



SMARCO

SMART Communities Skills
Development in Europe

Green Transition and Sustainability'
in Smart Communities – UNIT 1

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Key objectives

By the end of the course, participants will be able to:

- **Define and explain** the concepts of *smart*, *sustainable*, and *green* communities and cities, and how they interconnect.
- **Describe** the major frameworks, standards, and policy initiatives guiding smart urban transformation (e.g., SDG 11, EU Green Deal, ISO 37122, SCBoK).
- **Recognize** the technological building blocks of smart cities (IoT, AI, data analytics, digital twins) and their role in sustainable operations.
- **Understand** how sustainability principles (resource efficiency, circular economy, resilience) apply at community and city scales.
- **Identify** governance models, citizen participation approaches, and innovation ecosystems that enable human-centered smart development.



Unit 1 – Foundations of Smart, Sustainable, and Green Communities

- This foundational unit introduces the principles, frameworks, and paradigms that shape the development of smart, sustainable, and green communities. It emphasizes the integration of technology, ecology, governance, and citizen participation as interconnected pillars of modern urban and regional ecosystems.
- Learning Objectives. By the end of Unit A, participants will be able to:
 - Explain the fundamental concepts of sustainability, green transition, and smart community development.
 - Understand the interrelation between digital transformation and sustainable urban growth.
 - Recognize key international and European frameworks that guide smart and sustainable community development.
 - Apply systems thinking to interpret how environmental, social, economic, and technological dimensions interact within communities.
 - Identify the enabling factors (data, technology, governance, citizen engagement) that drive community transformation.



Key terms



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Sustainable Development



Definition: Meeting present needs without compromising the ability of future generations to meet theirs.



Example: Example: Implementing renewable energy systems in local communities.



Link: <https://sdgs.un.org/goals>



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Green transition



Definition: The shift toward a climate-neutral, resource-efficient, and sustainable economy.



Example: The EU Green Deal's goal to achieve climate neutrality by 2050.



Link: <https://commission.europa.eu/strategy/priorities-2019-2024/european-green-deal>



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Circular Economy



Definition: An economic model focused on reuse, repair, recycling, and waste elimination.



Example: Amsterdam's circular city strategy reduces construction waste.



Link:

<https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits>



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Smart Community



Definition: A local network where citizens, government, and businesses collaborate through digital innovation for sustainable growth.



Example: Helsinki's citizen engagement platforms for urban planning.



Link: <https://smart-communities.org/>



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ESG (Environmental, Social, Governance)



Definition: A framework for evaluating sustainability and ethical impact in organizations or cities.



Example: Example: A city reporting CO₂ emissions and social inclusion metrics under ESG.



Link: <https://www.unpri.org/esg-issues>



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Life Cycle Assessment (LCA)

- **Definition:** A method for assessing environmental impacts across all stages of a product's life.
- **Example:** Evaluating carbon emissions from building materials to demolition.
- **Link:** <https://www.iso.org/standard/37456.html>



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Ecodesign



Definition: Designing products with minimal environmental impact throughout their life cycle.



Example: Philips designing energy-efficient, recyclable LED bulbs.



Link: <https://ec.europa.eu/environment/ecodesign>



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Resilience

- **Definition:** The capacity of a community or system to recover and adapt after disruptions (e.g., climate events).
- **Example:** Copenhagen's flood-resilient urban design.
- **Link:** <https://resilientcitiesnetwork.org>



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Why “Smart” and “Sustainable” Matter Together



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Smart, Sustainable, and Green Communities: A Unified Vision

Modern communities must balance **technological innovation**, **environmental protection**, and **social inclusion**.

- Smart” means *data-driven efficiency*; “Sustainable” means *long-term ecological and social balance*.
- The **smart + green = resilient** approach ensures both digital and ecological transformation.

Integration builds **livable, equitable, and future-ready communities**.



The Evolution of Urban Development

- **The evolution**

- **Smart City 1.0 – Digital City (1990s–2000s)**: Focused on ICT infrastructure — broadband, e-government, online services.
 - **Smart City 2.0 – Smart City (2010s)**: Integration of data, IoT, and analytics for efficient urban operations.
 - **Smart City 3.0 – Sustainable Smart Community (2020s–)**: Combines digital innovation with social inclusion and ecological goals.
- The focus shifts from **technology itself** → to **how technology empowers people and protects the planet**.

<https://www.smartcitieslibrary.com/the-3-generations-of-smart-cities/>



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Core Principles Guiding Smart Community Development

Connectivity: Seamless digital infrastructure linking citizens, services, and devices.

Inclusion: Equal access to technology and opportunities for all social groups.

Innovation: Continuous experimentation and adaptation through data and collaboration.

Participation: Active citizen involvement in decision-making and co-creation of solutions.

Sustainability: Integrating environmental, social, and economic goals into digital initiatives.



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Balancing People, Planet, and Prosperity



The **Triple Bottom Line (TBL)** expands success measurement beyond profit — adding **social** and **environmental** dimensions.



People: Social well-being, inclusion, equity, and quality of life.



Planet: Environmental protection, climate action, and resource efficiency.



Prosperity: Economic viability and innovation supporting sustainability goals.



Smart communities integrate these three pillars into all digital and policy initiatives.



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The thin balance



Short Assignment #1



Task:

Identify **one sustainability challenge** faced by your city, town, or community (e.g., waste, mobility, energy use, social inequality).

Propose **one digital or smart solution** that could help address it (e.g., sensor-based recycling, community app, open data dashboard).

Explain briefly **how your idea aligns** with the principles of *connectivity, inclusion, and sustainability*.



Quick examples:

Traffic congestion → smart public transport app.

High energy consumption → IoT-enabled smart meters.

Low civic engagement → mobile platform for participatory budgeting.



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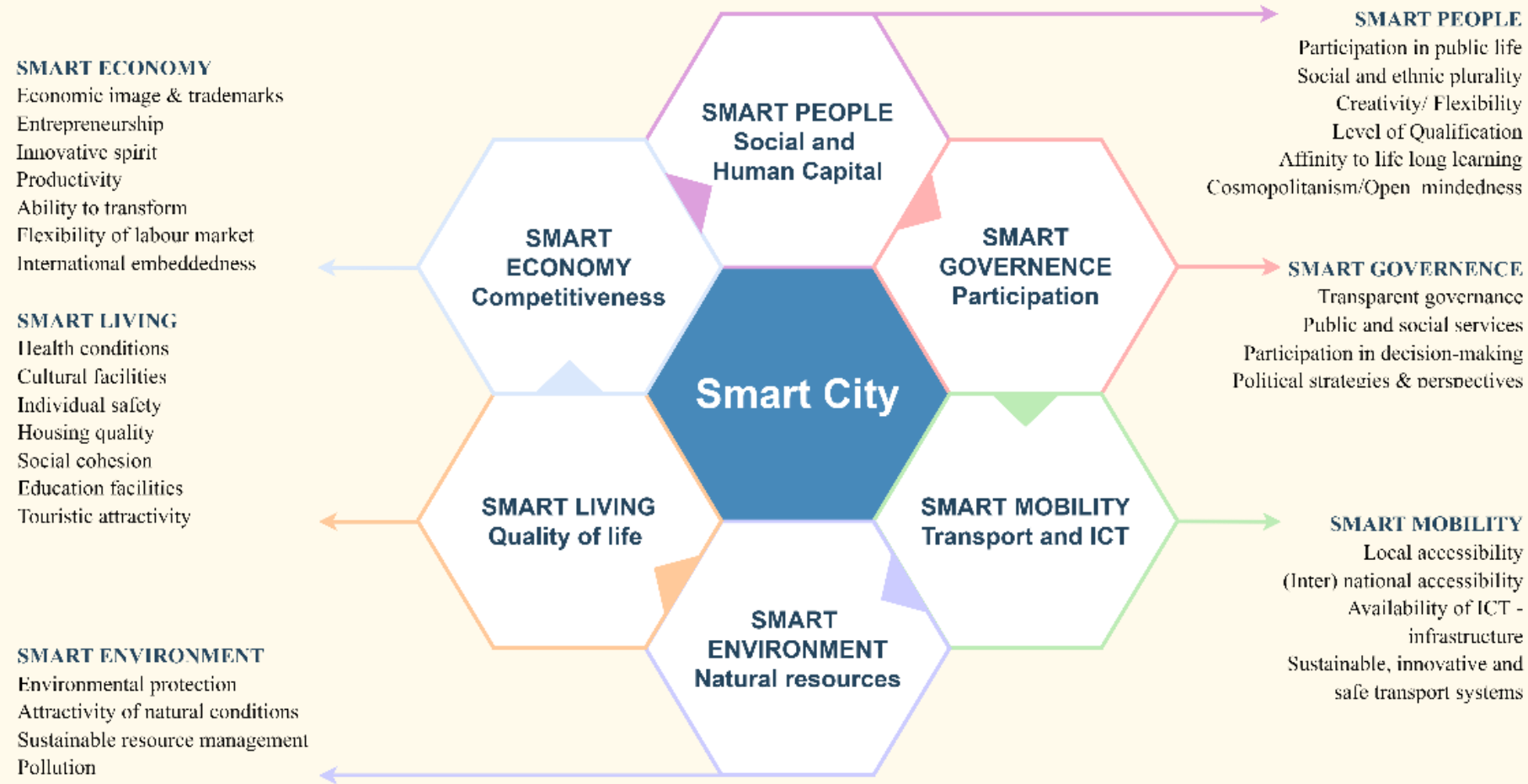
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Understanding Interconnected Urban Systems

- **Systems thinking** views a community as an **interconnected network** of social, economic, environmental, and technological subsystems.
 - Actions in one domain (e.g., transport, housing, energy) influence outcomes in others.
- Promotes **holistic problem-solving** rather than isolated interventions.
- Helps identify **feedback loops, dependencies, and unintended consequences** in policy design.
- Core idea: A sustainable solution in one area should **benefit the entire system**, not create new problems elsewhere.



Giffinger's six-dimensional model

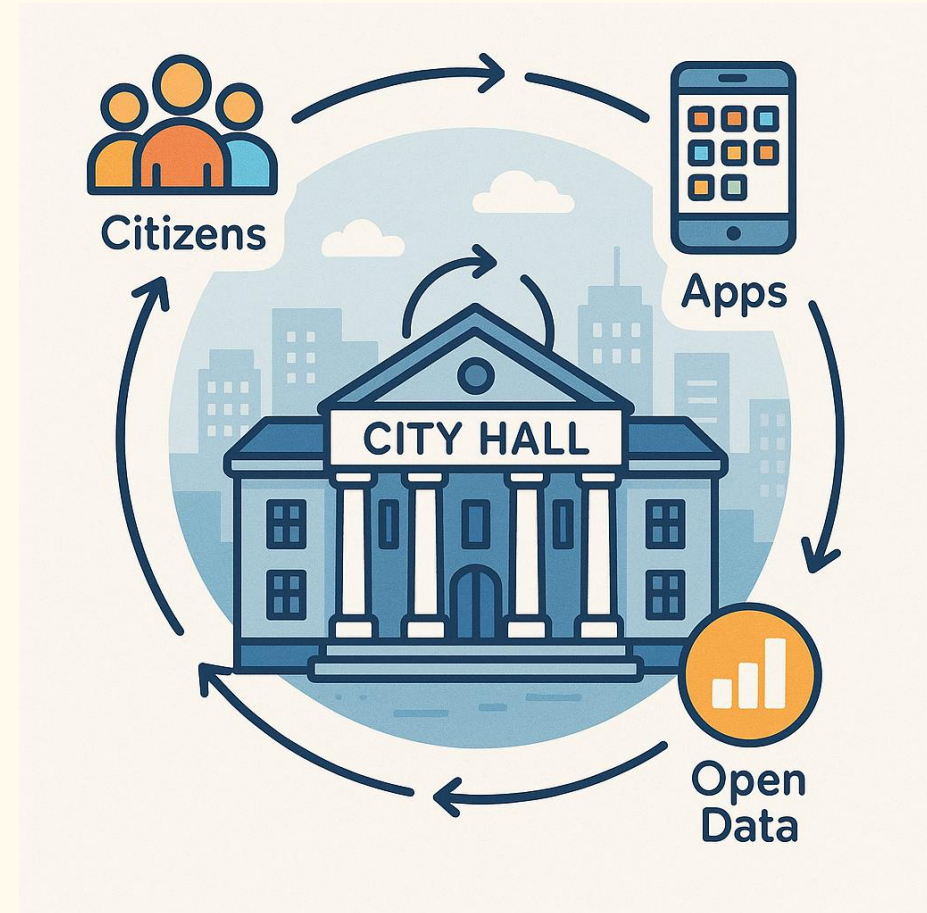


Digital Innovation as the Engine of Smart Communities

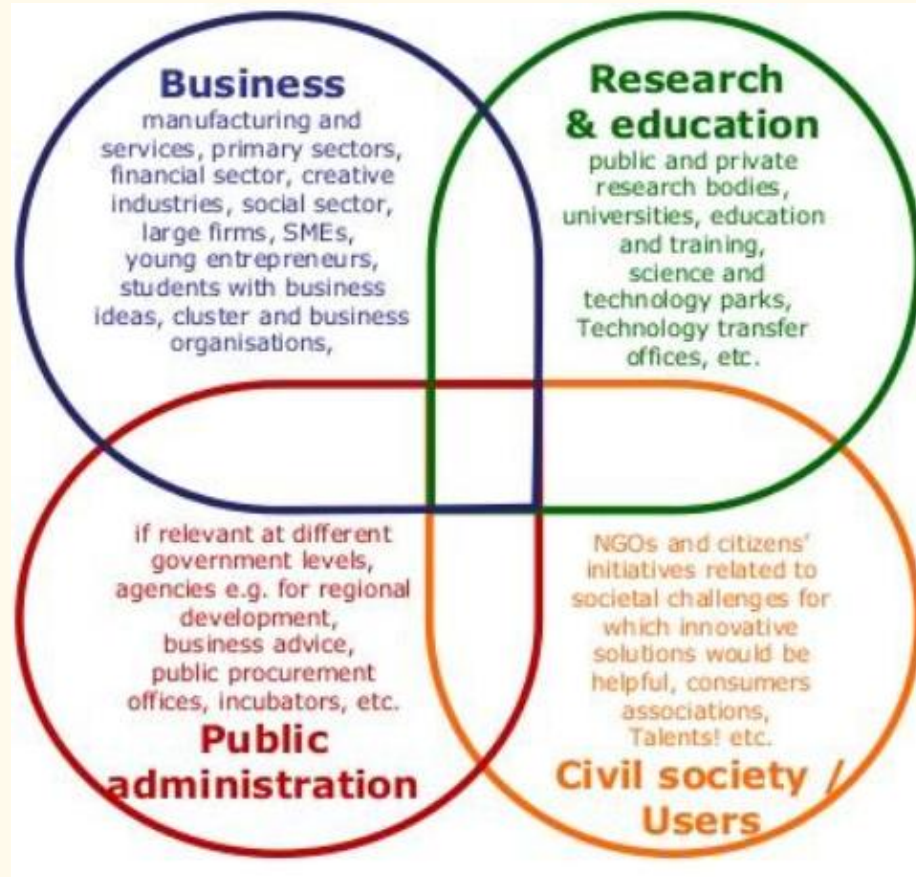
- **Data** is the foundation for understanding and optimizing urban systems.
- **IoT (Internet of Things)** connects sensors, buildings, and vehicles for real-time monitoring.
- **Open data** enables transparency and citizen-driven innovation.
- **AI and analytics** transform raw information into actionable insights for sustainability.
- Digital tools help track progress toward **energy efficiency, waste reduction, and social inclusion.**

Empowering People Through Digital Governance

- **Smart governance** promotes transparency, accountability, and open decision-making.
- **Citizen participation** turns residents from service consumers into *co-creators* of solutions.
- **Digital tools** (e-participation, open data, online consultations) expand democratic engagement.
- Effective governance aligns **policy, technology, and citizen needs**.
- Builds trust and ensures sustainability efforts reflect real community priorities.



Innovation Ecosystems in Smart Communities



- A **smart community ecosystem** connects **universities, startups, local government, and citizens**.
- Innovation emerges through **cross-sector collaboration** and shared challenges.
- **Living labs** and **urban innovation hubs** test and scale new digital and green solutions.
- Public-private partnerships (PPPs) accelerate technology adoption and investment.
- The ecosystem approach builds **local capacity** and supports continuous learning.



From Sustainability Theory to Green Action

Sustainable Development: Meeting present needs without compromising future generations' ability to meet theirs (Brundtland Report, 1987).

The Green Transition translates sustainability into practical systemic change—clean energy, circular economy, and resource efficiency.

Central idea: decoupling economic growth from environmental degradation.

Governments and organizations adopt green strategies to achieve climate neutrality and inclusive prosperity.

Smart communities act as local engines of this global transformation.

Circular Economy in Communities



The **circular economy** replaces the “take–make–dispose” model with “reuse–repair–recycle.”



Focuses on **resource efficiency**, **waste minimization**, and **product longevity**.



Encourages **local loops**—sharing, repairing, and reusing within communities.



Supports new business models such as **product-as-a-service** and **material recovery**.



Smart communities use **data and digital tools** to optimize circular flows (e.g., smart waste management).



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The R in circular economy



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Building Sustainability into Every Design Decision

Ecodesign integrates environmental and social criteria into the design process.

Minimizes energy use, emissions, and material waste across a product's life cycle.

Encourages **innovation that aligns with circular principles** — durable, repairable, and recyclable products.

Supports both environmental performance and economic competitiveness.

Regulation example: EU Ecodesign Directive guiding sustainable product design.



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Resilience in Urban Systems

Resilience is the capacity of a community to **absorb shocks, recover, and adapt** to future challenges.

Addresses risks from **climate change, economic crises, and social disruption.**

Builds on diversity, redundancy, and flexibility in urban systems.

Smart tools (e.g., sensors, early-warning dashboards) improve preparedness and response.

Resilience combines **physical robustness** with **social cohesion and governance capacity.**



Case Study: Helsinki Smart Community Model

Helsinki, Finland, aims to be **carbon-neutral by 2030** while ensuring digital inclusion.

Uses **open data portals** for transparency and citizen-led innovation.

Employs **smart mobility solutions**—electric buses, integrated transport apps.

Circular economy pilots reduce construction and food waste.

Strong emphasis on **citizen co-creation** through the *Helsinki Lab* and participatory budgeting.

Case study – Smart Kalasatama



Smart Kalasatama (2)

See also [Smart Kalasatama 1](#) for another case study of this district.

Overview

Smart Kalasatama is a smart city district located in Helsinki, Finland, built on a former harbor area and envisioned as a living lab for urban innovation. With the ambitious goal of giving residents 'one more hour every day' the project integrates smart technologies into everyday life-ranging from energy-efficient buildings and autonomous shuttles to flexible shared spaces and real-time digital services. Developed through agile piloting, co-creation, and integrated digital infrastructure, Kalasatama is a testbed for sustainability, citizen-centered design, and public-private collaboration. The district serves as a model for

- <https://atlasofurbantech.org/cases/fin-helsinki-kalasatama-2>
- <https://www.computerweekly.com/feature/Helsinki-The-trailblazing-smart-city>



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Uniting Technology, Ecology, and Society in Practice



True progress lies in **integrating digital innovation with sustainability planning.**



Smart and green strategies must be developed **together**, not sequentially.



Example synergies:

Smart grids → Renewable energy optimization.

Smart mobility → Lower emissions and better accessibility.

Digital twins → Eco-efficient urban planning.



Integration ensures that technology supports **environmental goals** and **social equity.**



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Indicators of Success for Smart Communities



Common frameworks:



ISO 37122: Smart City Indicators.



UN SDGs: global sustainability metrics.



SCBoK: Smart City Body of Knowledge by Fitsilis et al.



Key dimensions: **Environment, Economy, Governance, Technology, People, Mobility.**



Transparent data reporting enhances accountability and learning.



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Overcoming Obstacles to Smart-Sustainable Development



Data silos: fragmented systems prevent integration and sharing.



Limited digital skills among staff or citizens.



Funding and investment gaps for long-term sustainability projects.



Regulatory or bureaucratic barriers slowing innovation.



Lack of trust in data use and privacy protection.



Solutions: capacity building, partnerships, transparency, and co-creation.



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Reflection Exercise: What Makes a Community Truly Smart?

- **Reflection prompts:**

- Beyond technology, what social or cultural factors make a community “smart”?
- How can sustainability and digital innovation reinforce each other?
- What lessons from Helsinki or your local context stand out most?
- In one sentence, define *“a sustainable smart community.”*



Further reading / 1

• Key Frameworks & Policy Documents

- European Commission (2023) – The European Green Deal
https://commission.europa.eu/strategy/priorities-2019-2024/european-green-deal_en
- United Nations (2015) – Sustainable Development Goals (SDG 11 & SDG 13)
<https://sdgs.un.org/goals>
- ISO 37122 (2019) – Indicators for Smart Cities (International Organization for Standardization)



Further reading / 2

• Academic sources

- Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. (2007). *Smart cities: Ranking of European medium-sized cities*. Vienna University of Technology.
- Fitsilis, P. (2021). *Smart Cities Body of Knowledge (SCBoK)*.
https://www.researchgate.net/publication/355186850_Smart_Cities_Body_of_Knowledge
- UN-Habitat (2022). *World Cities Report: Envisaging the Future of Cities*.
- Savolainen, O. (2023). *5 ways the Helsinki Smart Region is building citizen-centric and sustainable cities*.
<https://govinsider.asia/intl-en/article/5-ways-the-helsinki-smart-region-is-building-citizen-centric-and-sustainable-cities-ossi-savolainen>

• Optional Exploration

- Atlas of Urban Tech: *Smart Kalasatama, Helsinki*
<https://atlasofurbantech.org/cases/fin-helsinki-kalasatama-2/>



Unit Completed - What's Next?

To consolidate your learning and reflect on the key concepts covered, please take a moment to complete this quiz.

Your feedback and results will help you track your progress and support continuous improvement of the training experience.

By completing this quiz, you will also become eligible to receive a certificate of successful training completion.

Click the [link](#) to begin the quiz!



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Panos Fitsilis bio page



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- **Professor Dr. Panos Fitsilis** is a full Professor at Business Administration Dept. of the University of Thessaly, Greece., Director of Research Lab for “Management, Digital and Educational Skills” (MANDEIS) of UTH, and academic coordinator of the module “Software Design” at Hellenic Open University.
- He has extensive project management experience with the development and deployment of large IT systems and extensive management experience in various senior management positions. His research interests include Smart Cities, Smart Factories, Industry 5.0, Business Information Systems, Social Systems, Educational Technology, Software Project Management, etc.



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