

# Using Remote Sensing to facilitate and accelerate a world wide Urban Sustainability Collaboration

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Harris C.M.Tiddens

# Overview

- Urban sustainability is a global challenge but we do not know what the requirements for real urban sustainability are
- Cities harbour half of the world population and account for a 70-80% share of “gross global product”
- The less than 200 National states are for global collaboration very asymmetric
- Compare them with the 9000 cities on our planet, they are much more similar
- Cooperation between cities at the moment is however immature
- Cities can learn from their peers, but who their peers are, is more than often unknown
- Cities mistakes are long lasting mistakes that we - with the growing urban burden - can only less and less afford
- But much more interesting Cities do very good things. They should therefore learn to learn from each other on an evidence based best praxis basis
- Remote Sensing could facilitate and accelerate this urgent needed mutual urban learning

# Long Term Objective

- We should use Remote Sensing to:
  - Create typologies of cities based on their geomorphological and meteorological properties, as well as their urban appearance to capture these in standardised sets of sustainability parameters
  - Deliver data time series on these parameters for tracking
- This would enable cities and their stakeholders:
  - See themselves in an unbiased well polished global mirror
  - To find their peers easily on a global basis and
  - To define what the sustainability target really should be
  - track down what the evidence based best practices are to achieve these targets

# Present Situation

- While traditional agriculture is dispersing, manufacturing and a large part of services are cluttering
- The present result of this concentration is impressive:
- “Looking at grid cells, a quarter of the world’s GDP is produced on just 0.3 percent of the land area (about the size of Cameroon), half on 1.5 percent, and nine-tenths on 16 percent.”

(World Bank Development Report 2009: Reshaping Economic Geography)

# How does this concentration split up?

## World Demographic profile (UN) Overview 1950-2050

In thousands

| Indicator                                  | 1955      | 1980      | 2005      |  | 2010      | 2025      |           | 2050      |
|--|-----------|-----------|-----------|--|-----------|-----------|-----------|-----------|
| Rural population (thousands)               | 1 915 798 | 2 710 919 | 3 350 116 |  | 3 411 951 | 3 426 276 |           | 2 792 995 |
| Urban population (thousands)               | 854 955   | 1 740 551 | 3 164 635 |  | 3 494 607 | 4 584 233 |           | 6 398 291 |
| Urban population from world population (%) | 30.9      | 39.1      | 48.6      |  | 50.6      | 57.2      |           | 69.6      |
|  |           |           |           |  |           |           |           |           |
| Indicator                                  | 1955-1960 | 1980-1985 | 2005-2010 |  | 2010-2015 | 2025-2030 | 2045-2050 |           |
| Rural annual growth rate (%)               | 1.21      | 1.12      | 0.37      |  | 0.22      | -0.43     | -1.18     |           |
| Urban annual growth rate (%)               | 3.06      | 2.66      | 1.98      |  | 1.91      | 1.6       | 1.08      |           |

# How does this concentration distribute ?

## World Demographic profile (UN) Overview 1950-2025

In thousands

| Size-class              |   | 1955    | 1980    | 2005      | 2025      |
|-------------------------|---|---------|---------|-----------|-----------|
| 10 million or more      | Number of agglomerations                          | 2       | 4       | 18        | 27        |
|                         | Population  | 26.932  | 69.249  | 268.263   | 446.822   |
| 5 to 10 million         | Number of agglomerations                          | 9       | 20      | 31        | 48        |
|                         | Population  | 53.816  | 149.327 | 217.440   | 336.651   |
| 1 to 5 million          | Number of agglomerations                          | 77      | 196     | 361       | 524       |
|                         | Population  | 140.475 | 366.178 | 711.205   | 1.057.574 |
| 500.000 to 1 million    | Number of agglomerations                          | 142     | 258     | 446       | 551       |
|                         | Population  | 99.117  | 179.172 | 312.845   | 389.614   |
| More than 500.000 Total | Population  | 320.340 | 763.926 | 1.509.753 | 2.230.661 |
|                         | Percentage of urban population                    | 37      | 44      | 48        | 49        |
|                         | Number of Agglomerations                          | 230     | 478     | 856       | 1.150     |
| Fewer than 500000       | Population  | 534.615 | 976.625 | 1.654.882 | 2.353.571 |
|                         | Percentage of urban population                    | 63      | 56      | 52        | 51        |
|                         | Assumed average Size of small urban agglomeration | 200     |         |           |           |
|                         | Resulting number of Urban Agglomerations          | 2.673   | 4.883   | 8.274     | 11.768    |

# Is it justified to speak about “Cities”?

**Yes! For all their complex individuality:  
Cities are more alike than different**

- Somehow a school kid can recognise and describe a city
  - Houses, Shops, Factories, Schools etc.
  - Streets often waterways
  - Transport of people, water, goods and energy
  - Concentrated Supply of goods and services
- And the density of cities is economically seen extremely attractive

# So cities have a physical and abstract appearance

- Cities are primary discernible on
  - Form
  - Size
  - Location
  - Reflections and Emissions
- Cities have basic secondary characteristics that base on
  - Density
  - Distance
  - Division (Physical and Abstract as: Geomorphological obstacles, borders, languages, rules)

# Cities have a behaviour

- We can safely assume that cities are complex adaptive systems with an individual and with a common behaviour
  - Cities live and can die
  - They can be
    - benign for their civilians as well as a hell
    - Stupid or Smart
    - self cleaning or self poisoning
    - parasitic on their environment
  - Can they become Sustainable?

# Cities have a maturity

|  |          |                              |   |
|--|----------|------------------------------|---|
| Urban Capability<br>Maturity Modell Levels | Level 5  | Optimising                   | Optimising (process improvement) process management includes deliberate process optimization/improvement. |
|  | Level 4  | Managed                      | Managed (quantified) process management and measurement takes place.                                      |
|  | Level 3  | Defined                      | Defined (institutionalized) the process is defined/confirmed as a standard business process.              |
|  | Level 2  | Repeatable                   | Repeatable (project management, process discipline) the process is used repeatedly.                       |
|  | Level 1  | Initial                      | Initial (chaotic, ad hoc, heroic) the starting point for use of a new process.                            |
|  | Level 0  | Anarchy                      | No recognisable processes, clan and gang rule   |
|  | Level -1 | Deteriorating, falling apart | Fighting. Epidemics. Dirt piling up, Increasing Self Poisoning  |
|  | Level -2 | Dying                        | People massively dying or fleeing   |
|  | Level -3 | Dead                         | No inhabitants  |

# **We can .....and we should compare cities Urban Sustainability is not alone a matter of the individual cities**

- When
  - 70-80% of our economic output is generated in or through our cities then the same goes for the man made hazards
  - Cities are discernible complex adaptive systems that have comparable properties and behaviour,

We can then can safely assume:

The success of how we face our global sustainability challenge depends largely on our ability to care that about 9000 cities develop good sustainable behaviour.

# The management of cities is traditionally a task of the national states

- But globally seen national states are
  - Extremely asymmetric
  - Much much simpler than the cities themselves
  - So shall we wait to solve our sustainability challenges for the chain of communication and command from let's say:
    - the UN Organisation or a climate panel
    - to the EU
    - to a national state, to a federal state,
    - to a district, cities, to the city stakeholders
    - and then back ....and for how many iteration loops?

# So who is helping the cities globally?

## The major supra national organisations dealing with urban agglomerations:

- UN-Habitat:
  - Main Focus on developing countries, specially on poverty, water- and environment-protection
  - Every two years a World Urban Forum with some hundred two hundred participants
  - ca.25 Mio \$ general purpose and regular budget, as well as 135,7 Mio Special purpose funding
  - Some hundred permanent and undefined direct special project staff
- World Bank:
  - Just contributed in November an excellent, but single, study
- World Organization of United Cities and Local Governments
  - Facilitating of networking between the local governments
  - 1000 direct members in 95 countries // about 15 employees
- ICLEI Local Governments for sustainability
  - 1004 Cities in 66 countries, mainly W-Europe and America. China and Russia almost not represented.
  - Some 15 employees
- City Mayors
  - Focuses on the large and rich cities // few Employees

## ....so cities should learn to learn from each other directly

To enable that cities should learn to see themselves in a way that

- Mirrors the urban similarities (and not paralyse themselves on differences)
- Reflects the interests and maturity of all stakeholders
- Concentrates on relevant problems
- Enables them to see what real sustainability could be
- Shows what -at present- the best approaches are to reach these sustainability targets
- Enables a regular review of these solutions and treatments

So how do the cities directly cooperate at the moment?

# Let's talk about.....

## Shijiazhuang 石家庄

- Population (2004)
  - Urban 2,172,800
  - Prefecture-level city 9,090,200
  - Density 573.6/km<sup>2</sup> (1,485.6/sq mi)
  - Urban Density 4,775.4/km<sup>2</sup> (12,368.2/sq mi)
- Sister Cities
  - Saskatchewan, Canada
  - Bielsko-Biala, Poland
  - Cheonan, South Korea
  - Soria, Castilla y León, Spain
  - Falkenberg, Sweden
  - Iowa, United States
  - New Jersey, United States
  - Las Cruces, New Mexico, United States
  - Nagykanizsa, Hungary

# Remote Sensing could deliver Standardised Parameters and their respective Time Lines.....

- Climate
  - Average Temperature
  - Precipitation
  - Wind
  - Sun
- Water
- Geomorphology
- Urban Landscape
  - Single Centre/ Multiple Centre / Doughnut / Street City / Waterway-city
  - Functional Morphology
    - (relations Brown; White; Green...)
    - Granularity
  - Building Volume
  - Building Density
  - Vegetation
- Traffic
  - Volume
  - Speed
- Energy loss
- Basic Emissions
  - Atmosphere
  - Water
  - Land

**To use Remote Sensing is not a purpose in  
itself.....**

**.....but to enable a new Discipline.....**

The success of how we face our global sustainability challenge depends largely on our ability to care that about 9000 cities develop good sustainable behaviour.

- We could describe this new discipline simply as

**Urban Sustainability Care**

# Evidence Based Best Practices

The resemblance of “Urban Sustainability Care” with “Human Health Care” is not coincidental

- Differences
  - 9000 cities are not so much entities compared to the more than 6 billion human beings
  - Cities seem to be more fuzzy than biological human beings
- Similarities
  - Knowledge explosion without much use
  - Answer in medical health care is:
    - Cochrane Collaboration
      - Good science / relevant problems / evidence based best practices

# The five main tasks of the Cochrane Collaboration for evidence based best practice medical care

Who is collaborating: Patient Organisations, Medical Doctors, Pharma Universities, Insurances, Hospitals, Government. They agree on:

- Common definition and description of prevailing quality criteria
  - for sound medical research.
  
- Defining clinically relevant topic areas,
  
- Reviewing relevant scientific research with a relevant clinical question at its core, and regularly updating these reviews.
  -
  
- (If necessary) Creating new or adapting existing standard treatment and prevention protocols (treatment schemes) for these clinical questions.
  - 
  -
  
- Systematic publishing of these so called “Cochrane Reviews” in the “Cochrane Library” in versions adapted for medical doctors, patient associations, insurances etc.
  - 
  -

## **Let me conclude**

**Would somebody see our national states as the signs of human life from outer space....?**

- No....We would predominantly see our cities.
- To look and perceive from outside is the realm of remote sensing
- So let's use remote sensing as the starting point to facilitate and accelerate a worldwide

## **Urban Sustainability Collaboration**

**for Evidence Based Best Practice  
Urban Sustainability Care**

# Possible next steps to set up the “Urban Sustainability Care”

- Define the remote sensing techniques and practices that practically and economically could deal with 9000 cities
- Track down the institutions (science, urban stakeholder organisations, representatives of trade and industry, notably in the area of sustainable energy, traffic and water)
- Set up a convening congress
  - to get the basics clear and
  - one or two basic challenges prioritised and the project described
- Clear funding and resources.
- Set up an – international - trial with of some 120 cities (250 k – 1 Million inhabitants) (20 respectively in the N-Hemisphere: North America /EU / Russia / China / Japan each )
- Publish the results in an Internet platform that enables stakeholders to identify their
  - -urban peers,
  - -own basic parameters
  - Add -separately- further information
- Evaluate the results in a second congress
- Set up the second complete wave and roll out

Thank you!



Harris C.M Tiddens

狄海瑞

Elbingerstraße 16  
D-50997 Cologne  
Germany

GSM (G): +49 170 8369 071  
GSM(CN): +86 135 1101 3985  
Harris.Tiddens@t-online.de

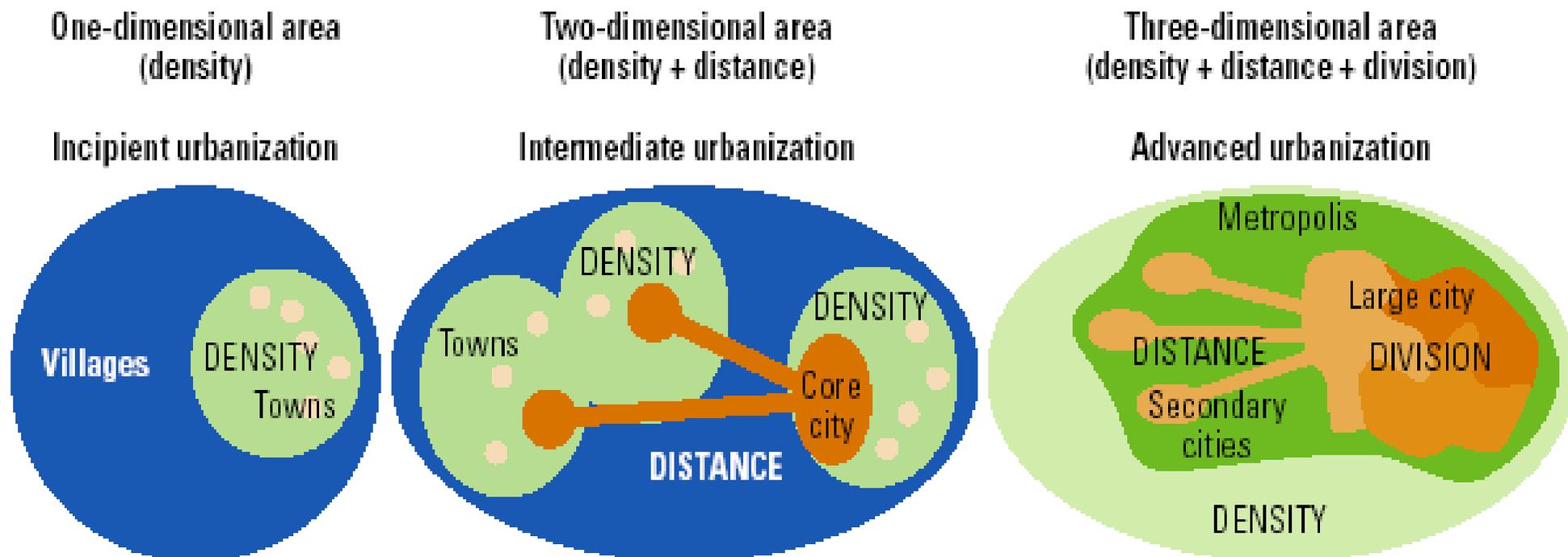
Sustainable Thinking Systems

可持续的思维体系

# Back Up

# Remote Sensing could help that peers find each other

Figure 7.2 The dimensions increase with the level of urbanization



Source: WDR 2009 team.

Define types/categories of Urbanisation and allocate the 9000 cities accordingly