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Electronic Governance

# Blockchain for innovative and sustainable cities: Implications of a transformative technology

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UNU- EGOV : Operating Unit on policy-driven  
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- a **think tank dedicated to Electronic Governance**
- a core **centre of research, advisory services and training**
- a **bridge between research and public policies**
- an **innovation enhancer**
- a **solid partner within the UN system and its Member States** with a particular focus on sustainable development, social inclusion and active citizenship.



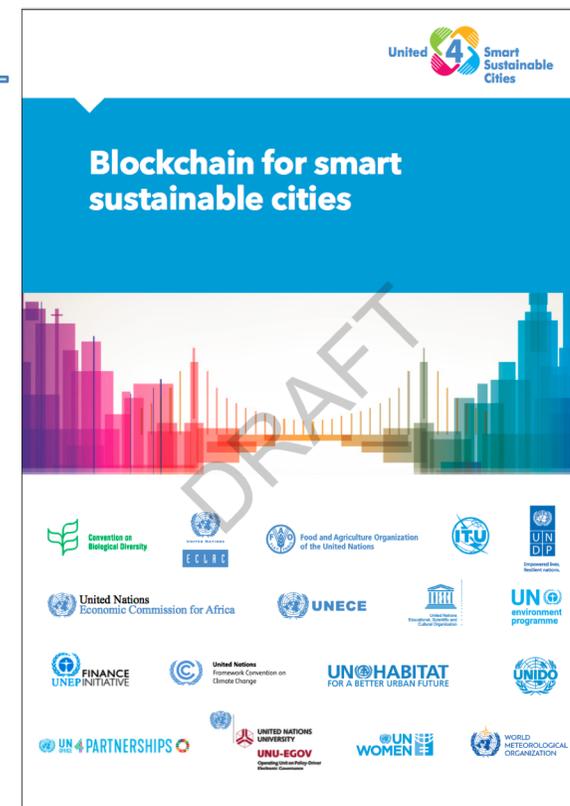
... striving to cement its  
role as **an international  
reference of excellence**,  
bringing together  
multidisciplinary and  
multicultural teams  
around complex  
problems and emerging  
challenges



# Blockchain for Smart Sustainable Cities

This report explores the role played by blockchain technologies in designing an efficient, secure, and scalable distributed architecture to address the significant challenges on interoperability protocols, security and privacy, data collection and sharing, data analytics, and latency within smart cities.

It underscores a series of use-cases highlighting the adoption of this technology into various spheres. Building on the analysis of the use-cases, this report demonstrates the complexity of the blockchain for cities and proposes a framework highlighting the critical dimensions and patterns for the application of blockchain in smart cities.



# Urban Challenges



Cities today face many challenges related to rapid urbanization, including:



inadequate housing  
and infrastructure



poverty  
and hunger



air pollution



negative health  
impacts



tree loss



environmental  
hazards



waste



biodiversity  
loss



# The 2030 Agenda for Sustainable Development



The potential for exacerbation of the problems affecting cities makes them significant vectors for actions to tackle urgent challenges such as poverty, inequality, pollution, mitigation and adaptation to climate change.

The [Sustainable Development Goals \(SDGs\)](#) of the United Nations aim to address these challenges – particularly SDG 11, which aims to make cities and human settlements inclusive, safe, resilient and sustainable.

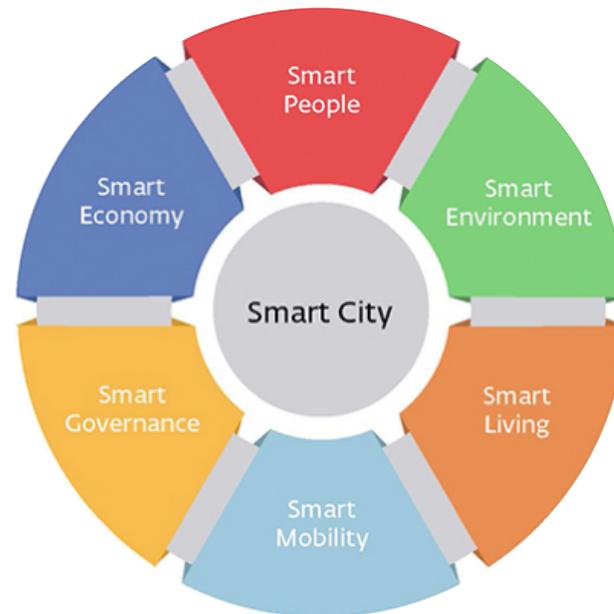


SDG 11:  
Sustainability

A centerpiece of efforts to reach SDG 11 is imperative to make our cities more sustainable through better utilization of technology. Within the concept of smart cities, solutions are to be found to make cities and communities more efficient, technologically advanced, greener, and socially inclusive. In this context, one of the key definitions for Smart sustainable cities (SSC) developed by the International Telecommunication Union (ITU) is as follows

*"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects."*

Recommendation ITU-T Y.4900



Six dimensions of smart cities

# Smart city implementation challenges

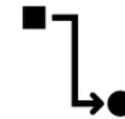
However, there are also challenges associated with the implementation of a smart city, such as:



Security



Communication,  
social and regulatory



Data sharing,  
transparency,  
privacy and  
traceability



Trust



Financing

# Blockchain as a solution

Blockchain technology is increasingly seen as a tool for boosting data transparency and traceability in smart cities. As a decentralized IT infrastructure, blockchain technology can serve as a suitable means to manage the growing networks emanating from smart sustainable cities. Blockchain can help:



Monitor supply  
chains



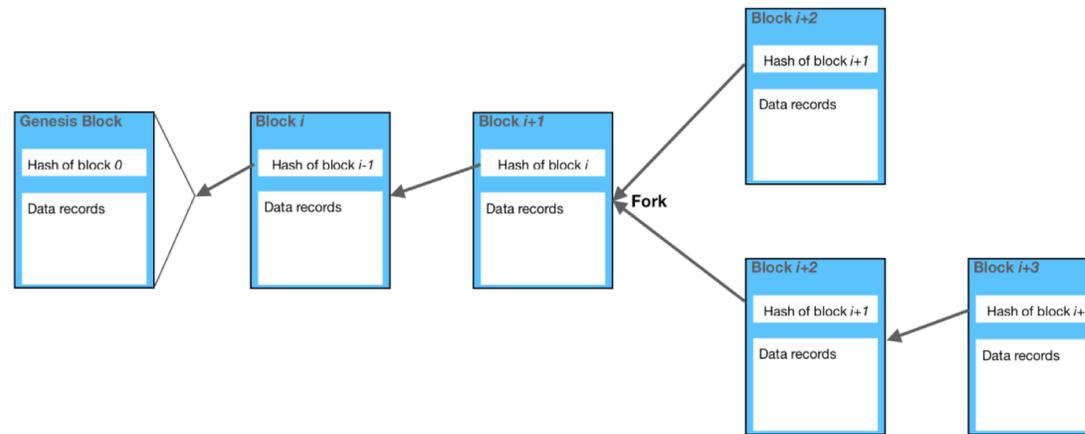
Execute and  
validate data  
trails



Ensure  
authenticity and  
integrity of data

# Blockchain explained

Blockchain is a sequence of blocks, which holds a complete list of transaction records like a conventional public ledger. These transactions or contracts are enclosed in code and stored in transparent and shared databases where they are protected from deletion or change.



Simplified data structure and main elements of blockchain

## There are five principles related to blockchain functioning:



Each party on a blockchain has access to the entire distributed database.



Communications occur directly between peers without the intervention of a third party or a central entity.



Information about the transactions and the associated value is provided to all the participants with access to the network. Actors can choose to remain anonymous or reveal their identity.



The irreversibility of records bestows the permanent character of the transaction recorded in the database, their chronological order and their availability.



The digital nature of the ledger of the blockchain transaction can be programmed automatically through the set-up of algorithms and rules.

# Blockchain for Cities (B4C): Smart Economy



Energy



Telecommunication



Finance

B4C applications in smart economy

# Blockchain for Cities (B4C): smart living, smart environment and smart mobility



Healthcare  
services



Education



Social care



Mobility and  
transportation



Environment

# Blockchain for Cities (B4C): Smart governance, smart people and smart community



Democracy and decision making



Identity



Voting



Public accounting, contracts and taxes



Law enforcement and legal systems



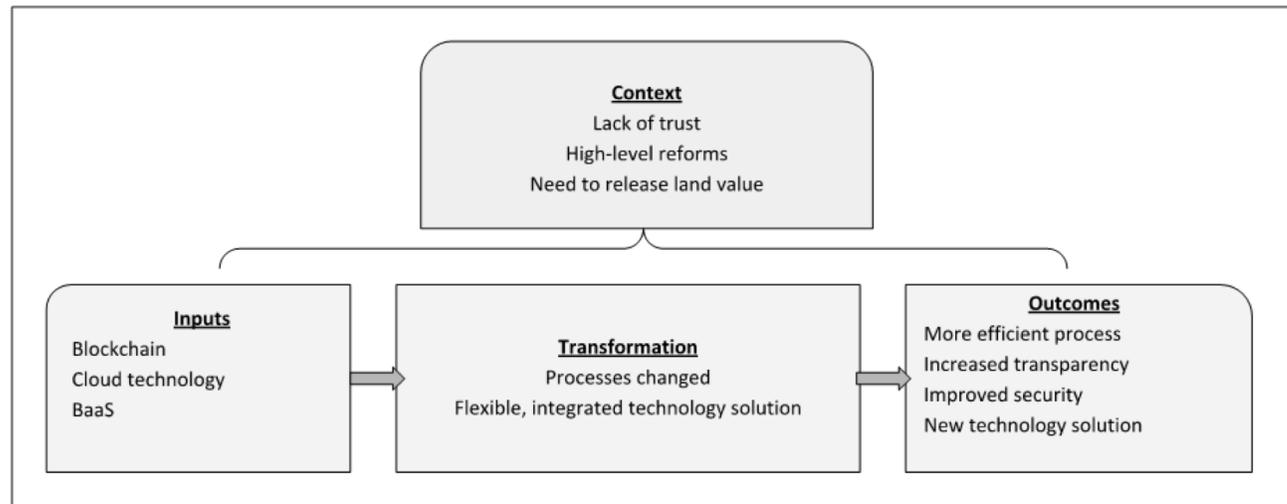
Title and asset registration



Certification

## Building applications for cell towers in Italy

- Blockchain as solution of better governance and administrative approaches to increase efficiency and new public accountability mechanisms.
- Development of the processes surrounding the building or modifying of cell towers, unifying the underlying technologies and allowing the community to vote on the location of cell towers. The solution would have to interface with legacy systems and be cloud-based.
- Use-case for situations where public administration struggles to offer high-quality services efficiently, resulting in lack of trust.

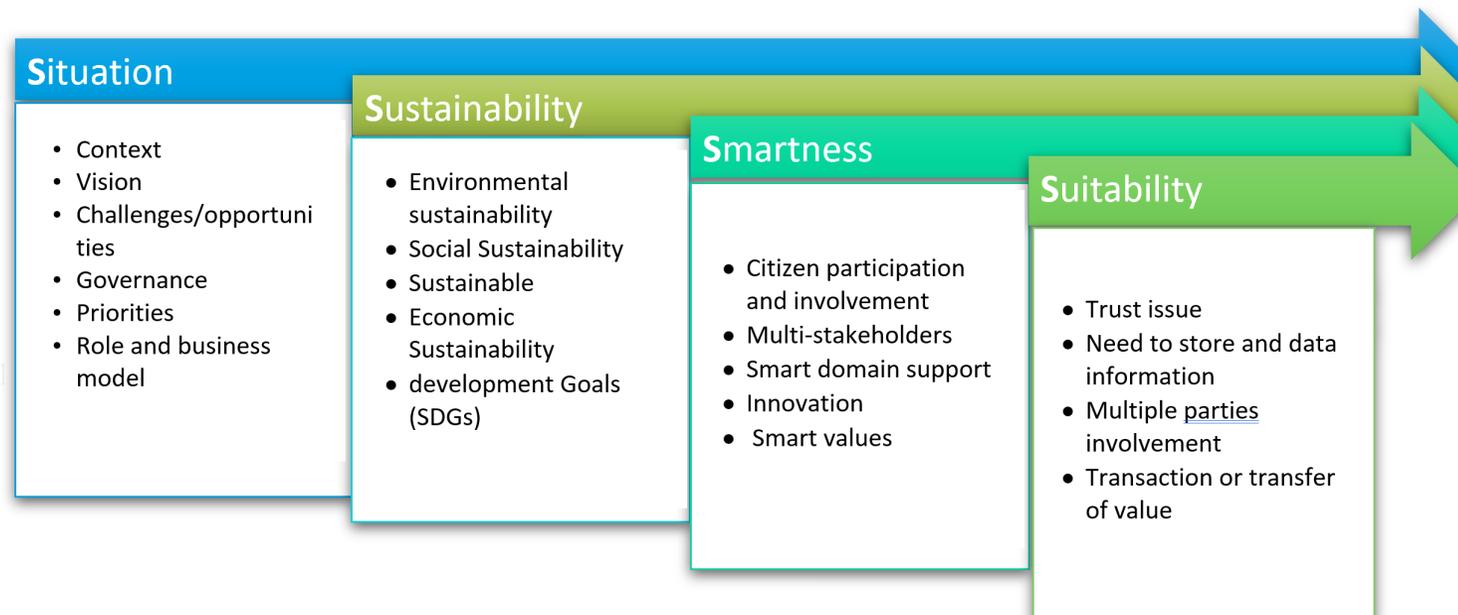


Alpine Tower

- The objective is to foster a participative governance and decision making
- South Tyrol, Italy is looking to simplify bureaucratic processes, unify the underlying technologies and improve inter-agency efficiency to build trust in administration.
- The lack of trust in public administration entities and bureaucracies could be overcome by providing more transparent channels of functioning predicated on blockchain for easy determination of the success of a process as well its time-lines.
- However, local legislation and having multiple stakeholders makes it more complex to design appropriate solutions.

# Framework for Blockchain application for smart and sustainable cities

The report presents a cross-case analysis highlighting the challenges, opportunities, and lessons learned from the use-cases from a diversity of public services. The findings from these analyses are summarised in the “4S framework” below.



Framework of B4C

## Blockchain and environmental sustainability

65 initiatives addressing environmental issue

Blockchain provide opportunities transparent and verifiable records of transactions and trace the records

Potential of blockchain in environmental sustainability:

- Resource rights
  - Products origin
  - Incentive system
- 
- Development of alternative protocol to create to reduce the energy intensity

# Key considerations

The key considerations in implementing blockchain technologies. These considerations are critical for GCIO and IT leaders as well as decision- and policy-makers to reflect on and integrate when considering the applications of blockchain for cities

1

Building a Blockchain ecosystem

2

Defining a governance model

3

Prioritizing sustainability and smartness in technology and innovation adoption

4

Complying with the standards and regulation

5

Ensuring data protection and privacy

6

Acquiring knowledge and developing capabilities

More specifically, Public service administrators, policy-advisors and decision-makers should:

- **Approach** blockchain with caution.
- **Build** a blockchain for ecosystem in collaboration with other stakeholders.
- **Develop** expert capacity and wider understanding about blockchain and smart contracts.
- **Create** a framework to address legal matters, data security and privacy, and stakeholder self-interest.
- **Focus** on planning that takes a need-driven approach.
- **Consider** the digital exclusion of parts of society and inequalities.
- **Ensure** that initiatives are closely monitored, reported on and lessons learned are shared.

**THANK YOU. ANY QUESTIONS?**

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