LABORATORY OF INDUSTRIAL & ENERGY ECONOMICS
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Smart City: The meaning and definition of an "umbrella" concept. Implications for research, study and policy.

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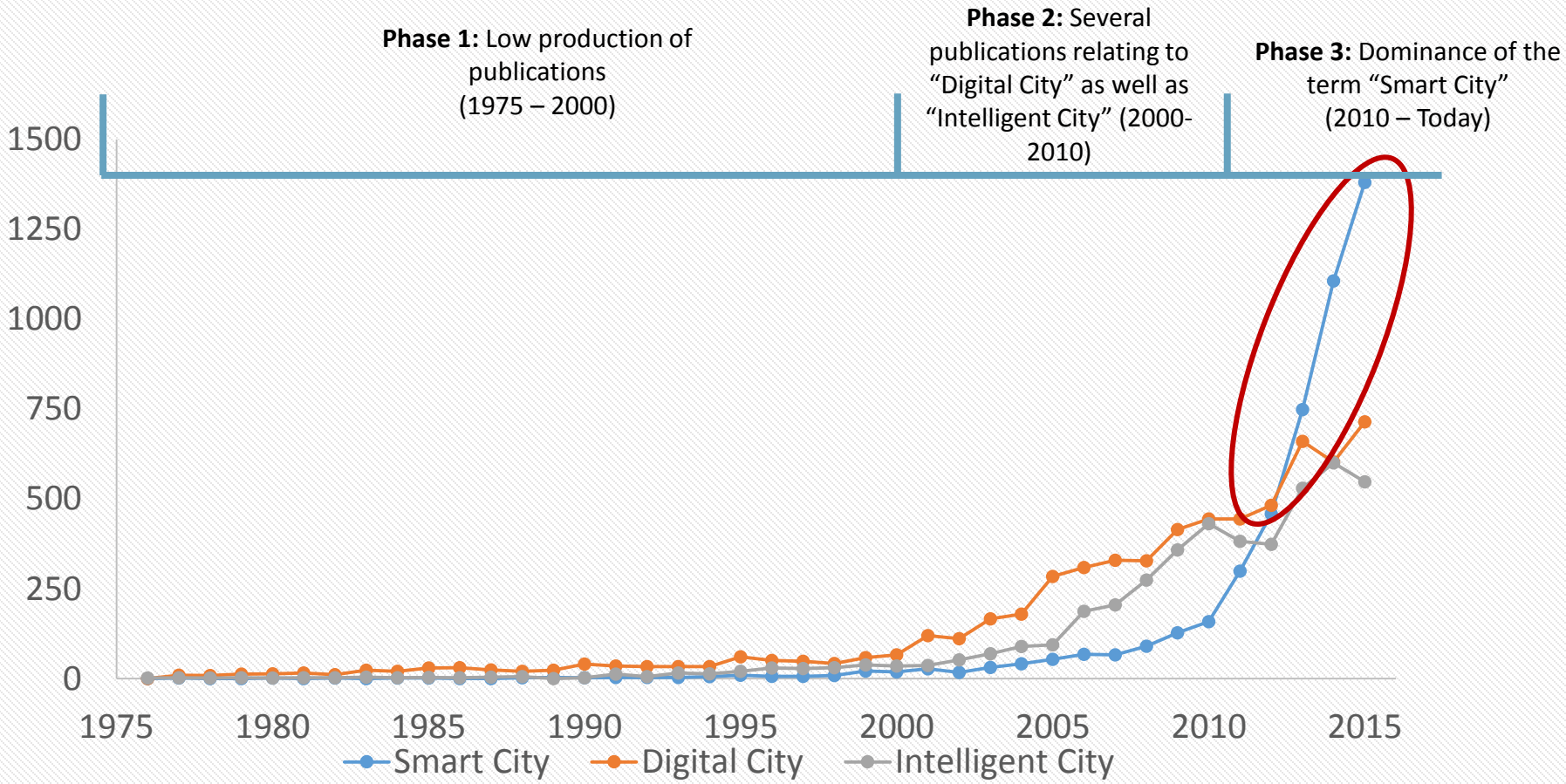
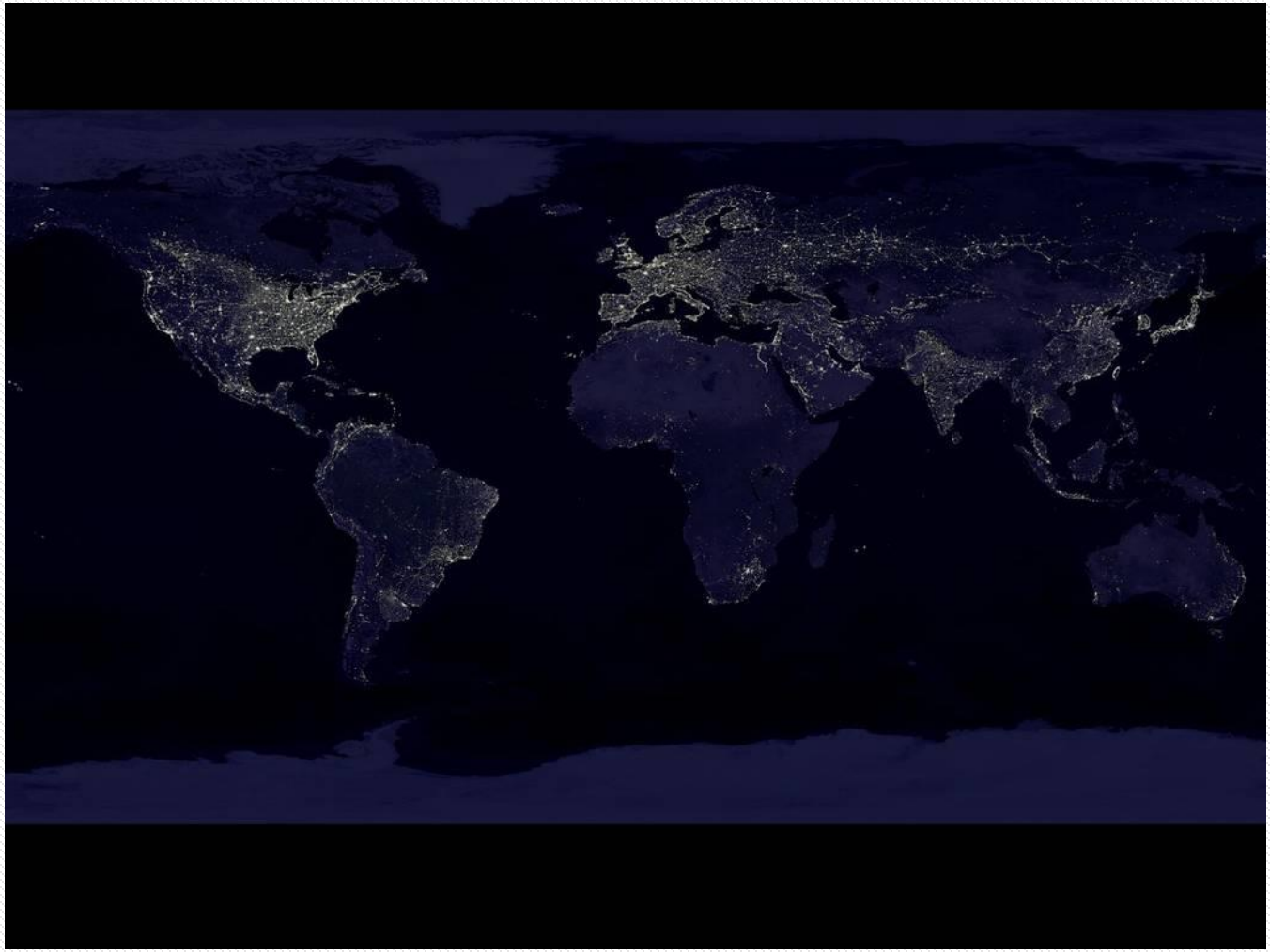
Impressive growth of the number of publications in the field of «Smart Cities» after 2010



Source: Scopus

Will the cities rule the world?
A new emerging constellation of cities
(NASA composite photo, August 2017)



The “smart city” concept: Some stylized facts

- When **cities rule** the world: The city as “the nexus of economic and political power”.
- The “smart city” **umbrella** has actually been around for almost two decades.
- Impressive growth of **number of publications** in the field of “Smart Cities” after 2010.
- Impressive growth of **smart cities initiatives** worlwide since the beginning of the 21st century.
- A **multidisciplinary** scholarly community studies the dynamics and transformation of cities to digital, intelligent, smart and sustainable entities.
- A **large number of actors** can be involved in smart city fields, can contribute to smart city sub-systems and initiatives →smart cities as “organizational fields”.

Context matters

- The nature of the concept: It is by default an “umbrella” term, a label related to a **vision** that can mobilise people, organisations, resources. An emerging, evolving, and fluid concept → It leads to difficulties of definition, unavoidable definitional impreciseness and a number of not always clear tacit assumptions.
- No universally accepted definition. It means different things to different people in different parts of the world. For instance there are **different connotations** in Asia than in Europe.
- It is obvious that **ICT** (in particular IoT) and **creative industries** are transforming many urban areas economically, socially and spatially. After all smart cities are **a demonstration of the Internet of Things (IoT)** [use of sensors, generate data than can be processed, combined, communicated, integrated and analyzed to support some aspects of the city life to function better]
- Perhaps some **definitional boundaries** and a **conceptual framework for operationalising the necessary constructs** can guide cities towards this great transformation.

An Operational and more empirically verifiable Definition for Smart City initiatives

Three pillars

- Improvement of the **functions of the physical and digital infrastructure and service provision** of the city through the utilisation of novel technologies and innovative organisational schemes.
- Development of **Innovation and Entrepreneurship** based on knowledge-intensive and creative activities - **Local/Regional Competitiveness** Enhancement. In this respect linking Knowledge institutions (Universities, Research Institutes, training bodies etc.) with the productive, cultural and creative sectors is essential.
- The City as a field for **Creativity and Experimentation (**i.e. **a Laboratory for Innovation and a test bed for new ideas and ventures)**– Retrofitting of old buildings and re-use of abandoned spaces (e.g. for hosting new business ventures, creative and cultural activities)

The real challenge

- "Building entire smart cities from scratch (the concept of "instant city", Songdo near Seoul, Masdar City in Abu Dhabi) which is related to a costly vision (average price $ 30-60 billion dollars) **vs**. the need to design a system that puts all that technology truly at the service of the citizens/ inhabitants and not the other way round" [Saskia Sassen]
- Development of an **Innovation Ecosystem** at a local as well as at territorial/regional level, that has the ability to adapt to the changes of the (economic, social, institutional and natural) environment and the changing local, regional and global needs.
  - **Collaboration and Interaction** between different **Stakeholders - Knowledge Entities** (municipality, other public-government authorities, established and young firms, academic/research authorities, NGOs, business associations, citizen communities and others)

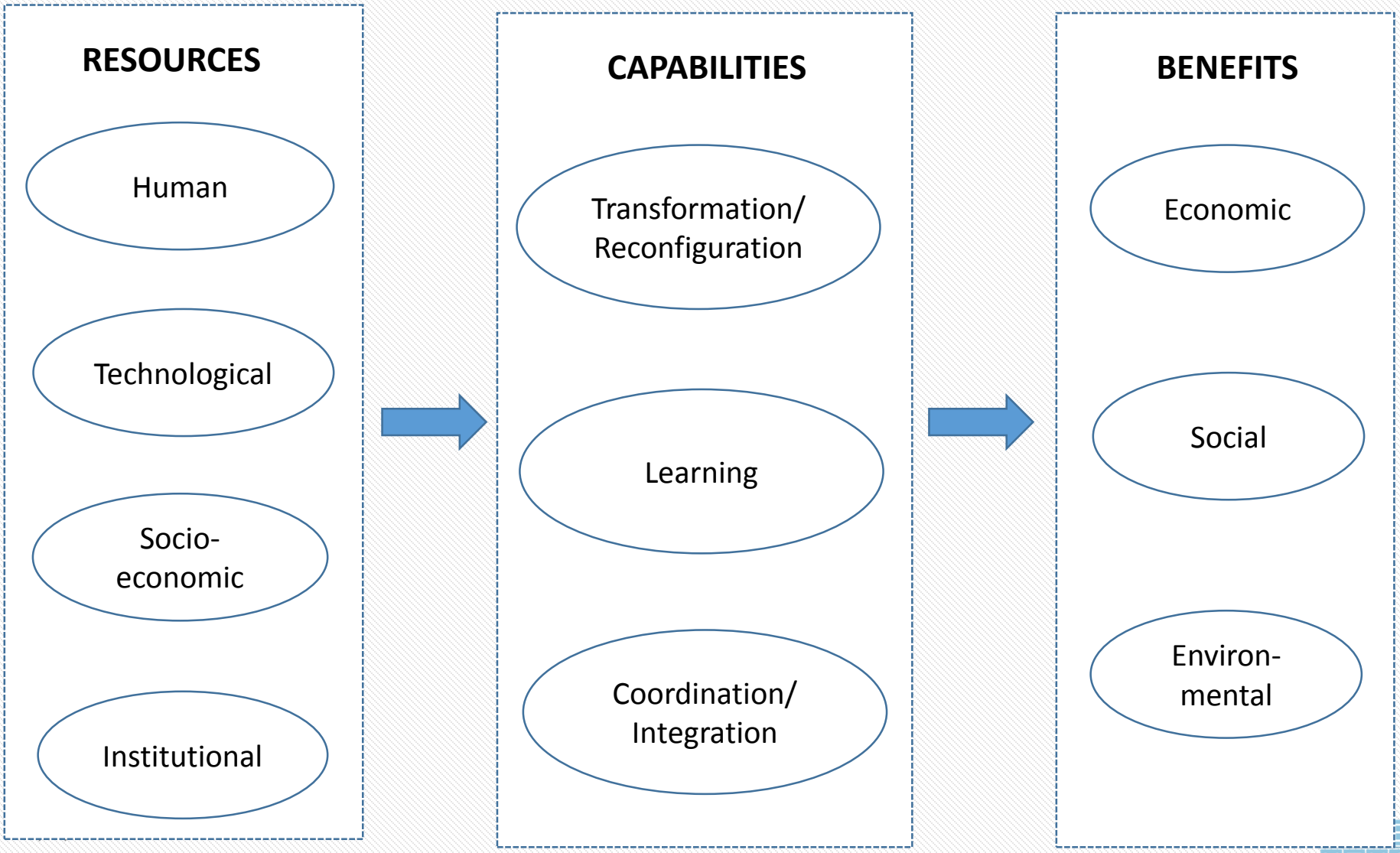
Scientific Research in the field of Smart Cities

- Not a well-developed **theoretical framework**
- Limited research (and without a common approach) has tackled **enabling factors** of a smart city initiative (what really makes cities smart) (Lee et al., 2014)
- The **technological issues** have already received intense scholarly attention, but the corresponding **managerial, organisational and socioeconomic challenges** have been critically under-investigated
  - **ICTs**, as a General Purpose Technology (GPT), constitute **a significant but not a unique component** of a Smart City.

Some more comprehensive Conceptual Frameworks

- **Nam and Pardo (2011): 3 categories of fundamental factors** which make a city smart: a) technology factors (infrastructures of hardware and software), b) human factors (creativity, diversity, and education), and c) institutional factors (governance and policy).
- **Lee et al. (2014):** An holistic taxonomy for analyzing smart city development and implementation consisting of **6 key conceptual dimensions** that focus on both technological and institutional elements: a) Urban openness, b) service innovation, c) partnerships formation, d) urban proactiveness, e) smart city infrastructure integration, and f) smart city governance.
- **Dameri and Ricciardi (2015) -** A Smart City Intellectual Capital (SC-IC) framework:
  - **6 Critical Resources:** a) human capital, b) social capital, c) institutional capital, d) process capital, e) environmental capital, f) renewal capital)
  - **3 Intertwined Capabilities:** a) network management, b) knowledge management, c) project portfolio management
  - **5 Key Final Goals:** a) city value creation, b) competitiveness, c) sustainability, d) resilience, e) quality of life

A proposed Conceptual Framework



Required Resources

- **Human**
  - Technological and Managerial Knowledge of the executives of the public and private actors
  - Universities, Research Centres, Knowledge Institutions, Knowledge-intensive Firms etc.
- **Technological**
  - Broadband Capacity, Sensors Network, etc.
- **Socioeconomic**
  - Types of economic activities and level of economic development
  - Level of internet/ICTs usage
  - Broader demographic characteristics
- **Institutional**
  - Policies/Strategies for “Smart Cities” and “Smart Specialisation” at the local, regional and national level
  - Networking and Cooperation Culture

Necessary Capabilities

- **Transformation/Reconfiguration**
  - ➢ Effective and efficient management of smart city projects
    - o Adoption of performance-based requirements at the design phase in order to favour innovation solutions
    - o Selection of an appropriate funding model in order to mitigate effectively the financial risks and ensure the long-term viability of project operation
    - o Effective coordination of different smart city projects in order to address possible conflicts and exploit possible synergies
- **Learning**
  - Systematic interaction and knowledge exchange between different city entities - Learning from both successes and failures
  - Networking and cooperation with other Cities
  - Systematic mechanism for the evaluation of smart city projects-actions
- **Coordination/Integration**
  - Active engagement of the society in the smart city initiative
  - Interoperability between different urban infrastructures/systems for the provision of more integrated services
  - Creation and continuous enrichment of an open data set

Expected Benefits

- **Economic**
  - Enhancement of urban functions efficiency
  - Creation of opportunities for knowledge-intensive entrepreneurship and more generally enhancement of local economic development
- **Social**
  - Provision of better services (health, transport, eGovernment, safety etc.) to citizens
  - Increase of their participation in decision making
- **Environmental**
  - Reduction air pollution, noise and CO_2 emissions
  - More efficient management of water resources

Indicative “Smart City” Initiatives in Greece

- Smart Cities Consortium: Municipalities of Athens, Thessaloniki, Heraklion in cooperation with Open Technologies Alliance (GFOSS), Laboratory of Industrial and Energy Economics at NTUA, Hellenic Association of Mobile Applications Companies (HAMAC), Greek Mobile Operators Association (EEKT).
- Athens as a Digital City (Digital Council, Chief Information Officer, *Athens's Resilience* Strategy, Digital Strategy and Action Plan, Innovathens).
- Heraklion - Roadmap towards becoming a Smart City
- Incubator “EPI.noo” for the valorization of research conducted at the National Technical University of Athens (NTUA) and promotion of tech-entrepreneurship in the broader ICT area
- Interdisciplinary Working Group of the National Technical University of Athens