Methodologies in Integrative Smart City Research

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Cities 4people:
Smart Cities and Data Analytics
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Data Analytics for Intelligent Cities:
A ‘small-world’ perspective
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Digital Technology in Smart City

Open questions
- How do technology and digitization influence urban development resp. decision making?
  - Focus on intelligence
- How do we understand ‘city’?
  - Focus on approach
Objectives & structure

Why discussing methodologies of Smart City research?
- SC discussion on technology or a scientific research field?
- Missing of integrative methodological frame?

- Smart City – as a field of research
  - Different understandings
  - The 'city' and use of data
    - Type of information
    - Value creation

- A potential methodological frame
  - 'city' and 'intelligence' in sociotechnical context
  - Perspectives for integrative research

→ Meaning of ICT and digitization in the ontological context of city
Different understandings

- **Smart Cities combine diverse technologies to reduce their environmental impact and offer citizens better lives.**
  - European Smart City stakeholder platform

- ‘Smart City’ initiatives as multi-stakeholder municipally based partnerships aimed at addressing problems of common interest with the aid of ICTs, ...
  - DG Internal Policies (2014) Mapping Smart Cities in the EU.

- Caragliu and Chiara del Bo (2018): Advanced Importance of SC research

- **Synergetic process of urban development ... ICTs and standard technologies combined with human and social capital, along with the participated governance ....** (p.10)

- Conclusions in bibliographic analysis: Komninos and Mora (2018)
  - no common understanding across public boards, enterprises and society
  - fragmented literature/theories between disciplines
Scientific view: Use and types of data

What kind of information?

“There is thus a major distinction between digital technologies being used for the short-term routine management of cities and those for longer-term strategic planning, and this difference is reflected in much of the data, information and knowledge that pertains to the functions that smart city technologies are able to inform.”


What kind of city and value creation?

(related to Nam et al, 2011; Dameri et al., 2014; Caragliu et al., 2018)
Smart City discussions
scientific views

Nam, Taewoo & Pardo, Theresa A. (2011)

Smart City

Technology Factors
- Physical infrastructure
- Smart & mobile technologies
- Virtual & digital technologies

ICT, data driven

Digital city
Intelligent city
Ubiquitous city
Wired city
Hybrid city
Information city

Human Factors
- Human infrastructure
- Social capital

Creative city
Learning city
Human city
Knowledge city

Institutional Factors
- Governance
- Regulations/directives
- Policy

Smart community
Smart growth

Citizen centered
Smart City research 1: ICT and data centered

ICT-centred smart city: highly instrumented

- to optimise decision making in the short and long term
- better to manage and to control city systems .... about real time functioning

Smart City Barcelona: IoE Connections and Impacts

**Barcelona approach**

- Digital twin of 12 urban key elements
- providing 22 programmes/urban services

**Need of real time information**

→ Comprehensive sensoring and digitization
→ Decision rules and algorithms
→ Key performance indicators
Value creation
Smart City = Digital TWIN city enables
- new and automated forms of real time decision making
- modelling and scenario-building (based on revealed preferences)
- IoE AND provides user generated information/content needs data centered governance
Value creation through digital web based information

- **Research field in SRF**
  - GeoWeb and the production of Place
    - the world of volunteered geography (Goodchild 2007)
    - by Alexander Czech, doctoral work

- **Assumptions**
  - City is a manifestation of socio-cultural values, economic interests and (political) power conditions
  - User Generated digital city reproduces 'urban world' in social, functional and cultural artefacts

- **Research Questions**
  - Which forms, functions and hierarchies are existing in digital twin city?
  - Do these digital artefacts deliver new polycentric structures in comparision to existing studies and planning documents?
  - ....
Value creation through digital web based information

Methods

- Retrieval of open data: geotagged User Generated Content:
- Learning based text extraction of all web based information

- Evaluation of digital representation of 'urban reality'

Interim results: unequal representation of places through the web
- Differentiated by languages / uneven geographies
Learning processes an (strategic) decision finding

- City as actor in a competitive environment: benchmarking & mitigating emissions
- Balancing competitiveness and quality of life in a sustainable way
- (future) position of Smart City .... well performing in a forward-looking way ...... activating the potentials through integration of stakeholders, costumers and residents

Need of place based citizens centered evidence through integration of:
- quantitative information
- stakeholders‘ and citizens‘ knowledge/assessment
- Settings/methods of collective decision finding process
Smart City research 2: citizen based collective evidence

Value creation
Smart City = part of the wider ecosystem enabling
- Integration of digital knowledge and citizens' creative contribution
- Evaluation of projects & strategies based on modelling and participatory evaluation
Needs network based or participatory governance

based on Batty, et al., 2012
Value creation through interactive learning

- **Research field of SRF-teams**
  - Smart City benchmarking and stakeholder network: Krakow and other cities, PLEEC cities
  - Urban Lab: E_Profile

- **Assumptions**
  - City is the outcome of urban assets and deficits and of dominant stakeholder interests embedded in political power conditions
  - Urban development (as sum of local innovations) is driven through urban needs/challenges and evidence based learning processes

- **Research Questions**
  - How to improve effective strategic decision finding through the support of digital information and how to use digital tools for communication?
    - Strategic positioning in urban system / road map for energy efficient development
  - How to support a transformation process towards more resilient energetic conditions under complex conditions of neighbourhoods?
    - E_Profile: effective transformation process on neighbourhood level
Value creation through interactive learning

E-Profile-methods
- Participatory stakeholder approach
- GIS-based modelling of energy consumption

Results
- Web-based communication instrument: Dashbord as instrument
  - on level of urban quarters
  - key performance indicators
  - Flexible Use for scenario communication
  - impacts of potential ways of transition
Integrative research methodologies

**Type of intelligence**
- Data driven
- Collective

**Augmented realities and uneven geographies:**
- Looks at the digitally defined place through discriminating characteristics, i.e., languages
- Acknowledges the algorithmic layer of information sorting and representing
- Production of place through (socially constructed) geoweb
- But still geotagged (data driven) research view on urban issues

**User geotagged data:**
- Detecting patterns & flows;
- Urban characteristics

**Citizen centered use of digital city/neighborhood**

**Open Innovation and digital city:**
- Looks at the local conditions and is coping with challenges
- Acknowledges the algorithmic layer of information sorting and representing
- Production of place through integrated learning based evidence
- But still social (citizen centered) research view on urban issues

S'Hertogenbosch, 19th of April, 2018
Conclusion: SC research in a socio-technical context

Changing role of technology: From ICT to digital city

- From simple data driven evidence to aggregated knowledge as.. a form of universally distributed intelligence, constantly enhanced, coordinated in real time ....
  - Levy, 1997; Komninos et al. 2018

- But still no theory integrating long term perspectives with short termed real time decision making
  - Batty et al., 2017

Different ontology of City

- Systemic view: at least two subsystems
  - focus on physical & human subsystem: complexity analysis
  - increasing focus on 'new digital geographies'?

- Social manifestation of power relations and networks
  - Focus on ICT based learning and decision processes
  - Open innovation in the interplay of social and economic networks and ICT based collective intelligence


PLEEC – Planning Energy Efficient Cities; EC, FP-7; DG Energy; http://www.pleecproject.eu/
Many Thanks for Your Attention

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