Local Digital Twin with the various city's components (e.g. IoT Devices, systems/ applications, among others)

- Perform tests to the Local Digital Twin to evaluate and validate its performance and functionalities (e.g., interoperability with other city components, report generation and visualisation, among others)

- Implement changes based on the testing feedback into the Local Digital Twin, achieving a more refined and optimized solution

Calendar Estimate

	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

	Year 4				Year 5				Year 6			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

- *Data prediction and simulation models*
- *Data analytics tool (3D modeling services)*

*Each procurement object is linked to its corresponding template, which is available in the Procurement Support Centre.

Interdependencies

- **1** *Digital Strategy*
- **13** *Local Digital Platform Implementation/Scale-up*
- **15** *Expand Strategy*
- **16** *Implementation Readiness*

Reference Roadmap Deep Dive | Initiatives

17 **Digital Twin Deployment**

Main Initiatives (2/2)

- Prepare and evolve the Local Digital Twin to address additional strategic objectives, needs and use cases (e.g. incorporate simulation capabilities, among others), and to augment its functionalities

- Upgrade the Local Digital Twin to leverage mainly urban real-time data, ensuring the generation, monitoring and visualization of real-time insights

- Evolve the Local Digital Twin to a more predictive system by enhancing its analytical capacity (e.g., incorporate Big Data analytics), introducing data prediction models and simulation capabilities

- Define the Local Digital Twin interface (e.g., 2D or 3D) ensuring it is aligned with the strategic use cases that will be delivered by the Local Digital Twin

- Incorporate into the Local Digital Twin high performance computing methods enabled through Artificial Intelligence and Machine Learning

- Perform tests to the advanced features incorporated (e.g., prediction models, machine learning, among others) in the Local Digital Twin

- Engage stakeholders to capture feedback for a comprehensive review of the Local Digital Twin's performance, usability and alignment with community objectives

- Implement mechanisms to continuously update and evolve the Local Digital Twin

- Evaluate and assess the skills and knowledge required for the digital twin deployment and if necessary, hire additional profiles, upskill the current workforce or work with external partners, all in line with the community's change management strategy previously defined

Foundation   **Growth**   **Accelerate & Expand**

18 Operation & Monitor

Operation & Monitor Enabler is essential for the continuous functionality of the Local Digital Platform and Local Digital Twin within the city. It aims to achieve real-time monitoring, ensuring data integrity, and promptly resolving issues to maintain seamless operations.

Main Initiatives

- Define an operation and monitor strategy, where you set clear monitor objectives (such as tracking user engagement, measuring the impact of content, monitoring customer feedback, or identifying emerging trends)

- Identify and set specific KPIs that align with your monitoring objectives and monitor the ones already defined in the strategy and data capability. These could include metrics like user engagement, conversion rates, click-through rates, reach, and sentiment analysis

- Monitor the local digital platform, through user interactions with the platform, including likes, shares, comments, and clicks or keep track of conversations and mentions related to your brand, products, or services

- Constantly evaluate and refine the local digital platform by incorporating stakeholders' feedback, performance's insights and new technological innovations

- Monitor the performance of the local digital twin, including response times, data processing speed, and overall system efficiency. Address any bottlenecks or performance issues promptly

- Monitor the accessibility and usability of the local digital twin interface. Ensure that it is user-friendly, and consider the diverse needs of users, including city planners, administrators, and residents

- Establish a process for continuous improvement based on insights gained from monitoring activities. Regularly update and enhance the local digital twin to reflect the evolving needs and dynamics of the city

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Procurement Objects*

Not applicable

Interdependencies

13 *Local Digital Platform Implementation/Scale-up*

Reference Roadmap Deep Dive | Initiatives

00 Community Project Management Office

City/Community Project Management Office Enabler is essential for controlling collaboration and executing governance throughout project delivery, helping to drive the desired outcomes and risk mitigation.

Calendar Estimate

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Year 4				Year 5				Year 6			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Main Initiatives

- Define the purpose/ goals & objectives of the Project Management Office (PMO) for the successful implementation of the roadmap over time, building on the strengths and weaknesses identified in the assessments. Overall, the purpose of a PMO is to enhance the overall management and execution of projects. However, the specific goals and functions (e.g., change management, quality assurance, stakeholder management, standardisation of processes etc.) of a PMO can vary. The community needs to define what which objectives and functions they would like to include in the PMO.

- Select the most appropriate type of PMO - Based on the defined objectives and functions, select the most appropriate type of PMO the community wants to have in place. Typically, there are three main types of PMO based on the level of control they exercise: supportive, controlling, and directive.

- Define the various roles and responsibilities - Based on the defined objectives, functions, and type of PMO, define the various roles (e.g., PMO Manager or PMO Administrator) and responsibilities (e.g., Identify and mitigate project risks, change management, stakeholder management) needed to achieve the objectives and execute the defined functions of the PMO

- Define the reporting, procedures, processes, and tools needed to sucessfully execute the PMO roles and responsibilities, aligned with the PMO objectives

- Define KPIs that align with the PMO objectives. These KPIs should be specific, measurable, attainable, relevant, and time-bound (SMART) to provide meaningful insights into performance. These KPIs will help to define key areas for improvement which will help to optimise the PMO if needed.

- Implement the defined PMO, monitor its performance, and continuously optimise its efficiency. If needed the steps above can be repeated along the way in order for the PMO to be relevant and effective over time

Procurement Objects*

Not applicable
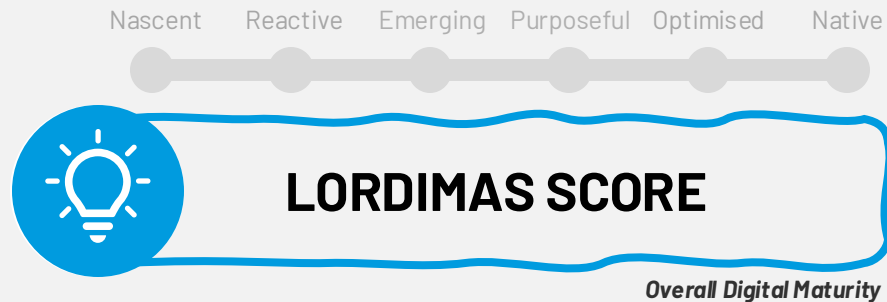
Interdependencies

Not applicable

Methodological Note

3

1. Understand your Maturity Level
2. Understand your Reference Roadmap
3. Relevant sources consulted

Understand Your Maturity Level | LORDIMAS

Nascent   Reactive   Emerging Purposeful Optimised   Native
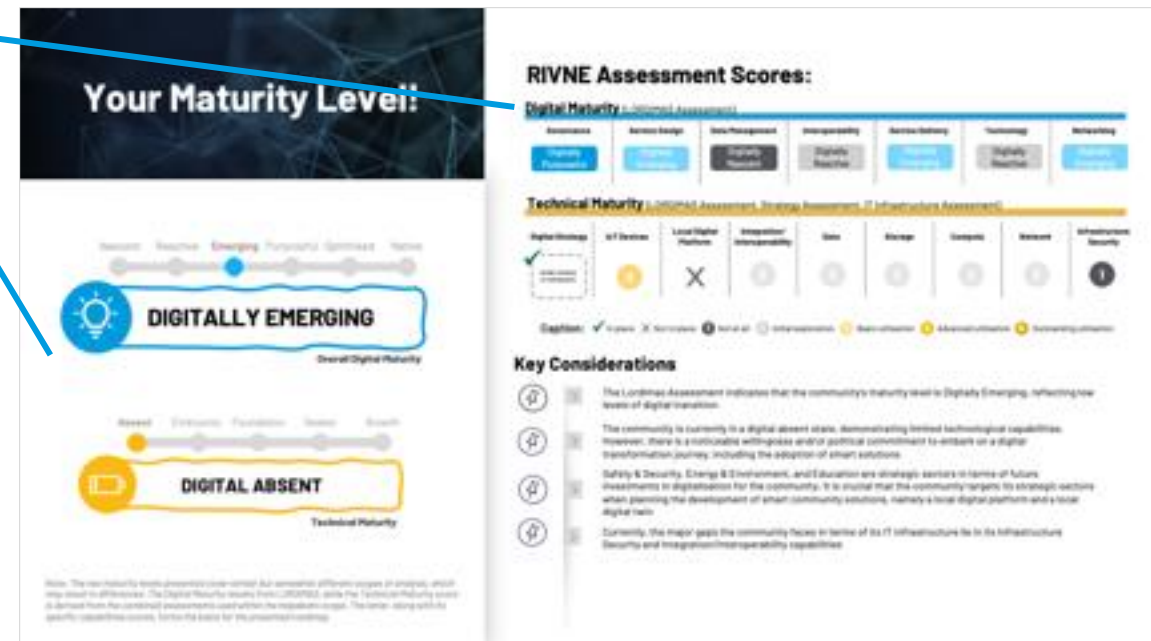
LORDIMAS SCORE

Overall Digital Maturity

This indicates the **maturity level** of the community resulting from the **LORDIMAS assessment**. It also highlights the **maturity level in each one of LORDIMAS evaluated topics:** Governance, Service design, Data management, Interoperability, Service delivery, Technology, and Networking.
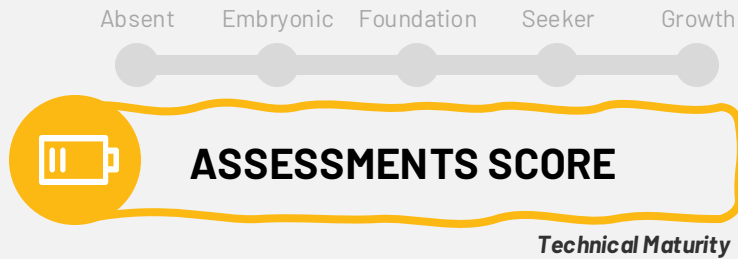
Digital Maturity (LORDIMAS Assessment)

Governance	Service Design	Data Management	Interoperability	Service Delivery	Technology	Networking
Digitally Purposeful	Digitally Emerging	Digitally Nascent	Digitally Reactive	Digitally Emerging	Digitally Reactive	Digitally Emerging

There are six possible levels:
- **Digitally nascent |** Lacking digital transition
- **Digital reactive |** Very low levels of digital transition
- **Digital emerging |** Low levels of digital transition
- **Digital purposeful |** Moderate levels of digital transition
- **Digital optimised |** High levels of digital transition
- **Digitally native |** Very high digital transition

Understand Your Maturity Level | Strategy and IT Infrastructure Assessments

Absent   Embryonic   Foundation   Seeker   Growth

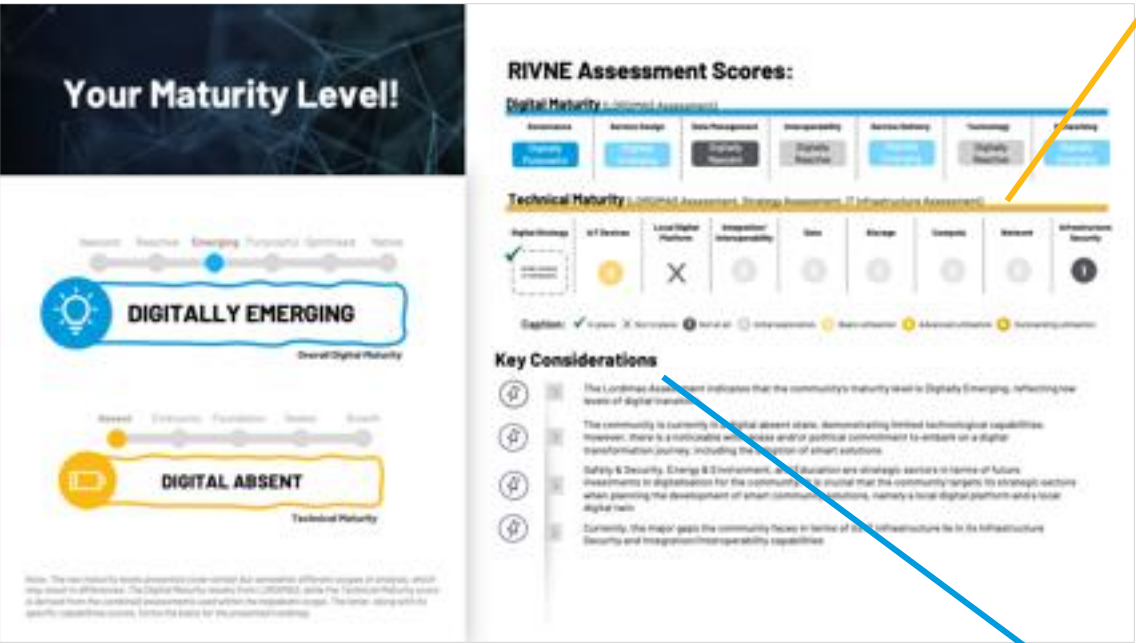## ASSESSMENTS SCORE

Technical Maturity

This indicates the overall **technical maturity level** that the community **obtains as a result of the LORDIMAS, Strategy and IT Infra Assessments**. These are five possible levels:

- **Digital Absent |** a community that is in a digital absent state and shows poor technological capabilities. However, there is willingness and/or political commitment to start its digital transformation journey including the adoption of smart solutions;
- **Digital Embryonic |** a community that grapples with inadequate technological capabilities to effectively fulfil its willingness and/or political commitment to embark on a digital transformation journey;
- **Digital Foundation |** a community that is in a digital foundation state and shows basic technological capabilities. All capabilities need to have started their development or exploration, and Integration/ Interoperability and Data should already be in use within the community;
- **Digital Seeker |** a community with a digital strategy, IoT devices or services and advanced technological capabilities in place, possibly already with a local digital platform in place or at development;
- **Digital Growth |** a community that has implemented a local digital platform and already displays more mature technological capabilities, but that needs to continuously evolve towards a local digital twin;
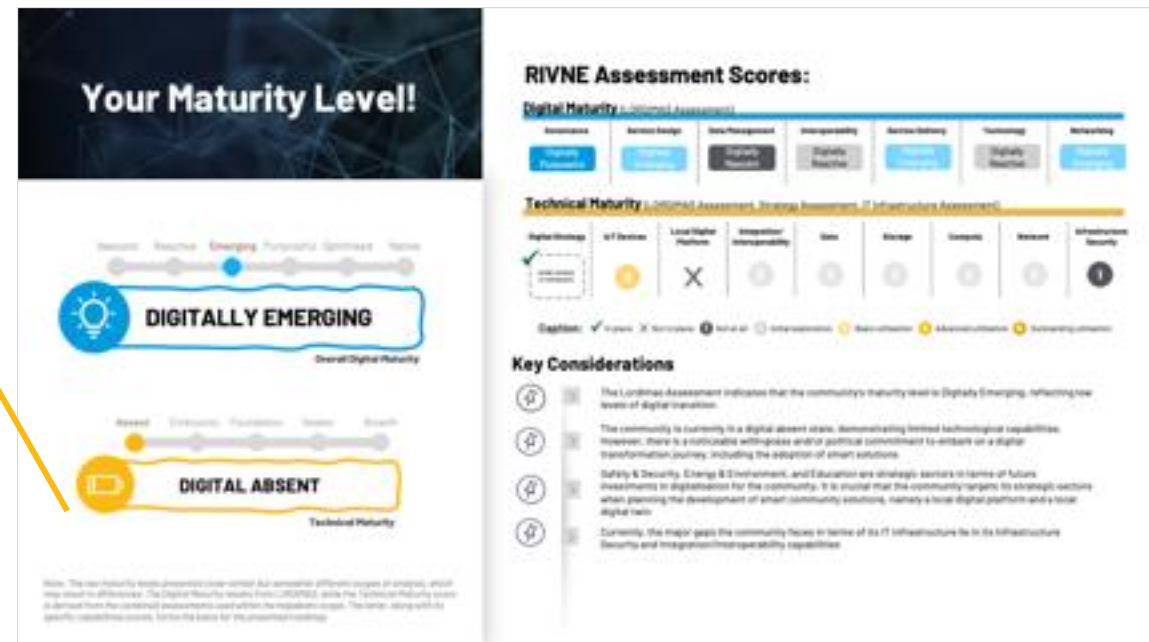
Technical Maturity (LORDIMAS Assessment, Strategy Assessment, IT Infrastructure Assessment)

Digital Strategy	IoT Devices	Local Digital Platform	Integration/ Interoperability	Data	Storage	Compute	Network	Infrastructure Security
✓ Under revision or refinement	3	X	2	2	2	2	2	1

This indicates the **dimensions evaluated** in the Strategy and IT Infrastructure assessments to classify the maturity level of each component. Throughout the assessment the **presence or absence of some relevant components** were evaluated, as well as the **mastery of some capabilities and enablers** using the **scale composed of five levels**, namely:
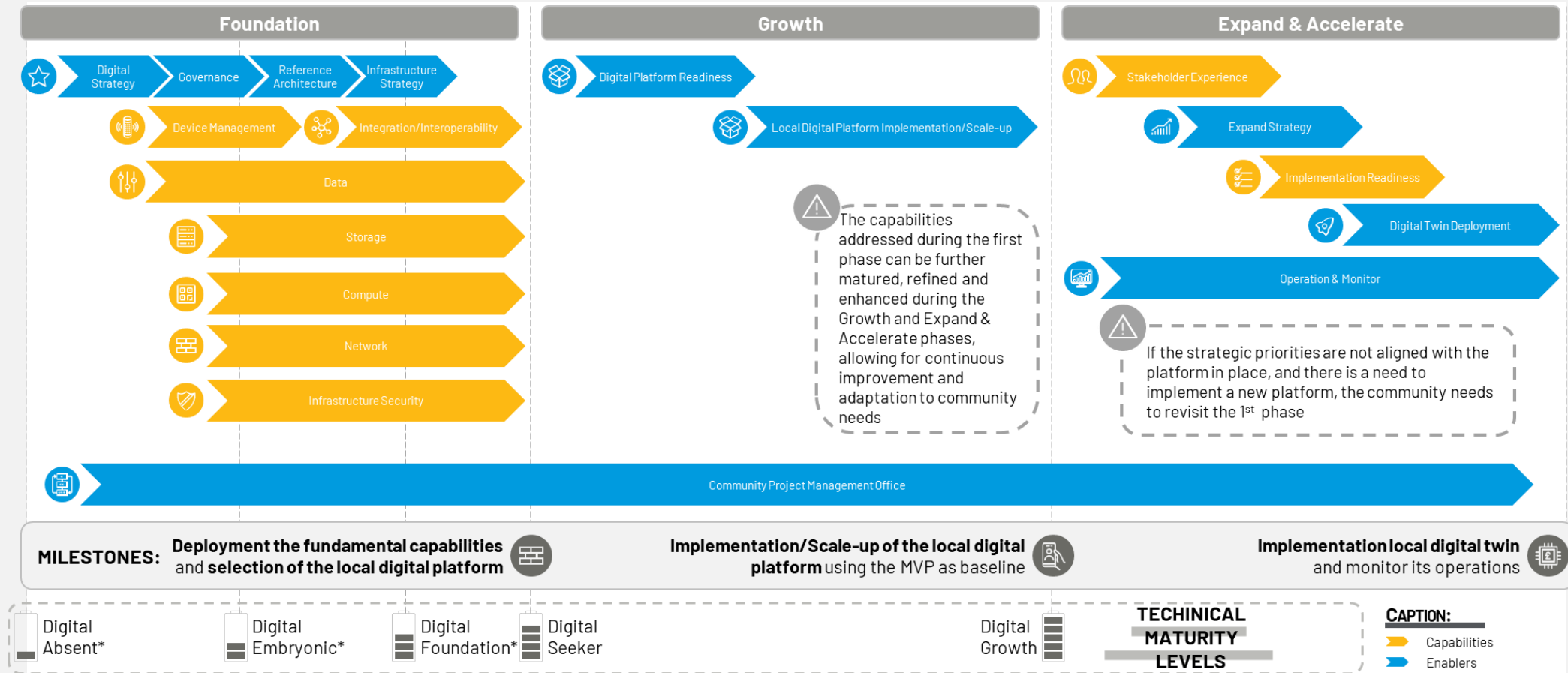
1. **Not At All |** At this level, there is little or no understanding / proficiency in the given capability. It's also not explored strategically within the community yet
2. **Initial Exploration |** This level shows a basic awareness or initial exploration of the capability. Cities may have started to experiment with the basic features or concepts, but they are far from having an outstanding utilisation of the capability
3. **Basic Utilisation |** The community has a functional understanding of the capability and already uses it for fundamental tasks
4. **Advanced Utilisation |** The community demonstrates a deep understanding of the complexities of the capability and can leverage its features for more complex tasks
5. **Outstanding Utilisation |** This level indicates an exceptional mastery and expertise of the capability. communities at this level not only show a comprehensive understanding of the capability but can also innovate, optimise, and excel in utilising it

This indicates some main **key considerations** that are important to highlight, depending on your community's characteristics and needs

Understand Your Reference Roadmap | Capabilities and Enablers

Based on the assessed technical maturity, a tailored Digital Transformation Roadmap is generated for each community, **derived from a fully integrated plan**. Below, a comprehensive roadmap **delineates all capabilities and enablers across the three phases** that each community might be subject to, outlining **key milestones**, and establishing the relationship between **technical maturity levels** and the tailored roadmap provided to the community

Foundation	Growth	Expand & Accelerate

Foundation
- Digital Strategy → Governance → Reference Architecture → Infrastructure Strategy
- Device Management → Integration/Interoperability
- Data
- Storage
- Compute
- Network
- Infrastructure Security

Growth
- Digital Platform Readiness
- Local Digital Platform Implementation/Scale-up

⚠ The capabilities addressed during the first phase can be further matured, refined and enhanced during the Growth and Expand & Accelerate phases, allowing for continuous improvement and adaptation to community needs

Expand & Accelerate
- Stakeholder Experience
- Expand Strategy
- Implementation Readiness
- Digital Twin Deployment
- Operation & Monitor

⚠ If the strategic priorities are not aligned with the platform in place, and there is a need to implement a new platform, the community needs to revisit the 1st phase

Community Project Management Office

MILESTONES: Deployment the fundamental capabilities and **selection of the local digital platform** | **Implementation/Scale-up of the local digital platform** using the MVP as baseline | **Implementation local digital twin** and monitor its operations

Digital Absent* | Digital Embryonic* | Digital Foundation* | Digital Seeker | Digital Growth

TECHNICAL MATURITY LEVELS

CAPTION:
- Capabilities
- Enablers

Relevant sources consulted | Good practices supporting our approach

The **approach** developed under this project leveraged good practices from multiple **reputed sources** in the field of smart community architectures, local digital platforms and digital twins for advancing the transformation of smart communities:

1. Digital Urban European Twins (DUET) Project – https://www.digitalurbantwins.com/

2. FIWARE – https://www.fiware.org/

3. Gartner - Ignition Guide to Creating a Digital Twin MVP – Summary Translation: Ignition Guide to Creating a Digital Twin MVP (gartner.com)

4. Gartner - Architect IoT Using the Gartner Reference Model – Architect IoT Using the Gartner Reference Model

5. IMEC - Open Urban Digital Twins - insights in the current state of play – https://www.researchgate.net/publication/354922238_Open_Urban_Digital_Twins_-insights_in_the_current_state_of_play

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Glossary

4

1. Digital Transformation Roadmap Glossary A-Z

Objects of Procurement Glossary A-Z

Object	Definition/explanation
Advanced cloud computing tools	Advanced cloud computing tools are innovative methodologies that exploit the capabilities of computing systems, such as virtual machines, containers, serverless computing or edge computing.
Advanced cloud technologies (IaaS)	Advanced cloud technologies, like edge computing, virtual machines, containers, and serverless computing, are used to optimise performance, scalability and efficiency in cloud-based applications (IaaS).
Cloud Automatic Computing Management Tool	Cloud Automatic Computing Management refers to the automated management of computing resources in the cloud, which includes provisioning, scaling, monitoring, and cleaning up resources. These processes are crucial for optimising performance, reducing costs, and maintaining security in a cloud environment. These tools offer different but complementary functionalities and can be combined to create a highly efficient and automated cloud management environment.
Cloud Automatic Storage Management tool	Cloud Automatic Storage Management tools are designed to facilitate the efficient and automated management of storage resources in cloud environments. These tools typically offer functionalities like automated provisioning, data replication, backup and recovery, and performance optimisation. These tools often include features like automatic data tiering, where data is moved between different storage tiers based on access patterns, automated snapshots and backups, and dynamic provisioning to scale storage resources as needed. The choice of a specific tool or service depends on factors like the cloud provider being used, the specific storage requirements of the application, budget constraints, and the level of control and customisation needed.
Cloud Computing measures Tool	Cloud Computing Measures Tools are designed to monitor, analyse, and optimise the performance and utilisation of cloud resources. These tools help ensure efficient operation, cost-effectiveness, and compliance with service level agreements (SLAs) and regulatory requirements.

A

C

Objects of Procurement Glossary A-Z

Object	Definition/explanation
Cloud Computing Provisioning and Cleanup Tool	A cloud computing provisioning and cleanup tool is a software solution specifically tailored to efficiently allocate, configure, and manage computing resources within cloud environments. It facilitates the provisioning of resources to meet application or user demands, while also managing the identification, reclamation, and optimisation of unused resources, thereby optimising resource utilisation, and enhancing performance in cloud-based infrastructures.
Cloud Storage Provisioning and Cleanup tools	Cloud Storage Provisioning and Cleanup Tools are specialised software solutions focused on managing cloud storage resources. These tools automate the process of allocating storage space (provisioning) and efficiently releasing it when no longer needed (cleanup). They are used to efficiently manage storage costs and ensuring optimal utilisation of cloud storage resources. These tools often include features like automatic data tiering, where data is moved between different storage classes based on access patterns, and policies for archiving or purging data that is no longer needed. The right tool for a specific use case will depend on the cloud storage provider being used, the volume and nature of the data, and the specific requirements for data management and compliance.
Cyber threat detection tool	Threat detection tools are software applications that identify and respond to malicious activities within a network or system. There are different types of tools and different technologies that perform various functions, among which: 1. Endpoint security tools protect individual devices. 2- Network secure tools monitor network traffic. 3. Host-based intrusion detection systems (HIDS) detect threats on individual systems. 4. Network intrusion detection systems (NIDS) detect threats on the network. 5. Security information and event management (SIEM) systems aggregate and analyse security data from multiple sources.

C

Objects of Procurement Glossary A-Z

Object	Definition/explanation
Data analytics tools (3D modelling services)	Data analytics tool for 3D modelling are software applications that analyse and visualise data, integrating the data into 3D models. Their basic features involve the integration of the data, advanced analytics, 3D visualisation. Additionally, these tools possess features of simulation and scenario analysis, real-time data monitoring, data sharing.
Data Backup tool	Data backup tools are software for creating copies (backups) of important data to safeguard against data loss.
Data governance tool	A data governance tool is a service designed to facilitate and support the implementation, management, and enforcement of data governance processes. It enables to effectively organise, store, retrieve, manipulate, and protect data assets while ensuring appropriate behaviour in their valuation, creation, consumption, and control.
Data prediction and simulation models	Data prediction refers to the process of using statistical or machine learning techniques to forecast future outcomes or trends based on past and current data. Simulation models are mathematical representations of real-world systems or processes used to mimic their behaviour over time. Data prediction and simulation models typically involve running hypothetical scenarios to understand the potential outcomes of different decisions or variables within the system. Specifically, predictive and simulation modelling is a specific application of data prediction, where mathematical models are developed to predict outcomes based on input variables and imitate their behaviour.
GDPR compliance tools	GDPR compliance tools are software solutions that assist the compliance to the General Data Protection Regulation (GDPR), which is a comprehensive data protection and privacy regulation governing the processing of personal data in the European Union (EU) and the European Economic Area (EEA). These solutions automate compliance tasks, including the identification and location of all personal data stored in an IT system; reporting on data types, storage and processing; automation of the collection and recording of data management consent across various consent levels for different data processing activities; data subjects rights management and access to their personal data; data rectification, erasure and restriction requests' management; detection, notification and management of data breaches.

The letter groupings on the left margin are:
- **D**
- **G**

Objects of Procurement Glossary A-Z

	Object	Definition/explanation
I	**IoT devices**	IoT devices are hardware pieces (sensors, actuators, gadgets, appliances, or machines) that are programmed for certain applications and can transmit data over the internet or other networks. They have at least one transducer (sensor or actuator) and one network interface (such as Ethernet, Wi-Fi, Bluetooth) that permit interfacing with the physical and digital worlds respectively.
	IoT platform	An IoT platform is an on-premises software suite or a cloud service that monitors, manages, and controls various types of endpoints.
L	**Local Digital platform**	Local Digital Platforms are the beating hearts of the urban digital transformation as they connect, analyse, and visualise all data from the urban fabric. They serve as a centralised system for collecting data from various systems, applications, and IoT devices, fostering interoperability and collaboration across different domains. The platforms play a crucial role in supporting smart community initiatives by providing a unified and accessible data repository for decision-making, planning, and optimising urban services and operations.
M	**Middleware Software (MW SOFTWARE)**	Middleware is a software that enables programs and databases to work together. It lies between applications and the underlying operating system, and its most basic function is to enable communication between different pieces of software. It enables functionalities such as: data translation and transformation, communication between applications, security, monitoring and management, integration, scalability, and resiliency.
N	**Network**	A network refers to the interconnected system of communication pathways that allow various components, devices, and systems to exchange information and data. The procurement of a network comprises hardware components (routers, software itches, cables, and network interface cards), and software (operating systems and network management tools).

Objects of Procurement Glossary A-Z

Object	Definition/explanation
N	
Network capacity infrastructure hardware	Network capacity infrastructure hardware refers to the hardware equipment that enable a network to effectively and efficiently handle a certain a amount of data in a given period of time without compromising its performance, responsiveness or functionality. It comprises hardware components such as: high-performance software itches, high-capacity routers, high-capacity firewalls, high-capacity network interface cards (NICs), and optical cables that can transmit multiple data streams over a single fibre optic cable.
Network monitoring tool	Network monitoring tools are software applications or hardware devices that provide performance and availability monitoring for data communication networks. These tools enable the collection of performance data over time, including features to conduct baselining, threshold evaluation, network traffic analysis, service-level reporting, trend analysis, and historical reporting.
O	
On-premises Automatic Computing Management Tool	On-premises automatic computing management tools are software solutions designed to automate the management of computing resources within an organization's local infrastructure, such as on-site data centres or private cloud environments.
On-Premises Automatic Storage Management tool	On-premises automatic storage management tools are software solutions designed to automate the management of storage resources within an organization's local infrastructure, such as on-site data centres or private environments.

Objects of Procurement Glossary A-Z

Object	Definition/explanation
On-premises Computing measures Tool	An on-premises computing measures tool is a software designed to monitor and manage the performance, utilisation, and resources of traditional, locally hosted IT infrastructure, including servers, networking equipment, and storage devices, typically within an organization's own data centre or private cloud environment.
On-premises Computing Provisioning and Cleanup Tool	An on-premises computing provisioning and cleanup tool is software designed to efficiently allocate, configure, and manage computing resources within an organisation's local infrastructure. It facilitates the allocation and setup of computing resources to meet application or user needs, while also managing the identification, reclamation, and optimisation of unused resources, enhancing overall efficiency and performance in on-premises computing environments.
On-Premises Storage Provisioning and Cleanup tool	An on-premises storage provisioning and cleanup tool is a service designed to efficiently allocate, configure, and manage storage resources within an organisation's local infrastructure. It facilitates the provisioning of storage capacity to meet application or user requirements, while also managing the identification, reclamation, and optimisation of unused storage space, enhancing overall efficiency and performance in on-premises storage environments.
PaaS platforms (managed in a stack logic)	PaaS (Platform as a Service) platforms provide a cloud-based environment for developers to build, test, and deploy applications without managing the underlying infrastructure. They offer tools, libraries, and services that simplify app development, allowing developers to focus on coding while the platform handles servers, storage, networking, and runtime management.

O

P

Objects of Procurement Glossary A-Z

	Object	Definition/explanation
P	**Public Wi fi**	Wireless internet connectivity provided in public spaces to allow individuals to access the internet using their Wi-Fi-enabled devices.
R	**Real-time data analytics tools**	Real-time data analytics tools are tools designed to process and analyse incoming data streams in real-time, enabling immediate insights and actionable information through capabilities such as streaming analytics, complex event processing, and real-time visualisation.
	Real-time data collection tools	Real-time data collection tools are software designed to gather data from diverse sources in real-time or near real-time. Some real-time data collection tools also enable collecting geospatial data. Geo-time series data combines geospatial information (latitude and longitude) with temporal data.
S	**SaaS software (managed in a stack logic)**	SaaS (Software as a Service) is a cloud-based model where software applications are delivered over the internet. Users can access and use the software through a web browser without needing to install or maintain it on their own devices. The service provider handles all updates, security, and infrastructure, allowing users to focus on utilizing the software for their needs.
U	**User authentication federation tool**	An authentication federation tool is a software solution or platform designed to facilitate and manage authentication federation in a secure and efficient manner. It enables seamless authentication and authorisation across multiple systems, applications, and domains. Some market examples are Azure Active Directory, OneLogin, among others.

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
A	**Adaptability**	Adaptability refers to the component's ability to easily integrate new technologies, respond to technological advancements, and accommodate changes in requirements or standards	Infrastructure Strategy; Storage; Network; Compute
	APIs	APIs, or Application Programming Interfaces, are sets of rules and protocols that enable different software applications to communicate with each other. They define the methods and data formats applications should use to request and exchange information, facilitating seamless integration and interaction between diverse systems and services	Device Management; Integration/ Interoperability
	Authentication federation tool	An authentication federation tool is a software solution or platform designed to facilitate and manage authentication federation in a secure and efficient manner. It enables seamless authentication and authorisation across multiple systems, applications, and domains. Some market examples are Azure Active Directory, OneLogin, among others	Infrastructure Security
	Automatic Storage Management	Database storage management solution that simplifies storage administration by automating tasks such as disk configuration, provisioning, and maintenance in a database environment	Storage
B	**Backup Solution**	Operationalises the business continuity plan by providing detailed processes and resources related to data backup, storage, recovery, etc	Security
	Bandwidth	The capacity at which a network can transmit data	Network
	Business Continuity Plan	A proactive and strategic approach to ensure the community can continue critical operations and services in the event of a disruptive incident or disaster	Security
C	**Cameras/ Image sensors**	Cameras and image sensors capture visual data and images. For example, autonomous vehicles rely on cameras to detect objects and monitor their surroundings. Image sensors function to capture images to be digitally stored for processing. License plate readers are an example, as well as facial recognition systems	Device Management; Data
	Capacity	The maximum number of resources that a system or infrastructure can handle effectively without compromising performance, responsiveness, or functionality	Infrastructure Strategy; Network; Implementation Readiness; Digital Twin Deployment

Digital Transformation Roadmap Glossary A-Z

C

Concept	Definition/explanation	Capability/Enabler(s)
Chief Digital Officer	The highest-ranking officer leading the strategic and operational management of digital policies in the public authority. A chief digital officer is a leader who combines business acumen with digital expertise to help organisations drive digital transformation via an enterprise-wise digital vision and strategy	Governance
Cloud	A model for delivering computing resources, such as virtualised servers, storage, and applications, over the internet	Infrastructure Strategy; Storage; Network; Compute; Implementation Readiness
Cloud Compute	Cloud compute involves accessing and utilising computing resources, including servers and storage, over the internet through cloud service providers, offering scalability and flexibility	Compute
Cloud Storage	Cloud storage involves storing and managing data on remote servers accessed over the internet, providing scalable, flexible, and easily accessible storage solutions	Storage
Compute	The processing power and capabilities of a system or network, including the hardware and software components responsible for performing calculations, running applications, and handling data	Device Management; Infrastructure Strategy; Digital Platform Readiness; Implementation Readiness
Compute Cleanup	The removal of computing resources that are no longer needed or are underutilised, aiming to optimise the efficiency of the compute infrastructure	Compute
Compute Policies and Procedures	A set of rules and configurations that define how computational resources are provisioned, managed, and utilised within an IT infrastructure	Compute
Compute Provisioning	Involves allocating and configuring resources to meet specific computing needs, ensuring that the required resources are available for running applications and handling workloads	Compute
Computing Adv. Technologies	Cutting-edge innovations and methodologies that leverage the capabilities of computing systems, such as virtual machines, containers, serverless computing or edge computing	Compute

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
C	**Containers**	Lightweight, standalone, and executable software packages that include everything needed to run an application, such as code, runtime, libraries, and system tools	Compute; Implementation Readiness; Integration/ Interoperability
	Cybersecurity Policy	Guidelines, rules, and procedures related to cybersecurity	Security
	Cybersecurity Strategy	A cybersecurity strategy covers a wide range of guidelines, rules and procedures related to cybersecurity	Security
D	**Data**	Communities generate large amounts of data which can be examined to uncover hidden patterns, correlations and insights. This capability helps communities and organisations within them to harness their data and use it to identify new opportunities	Governance; Device Management; Integration/ Interoperability; Data; Network; Compute; Security; Digital Platform Readiness; Local Digital Platform Implementation/Scale-up; Implementation Readiness; Digital Twin Deployment; Operation & Monitor;
	Data analysis	Process of examining, transforming, and interpreting large volumes of data to derive meaningful insights and identify patterns to make informed decisions	Data; Implementation Readiness;
	Data analysis tools	Data analysis tools are software applications or platforms designed to process, interpret, and derive meaningful insights from data. Some examples are the use of SAS Analytics, R, Python, MS Power BI among several others	Data
	Data backup and retention tools	Creating copies (backups) of important data to safeguard against data loss. Some market tools examples are Veeam, Druva, Rubrik, Windows BackupAssist, among others	Data
	Data Centralisation	Refers to the practice of community data being stored in a single location or database, making it easily accessible and manageable from a central point	Data
	Data Collection and Management	The processes and practices of gathering, organising, and utilising data from various sources within the community's infrastructure	Data

Digital Transformation Roadmap Glossary A–Z

Concept	Definition/explanation	Capability/Enabler(s)
Data Governance	Establishment and enforcement of policies, standards, and practices to ensure the quality, security, and responsible management of data throughout its lifecycle	Governance; Data
Data Governance Framework	Sets guidelines for how data is handled across the community's various departments and systems	Data
Data Governance Tool	Designed to facilitate and support the implementation, management, and enforcement of data governance processes	Data
Data Retention and Backup	Systematic preservation of information, ensuring its long-term storage and creating duplicates to safeguard against loss or system failures	Data
Data Strategy	Systematic planning and implementation of policies to acquire, manage, analyse, and leverage data effectively for informed decision-making and sustainable urban development	Data
Device	A device refers to a physical tool equipped with sensors and communication capabilities to collect, process, and transmit data for various applications. Examples include IoT sensors, cameras, and other connected gadgets that contribute to data-driven decision-making and community management	Device Management
Device Management Platform	An IoT device management platform is an integrated application that simplifies IoT device management by allowing you to manage and monitor the entire lifecycle of devices and sensors in one place—from planning and onboarding, to monitoring and maintenance, through to retirement.	Device Management
Device Management Strategy	The systematic approach and set of processes used to control, monitor, and optimise the deployment, operation, and maintenance of a large number of interconnected devices within the IoT ecosystem	Device Management
Digital Strategy	A comprehensive plan outlining how an organisation or community leverages digital technologies to achieve its goals	Integration/ Interoperability
Disaster Recovery	Strategic planning and implementation of measures to swiftly restore and resume critical systems and data in the aftermath of a disruptive event or disaster	Security

D

Digital Transformation Roadmap Glossary A-Z

Concept	Definition/explanation	Capability/Enabler(s)
Edge computing	A distributed computing paradigm where data processing and analysis occur closer to the data source or "edge" of the network, rather than in centralised data centres or cloud environments	Network; Compute
Effectiveness	The degree to which each component successfully fulfils its intended purpose and contributes to the overall goals and objectives of the smart community. For example, in the context of network, it evaluates how well the network meets the operational requirements and demands of the community	Governance; Device Management; Data; Infrastructure Strategy; Storage; Network; Compute
Fiber Optic	High-speed internet connections delivered via optical fibbers	Network
General Data Protection Regulation (GDPR)	A comprehensive data protection and privacy regulation governing the processing of personal data in the European Union (EU) and the European Economic Area (EEA)	Security
ICT Infrastructure	ICT infrastructure, or Information and Communication Technology infrastructure, refers to the combined hardware, software, networks, and facilities that enable the processing, storage, transmission, and management of information in an organisation or across a network	Reference Architecture
Infrastructure Security	Secure the entire infrastructure which includes all hardware and software	Security
IoT	The network of interconnected devices and sensors that can collect and exchange data	Reference Architecture; Device Management; Network; Digital Twin Deployment
IoT Devices	IoT Devices are physical objects with embedded sensors, software, and connectivity for data collection and exchange over the internet. These devices can range from household appliances to industrial machinery and smart community infrastructure. The key feature is their ability to communicate, enabling data sharing, remote monitoring, and automation. IoT Services support seamless device operation and management	Reference Architecture; Device Management; Network; Digital Twin Deployment

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I

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
I	**IoT sensor**	An IoT sensor is any sort of mechanism or tool, such as a camera or air quality monitor, integrated into a device. These sensors gather information related to the environments (e.g., air temperature and traffic patterns) in which they are deployed and transmit it to the cloud via Wi-Fi, Bluetooth, 5G or other mobile network	Device Management
	IT Infrastructure	The foundational components and systems that enable the processing, storage, and transmission of information within the community/community. To support the creation and operation of local digital platforms and digital twins, IT infrastructure includes the network, computing power, data processing, storage, and security	Device Management; Integration/ Interoperability; Compute
K	**Key Performance Indicator (KPI)**	Quantifiable measure of performance over time for a specific objective	Governance; Device Management; Data; Operation & Monitor; City/Community Project Management Office
L	**Local Digital Platform**	Local Digital Platforms are the beating hearts of the urban digital transformation as they connect, analyse and visualise all data from the urban fabric. It serves as a centralised system for collecting data from various systems, applications, and IoT devices, fostering interoperability and collaboration across different domains. The platform plays a crucial role in supporting smart community initiatives by providing a unified and accessible data repository for decision-making, planning, and optimising urban services and operations	Expand Strategy; Implementation Readiness; Digital Twin Deployment; Operation & Monitor
	Local Digital Twin	Local digital twins are a virtual representation of a community's physical assets, using data, data analytics and machine learning to help simulation models that can be updated and changed (real-time) as their physical equivalents change. Source: https://living-in.eu/groups/solutions/local-digital-twin	Expand Strategy; Implementation Readiness; Digital Twin Deployment; Operation & Monitor
	Low latency	Minimal delay or lag time between the initiation of a process or request and the receipt of the corresponding response	Storage; Network; Compute
M	**Monitoring**	Involves the systematic and continuous observation, measurement, or tracking of a process, system, or activity to assess its performance, progress, or behaviour over time	Governance

Digital Transformation Roadmap Glossary A-Z

Concept	Definition/explanation	Capability/Enabler(s)
Network	The interconnected system of communication pathways that allow various components, devices, and systems to exchange information and data	Device Management; Infrastructure Strategy; Network; Compute; Security; Digital Platform Readiness; Implementation Readiness
Network Adaptability	Flexibility and responsiveness of a system to accommodate changes, upgrades, or evolving technological requirements within a connected environment	Network
Network Capacity	Capacity refers to the maximum amount of resources that a system or infrastructure can handle effectively and efficiently without compromising its performance, responsiveness or functionality. In this context, it refers to the maximum amount of data that a network can handle within a given period of time	Network
Network Capacity and Effectiveness	Ability of a network to efficiently handle data traffic, ensuring optimal performance, reliability, and responsiveness for connected devices and users	Network
Network Connectivity	Ability of devices, systems, or networks to establish and maintain communication, facilitating data exchange and collaboration within an interconnected environment	Network
Network Coverage	The extent or reach of the network signal or connectivity in different geographical areas of the community	Network
Network Redundancy	Involves the implementation of backup systems and duplicate components to ensure uninterrupted operation, mitigate failures, and enhance the reliability of a network	Network
Network Reliability	Network reliability includes the consistent and trustworthy performance of a system, ensuring uninterrupted connectivity and minimal downtime for users and devices	Network
On-Premises Compute	Deployment of computing resources, such as servers and infrastructure, within an organisation's own physical location or data centre	Compute
On-Premises Storage	On-premise storage refers to the localised hosting and management of data within an organisation's own physical infrastructure, providing direct control and accessibility to stored information	Storage

N (rows: Network through Network Reliability)

O (rows: On-Premises Compute, On-Premises Storage)

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
O	**Open Source Software**	Refers to computer programs whose source code is made available to the public, allowing users to view, modify, and distribute the software freely. This collaborative and transparent development model encourages community involvement, fosters innovation, and typically results in software that is accessible and customisable for a wide range of users	Integration/ Interoperability
	Open Standards	Open standards are publicly available specifications and protocols that are developed collaboratively and are not owned or controlled by any single organisation. They facilitate interoperability and ensure that different systems and products can work together seamlessly, fostering compatibility and reducing dependence on proprietary technologies	Integration/ Interoperability
P	**Plan, Monitor & Test**	Plan, Monitor & Test Security entails the strategic development, ongoing surveillance, and systematic testing of security measures, including patch management, event monitoring, investigation protocols, and vulnerability assessments, to safeguard against potential threats and ensure a resilient cybersecurity framework	Security
	Privacy Compliance	Adhering to legal and regulatory standards to safeguard individuals' personal information, ensuring responsible and lawful data handling practices	Security
	Private subnet	Private subnet is a portion of an IP network that is isolated from the public internet, which provides an extra layer of security as resources can only be accessed via a gateway, such as a firewall or a Virtual Private Network (VPN)	Security
	Public subnet	Public subnet is a network segment where devices have public IP addresses and can be directly accessed from the internet	Security
	Public Wi-Fi	Wireless internet connectivity provided in public spaces to allow individuals to access the internet using their Wi-Fi-enabled devices	Network
R	**Real-time data collection**	Real-time data collection involves the continuous and immediate capture of data as it is generated or becomes available	Data; Implementation Readiness

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
R	**Redundancy**	The level of backup or duplicate systems, components, or processes in place to ensure continuity and reliability in the event of a failure or disruption	Infrastructure Strategy; Storage; Network; Compute
	Reliability	The system's ability to consistently perform its intended functions without failures or disruptions	Infrastructure Strategy; Network
S	**Scalability**	The ability of a component or system to efficiently handle increased demands or workloads without compromising performance or reliability	Device Management; Integration/ Interoperability; Infrastructure Strategy; Storage; Network; Compute; Implementation Readiness
	Security	The community's ability to address potential threats and risks, ensure compliance with regulatory requirements, and foster resilience against cyberattacks	Device Management; Data; Infrastructure Strategy; Compute; Security; Digital Platform Readiness; Implementation Readiness
	Security Advanced Measures	Security advanced measures encompass sophisticated and proactive strategies, technologies, and protocols implemented to fortify defences, detect and respond to cyber threats, and ensure robust protection of digital assets	Security
	Security Patch	A security patch is a software update specifically designed to fix vulnerabilities or weaknesses in a computer system, application, or firmware. It aims to enhance security by addressing known vulnerabilities and protecting against potential threats or exploits	Security
	Security Segmentation	Security segmentation involves dividing a network into distinct segments, such as public and private subnets, to enhance security by restricting access and isolating sensitive information from the public domain	Security
	Serverless computing	Serverless computing is a cloud computing model where developers write and deploy code without managing the underlying infrastructure. Applications are broken down into small functions triggered by events, scaling automatically and charging only for resources used	Compute

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
S	**Smart City Office**	Dedicated body within the community administration that will focus on planning, implementing, and overseeing initiatives related to making the community/community smarter through digital technologies and data-driven solutions	Governance
	Storage	Storage refers to the community's ability to securely and reliably store various types of data. This includes the physical and virtual components such as servers, databases, cloud storage, and other technologies that facilitate the retention and management of data	Governance; Device Management; Data; Infrastructure Strategy; Storage; Digital Platform Readiness; Implementation Readiness
	Storage cleanup	Storage clean-up involves the process of identifying, reclaiming, and managing storage space that is no longer needed storage provisioning is the process of allocating and configuring storage resources to meet the data storage requirements of applications, users, or systems used inefficiently	Storage
	Storage provisioning	The process of allocating and configuring storage resources to meet the data storage requirements of applications, users, or systems	Storage
	System/ Application	A system/application is a purposeful arrangement of hardware, software, and data designed to address urban challenges or enhance community functions. It often involves collecting and utilising data from diverse devices and sensors across the community. Examples include systems or applications for intelligent traffic signals, smart surveillance, waste collection route optimisation, and smart streetlights	Reference Architecture; Strategy; Compute; Local Digital Platform Implementation//Scale-up; Digital Twin Deployment
	SWOT Analysis	Strategic planning tool that assesses an entity's Strengths, Weaknesses, Opportunities, and Threats to make informed decisions and formulate effective strategies	Strategy
T	**Trade-off**	Decision to give up or compromise one thing in exchange for another, often involving competing factors or objectives, where improving one aspect may come at the expense of another	Strategy

Digital Transformation Roadmap Glossary A-Z

	Concept	Definition/explanation	Capability/Enabler(s)
V	**Virtual Machines (VMs)**	Software-based emulations of physical computers, enabling multiple operating systems to run on a single physical host or server, each within its own isolated environment (e.g., VMware, Hyper-V, KVM)	Compute; Implementation Readiness
	Virtualisation	Virtualisation is the process of creating a virtual version of computing resources, such as hardware, storage, or operating systems. It allows multiple virtual instances to run on a single physical system, improving resource utilisation, flexibility, and scalability	Compute
	Vulnerability assessments	Systematic process of identifying, evaluating, and prioritising potential vulnerabilities or weaknesses in the community	Security
#	**5G readiness**	5G, or fifth generation, refers to the latest standard in mobile telecommunications technology. It represents a significant advancement over its predecessor, 4G LTE. Key features of 5G include faster data transfer speeds, lower latency, increased capacity to support more devices, and improved connectivity for mobile devices, Internet of Things (IoT) devices, and various applications	Network