

# Linking People and Socio-Economic Information to a Location:

## Integrating Statistical and Geospatial Information

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# Summary

- **Need for Integration of Statistical and Geospatial Information**
- **Example of the Census**
- **Trends in Technology**
- **UN Activities**
- **Future Actions/Conclusion**



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# UN working with two professional communities

- Working with **National Statistical Offices** to evolve a global statistical system -- Many achievements over 65 years;
- Working with **National Geospatial Information Authorities** to evolve a global geospatial information platform with common practices and standards;
- Now working to bring these two communities together to evolve an **integrated national/global information system**.



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# Divergence and Overlaps

- Two communities operating on different analytical schemes and data structures, with minimal overlaps;
- Distinct culture, language, and practices;
- Comfortable as distinct professional communities;
- But now compelled by emerging trends to look for the common ground.
- What is the Common Ground? How to get there??



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# Matrix: Data Structure for Statistics

## Statistics

Gender Inequality Index and related indicators [Search glossaries](#)

Source: Human Development Indices: A statistical update 2011 | [United Nations Development Programme](#)

[Download](#) [Explore](#)

HDI rank	Gender Inequality Index		Maternal mortality ratio	Adolescent fertility rate	Seats in national parliament (% Female)	Population with at least secondary education (% ages 25 and older)		Labour force participation rate (%)		Reproductive Health			Total fertility rate	
	Rank	Value				Female	Male	Female	Male	Contraceptive prevalence rate, any method (% of married women ages 15-49)	At least one antenatal visit (%)	Births attended by skilled health personnel (%)		
	2011	2011												2010
VERY HIGH HUMAN DEVELOPMENT														
1	Norway	6	0.075	7	9.0	39.6	99.3	99.1	63.0	71.0	88.0	..	..	2.0
2	Australia	18	0.136	8	16.5	28.3	95.1	97.2	58.4	72.2	71.0	100.0	100.0	2.0
3	Netherlands	2	0.052	9	5.1	37.8	86.3	89.2	59.5	72.9	69.0	..	100.0	1.8
4	United States	47	0.299	24	41.2	16.8	95.3	94.5	58.4	71.9	73.0	..	99.0	2.1
5	New Zealand	32	0.195	14	30.9	33.6	71.6	73.5	61.8	75.7	75.0	95.0	100.0	2.1
6	Canada	20	0.140	12	14.0	24.9	92.3	92.7	62.7	73.0	74.0	..	98.0	1.7
7	Ireland	33	0.203	3	17.5	11.1	82.3	81.5	54.4	73.0	89.0	..	100.0	2.1
8	Liechtenstein	..	..	..	7.0	24.0	..	..	..	..	..	..	..	..
9	Germany	7	0.085	7	7.9	31.7	91.3	92.8	53.1	66.8	75.0	..	..	1.5

This data structure may explain to some degree why it took a long time to adopt the geographic approach



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# statistics as spatial information

Statistical world

Statistisches Bundesamt  
Deutschland

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You are here: [Start](#) > [National accounts](#) > [Domestic product](#) > [Tables](#)

**Indicators**

- Short-term indicators
- Structural indicators
- Sustainable development indicators
- More indicators

**Tables**

- level up

**Services**

- Press
- Information service
- Publications
- Library
- Events

**Databases**

- GENESIS-Online
- Federal Health Monitoring System

**Research and development**

- Scientific forum

**National Accounts**

**Important economic indicators**

Specification	Unit	2007	2008	2009
<b>Gross value added<sup>1</sup></b>	EUR bn.	2,176.57	2,239.24	2,149.88
<b>Agriculture, hunting and forestry; fishing</b>	EUR bn.	20.67	20.25	18.11
<b>Industry, including energy</b>	EUR bn.	568.38	572.72	471.74
<b>Construction</b>	EUR bn.	88.28	95.23	98.58
<b>Trade, transport and communications</b>	EUR bn.	379.58	397.43	378.23
<b>Financial, real-estate, renting and business activities</b>	EUR bn.	639.37	659.16	666.81
<b>Other service activities</b>	EUR bn.	480.29	494.45	516.41
<b>Gross domestic product<sup>1</sup></b>	EUR bn.	2,428.20	2,495.80	2,404.40
<b>Final consumption expenditure</b>	EUR bn.	1,810.96	1,861.48	1,888.43
<b>Final consumption expenditure (households and NPISHs)</b>	EUR bn.	1,375.39	1,409.71	1,416.36
<b>Government final consumption expenditure</b>	EUR bn.	435.57	451.77	472.07
<b>Gross fixed capital formation</b>	EUR bn.	455.53	474.71	431.95

Physical world

Google maps  Search Maps [Show search options](#)

Find businesses, addresses and places of interest.

Map | Satellite | Terrain

Print | Email | Link

Source: Eurostat

Statistics are about human characteristics and activities which are geographic in nature.



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# Location as Basic Unit of Observation

25 Dupont St, Town T  
x,y: 35.5676, 135.6587



Address / Geocode



Enumeration Areas

(operational geographic units for data collection)

Geographic Data Structure: Points, Lines, and Polygons



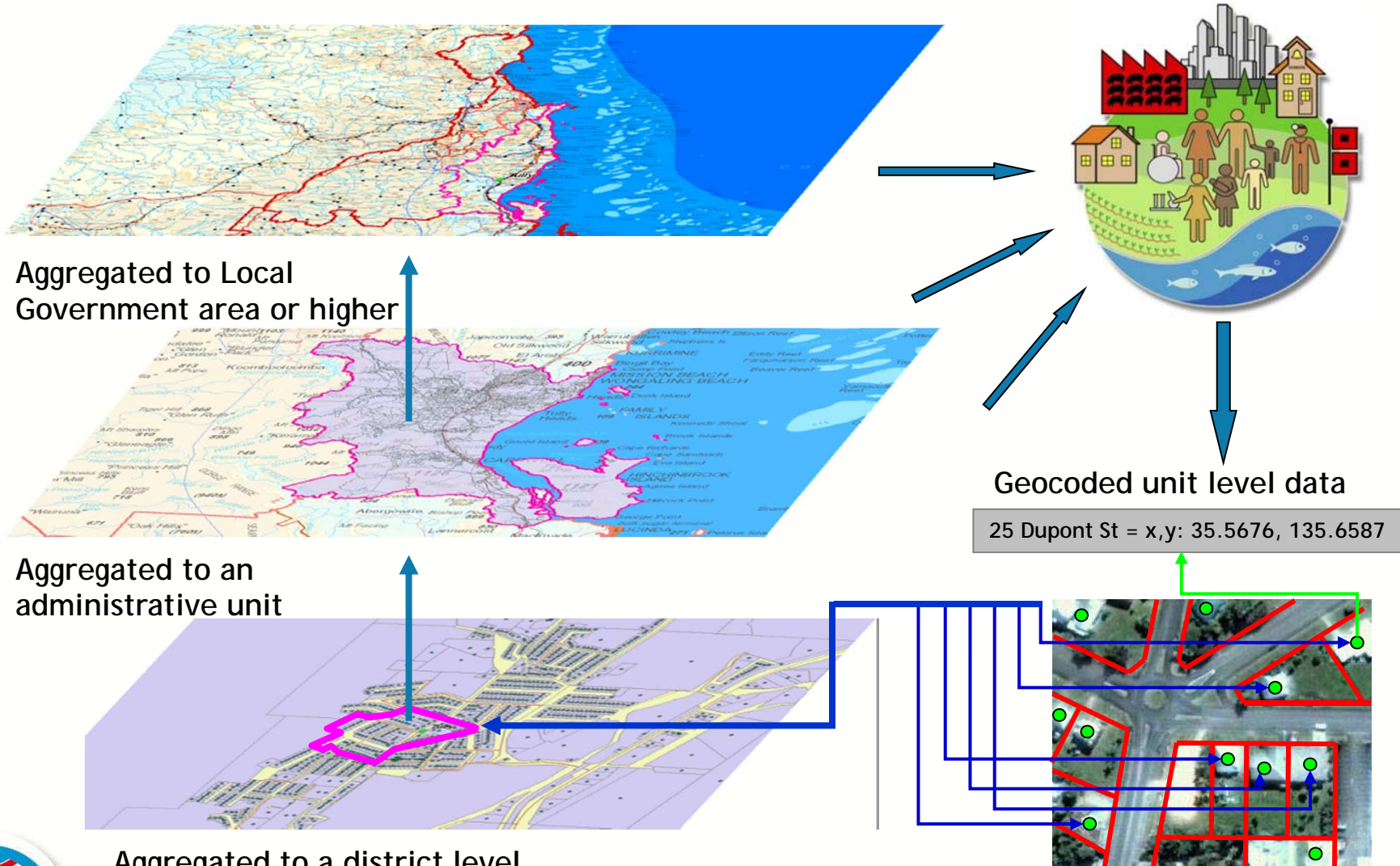
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# Need for a Statistical Spatial Framework

Analysis and aggregation across geographies



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Aggregated to a district level

A common geographic framework is fundamental to integration

Need for appropriate standards to support the linking of socio-economic information to location



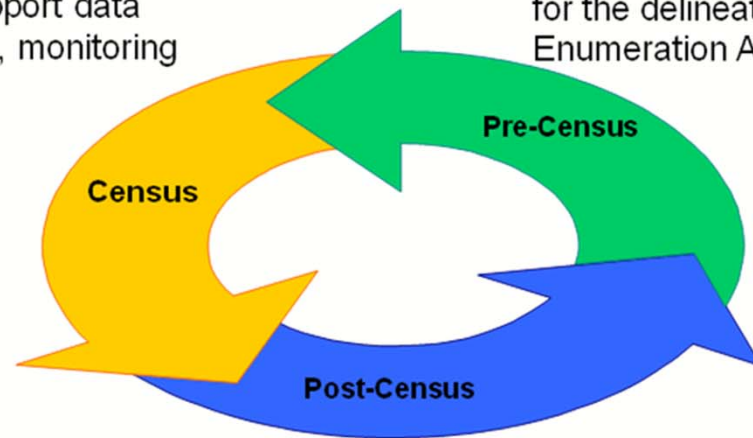
# Census Cycle

## Enumeration

Maps support data collection, monitoring

## Pre-enumeration

Maps provide cartographic basis for the delineation of Enumeration Areas



## Post-enumeration

Maps make it easier to analyze, display and disseminate; also support survey projects during the decade after the Census

Survey Samples  
Rolling Census

Census geography: Shift from “redoing from scratch” to “up-to-date-approach”



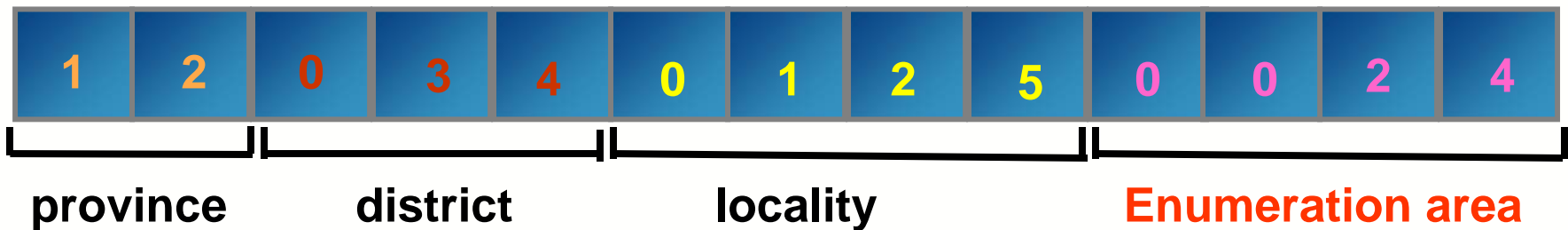
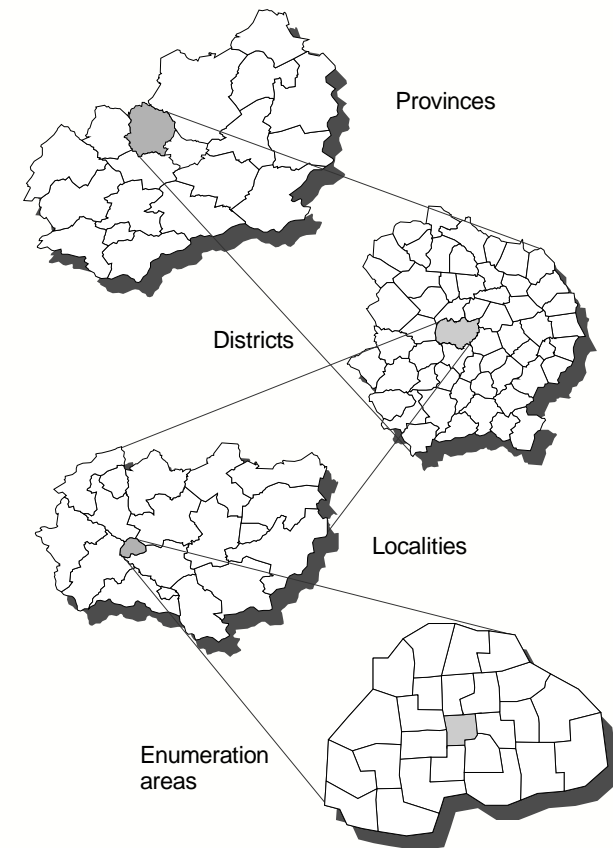
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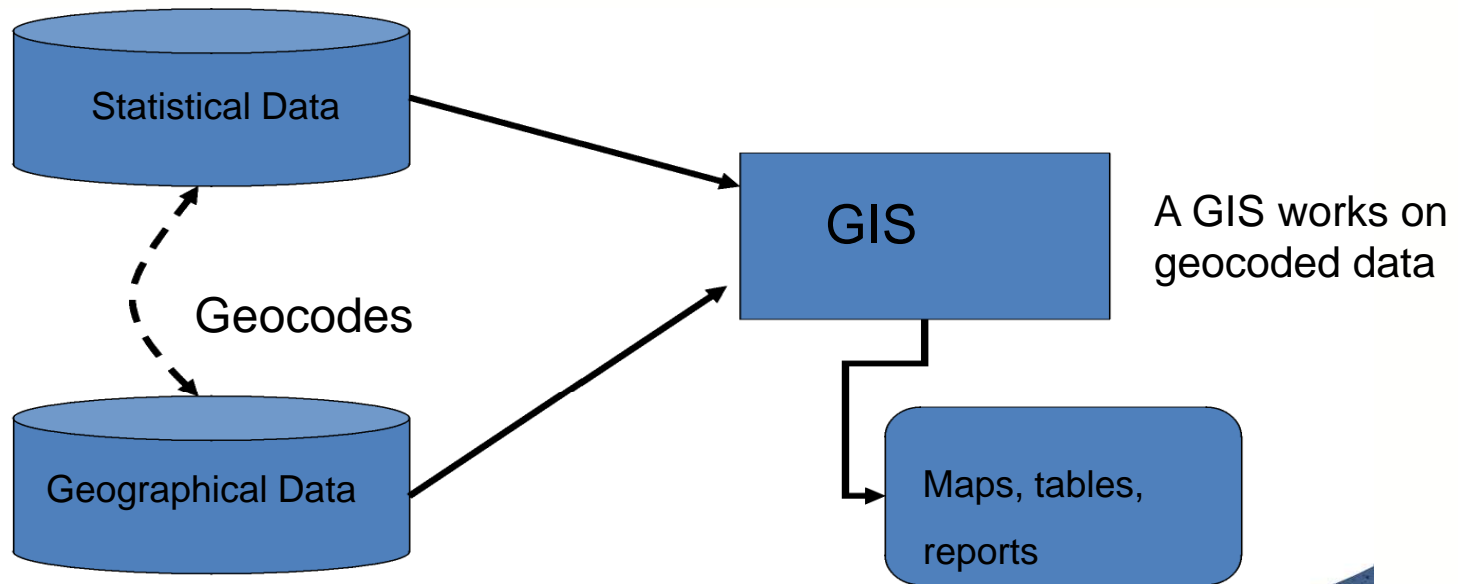
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# Coding Scheme

- Enumeration Area (EA): a basic geographic feature
- **Coding scheme:** relating EAs and administrative units:  
(A unique code assigned to each EA, used in data processing)
- Example of a hierarchical coding scheme:



# Geocoding



The Coding scheme is the basis to build a GIS which works on geocoded data.

Each NSO which has its coding scheme has already a “GIS”, even if it is not in a digital form!



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# Enumeration Area Map

Main components are:  
 Street network,  
 Buildings  
 EA boundaries layer  
 Annotation,  
 Symbols,  
 Labels  
 Building numbers  
 Neatlines  
 Legend



Enumeration Area Map

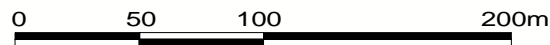
Province: Cartania 14  
 District: Chartes 032  
 Locality: Maptown 0221  
 EA-Code: 00361

Symbols

- District
- Locality
- EA
- Building number
- EA-Code
- Hospital
- Church
- School



Approximate scale



Census 2000 National Statistical Office - July 1998



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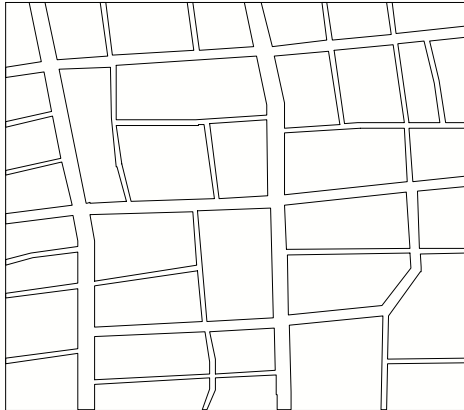
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# EA features stored as map layers in the same spatial reference system

Street Network



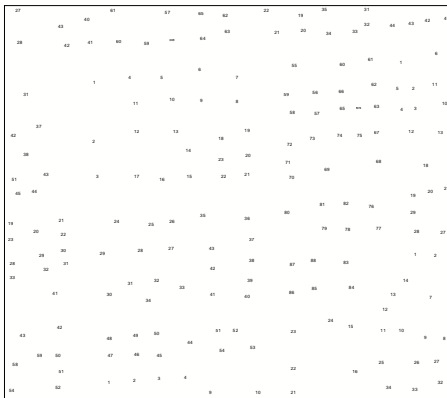
Buildings



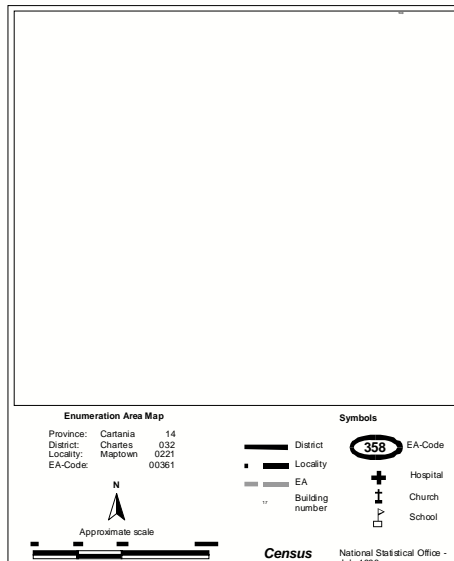
Boundaries



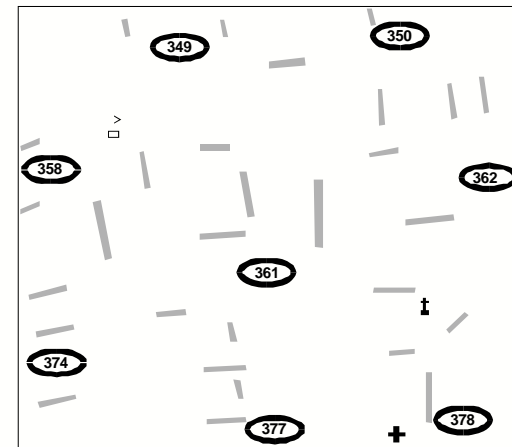
Building numbers



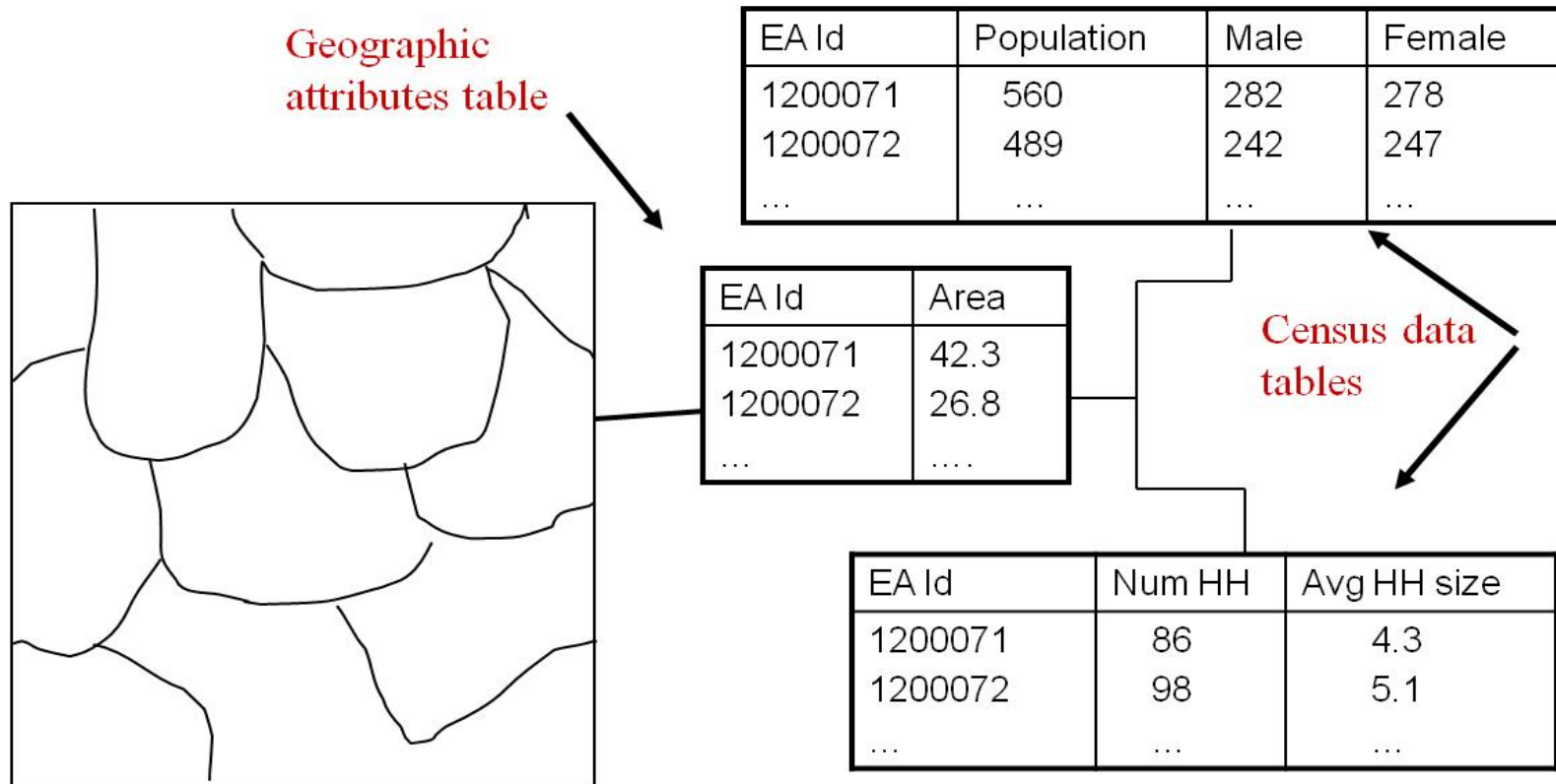
Neatlines and legend



Annotation and symbols



# Building a Geographic Database at EA level



Working with data stored in a geodatabase, you will organize and prepare data for (spatial) analysis, create geoprocessing models.

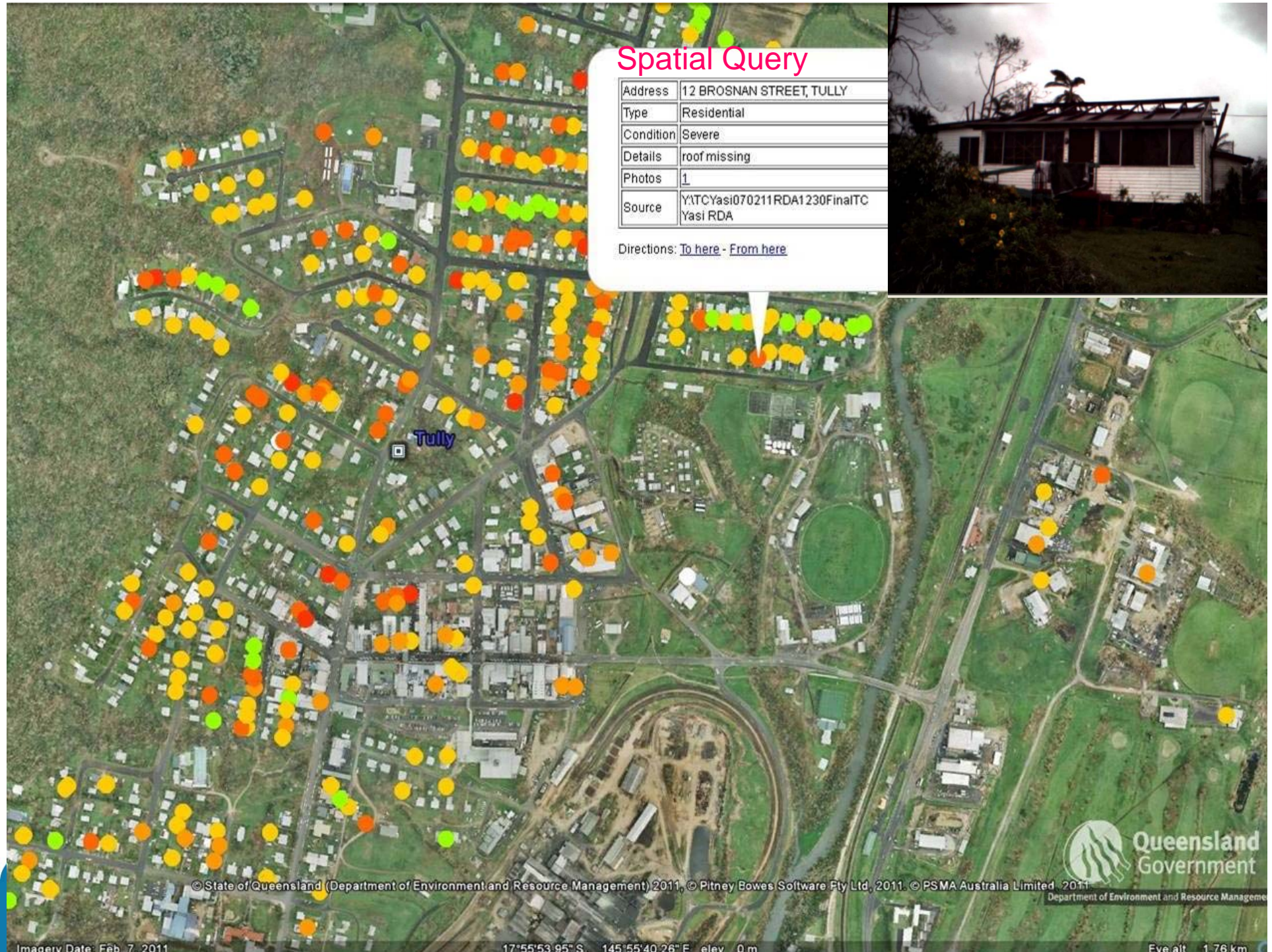




## Spatial Query

Address	12 BROSAN STREET, TULLY
Type	Residential
Condition	Severe
Details	roof missing
Photos	1
Source	Y:\TC\Yasi\070211RDA1230Final\TC Yasi RDA

Directions: [To here](#) - [From here](#)



© State of Queensland (Department of Environment and Resource Management) 2011, © Pitney Bowes Software Fly Ltd, 2011, © PSMA Australia Limited, 2011

Department of Environment and Resource Management

Imagery Date: Feb 7, 2011

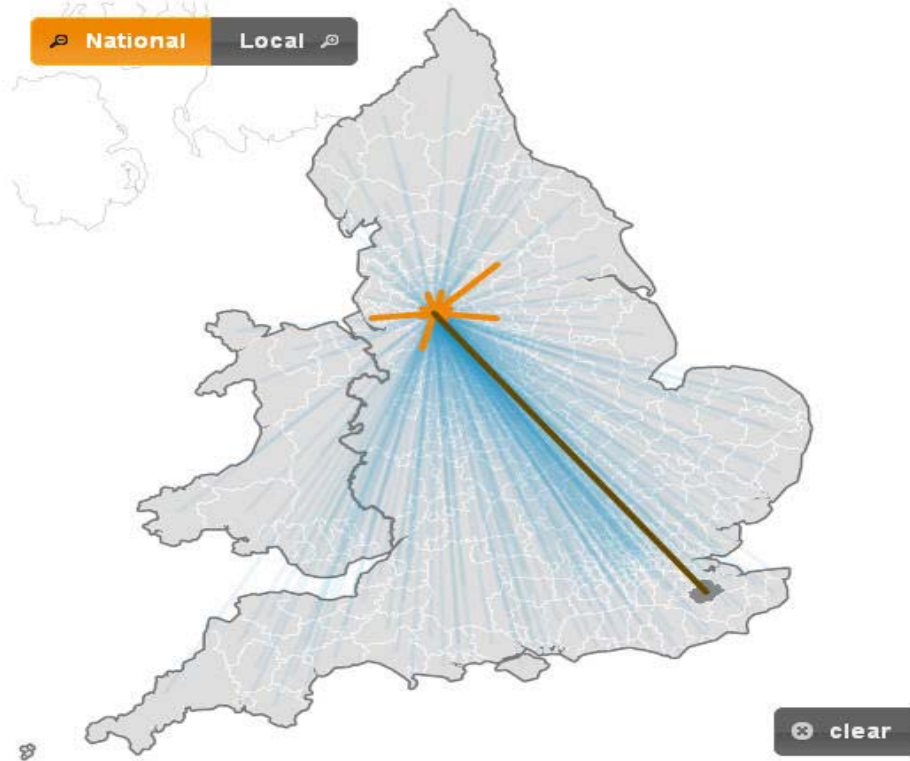
17°55'53.95" S, 145°55'40.26" E, elev. 0 m

Eye alt. 1.76 km



# Spatial Analysis/Migration Analytics

## Internal Migration in England & Wales, year ending June 2010



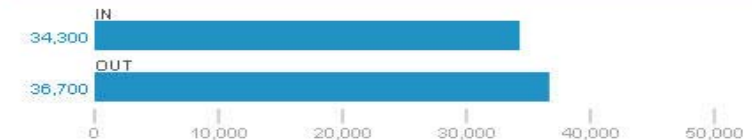
mouseover the map or the graph to see details of migration flows.  
click the 'clear' button to reset the map or use the list to select a different area

↓ To From ↑

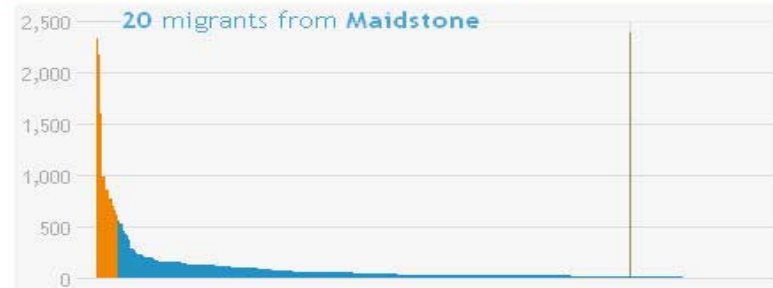
Manchester

### Manchester

inward and outward migration estimates



inward migration, ordered by total number of migrants



Significant flows highlighted using a method adapted from [Holmes and Haggett \(1977\)](#).

Graphic by [ONS Data Visualisation Centre](#)  
Data source: [ONS Migration Estimates \(published 18th October 2011\)](#)



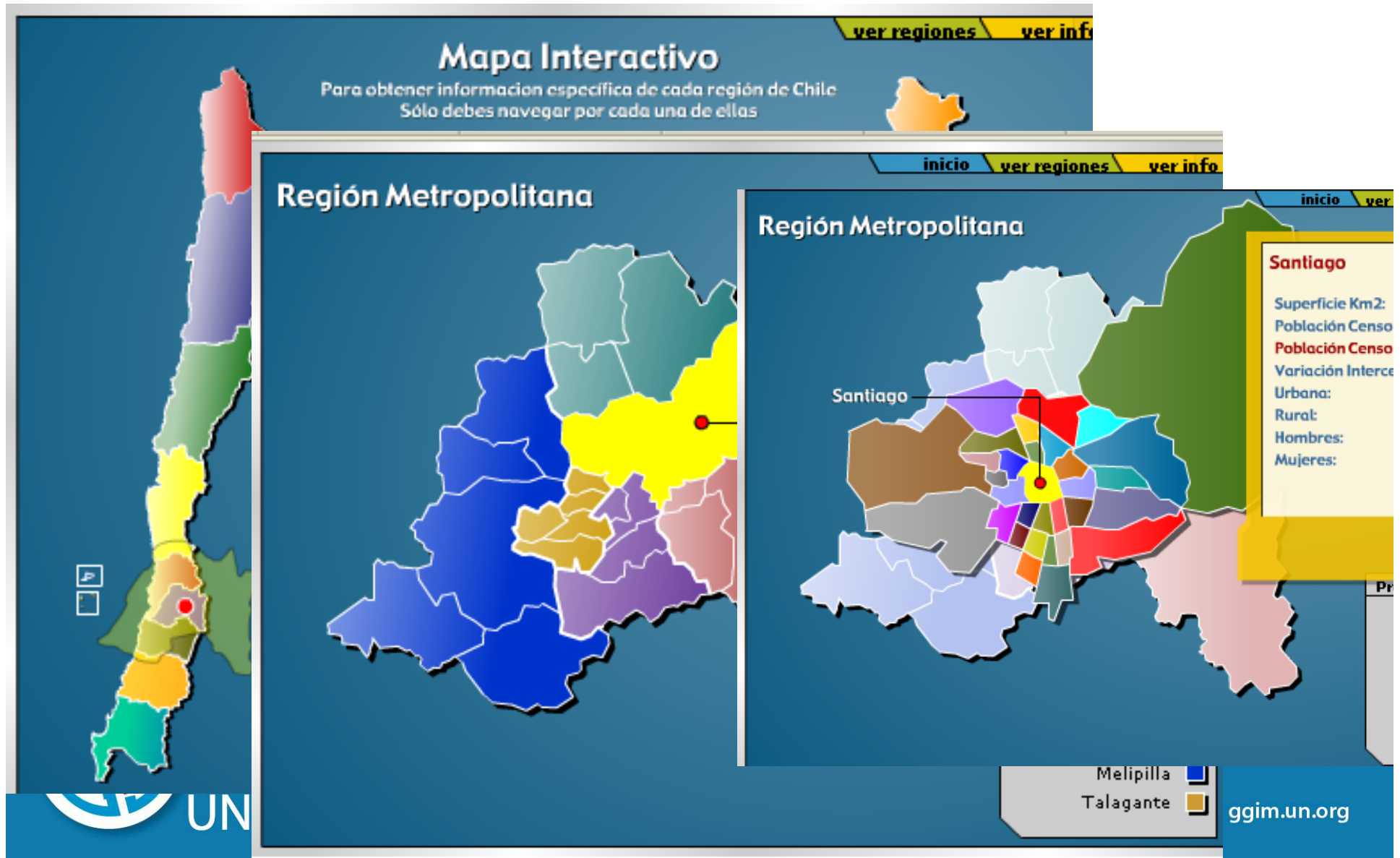
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# Interactive Map of Chile Administrative Districts-Atlases (Population and Housing Census 2002)



# Personal Digital Assistant (PDA):

## Integrated Field Data Collection

(Electronic Questionnaire + GPS, etc.)



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# Integrated Mobile Devices (PDA, Tablets) – Brazil: an example of massive use

- Data Collection and Entry:  
automated/built-in
- Embedded “GPS”: georeference units  
visited/track location of data  
entry/positioning and guidance of the  
enumerator
- Integrated field platforms with GPS,  
cellular, camera and OS applications
- Commercial or In-house devices, Tablet,  
Cell...



Figure 15 - Satellite image on PDA screen.





# Data Access



As technological developments and data availability advance rapidly, statistical agencies must be prepared to respond to user expectations for data access and interaction

Source: T. Trainor, US Census Bureau, 2009



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## Census Dissemination



- Customized to Census dissemination

- Use of SMS to disseminate some census results (e.g. Kenya)



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# Scalable Hardware - (Source: ESRI)



- Faster
- Multi Processors
- Loosely Coupled
- Connected

... and Services Oriented



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# Handbook on Geospatial Infrastructure in Support of Census Activities



- Audiences: managerial and technical
- “Cook-book” to illustrate the role of geospatial technology in each step of the census process
- Each country has to find its own best possible solution
- Available in the six UN official languages

<http://unstats.un.org/unsd/demographic/standmeth/handbooks/default.htm>



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## Regional Workshops on Census Mapping with GIS

- For English-speaking African countries: Lusaka, Zambia, 8-12 October 2007 : 30 participants from 14 countries
- ESCAP region: Bangkok, Thailand, 15-19 October 2007: 31 participants from 16 countries
- CARICOM: Port-o-Spain, Trinidad, 22-27 October 2007: 28 participants from 16 countries
- For French-speaking African countries: Rabat, Morocco, 12-16 November 2007: 48 participants from 10 countries
- for SPC region: Noumea, New Caledonia, 4-8 Feb. 2008: 30 participants from 10 countries and two territories
- ESCWA region: Doha, State of Qatar, 18-22 May 2008: 44 participants from 12 countries
- Latin America region: Santiago, Chile, 24-27 November, 2008: 47 participants from 17 countries
- CIS region: Minsk, Belarus, 8 - 12 December 2008, 41 participants from 11 countries

**(300 participants from 106 developing countries and two territories):**



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# Statistical Commission Decision on the Integration of Statistical and Geospatial Information

**Decision 41/110** (of the 41st SC session in 2010):

- Recognized the importance of the **integration of geographic and statistical information** and the opportunities provided in that context by the swift development of information technology, noting that national statistical offices are playing an increasing role in such integration, especially in the area of census management



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# UN Committee of Experts on Global Geospatial Information Management (UN-GGIM)

- **ECOSOC decision 2011/24** established the UN Committee of Experts on GGIM (UN-GGIM)
- “*Recognizing* the importance of **integrating cartographic and statistical information, as well as spatial data**, with a view to fostering location-based geospatial information, applications and services”



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# An Action Agenda for the Integration of Geospatial and Statistical Information

- Establishment of UN Expert Group on the Integration of Statistical and Geospatial Information
  - First meeting in New York, 30 Oct. – 1 Nov. 2013
- The United Nations will facilitate the collaboration of the two communities globally and nationally in:
  - **Developing a Statistical Spatial Framework**
    - Common geographic framework, fundamental to integration
    - Need for appropriate standards to support the integration
- International Workshop on Integrating Geospatial and Statistical Information, Beijing, 9-12 June 2014
- Global Forum on the Integration of Statistical and Geospatial Information- New York, 4-5 August 2014



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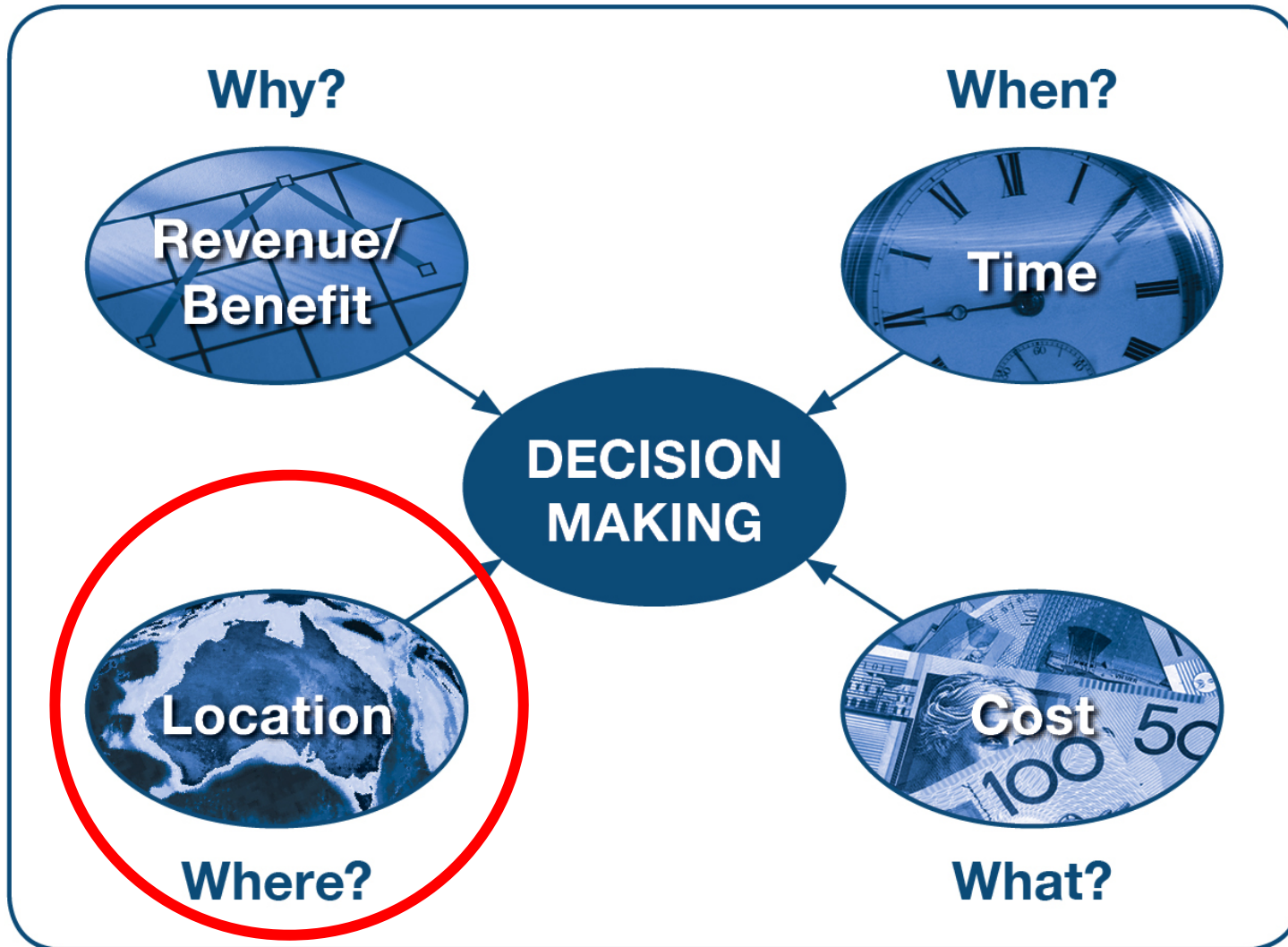
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# Conclusions:

- **Location matters!**
- The revision of UN Principles & Recommendations for the 2020 Round of Censuses has shown that NSOs are increasingly recognizing the importance of the use of Geospatial tools (GIS, GPS, Imagery, Web Mapping, etc.) in support of statistical activities
- **Strong Recommendation:** Census Geography/Mapping should be a continuous process
- Need for cooperation between NSOs and NMAs to develop a national geospatial infrastructure in support of statistical activities
- Integration of Statistical and Geospatial Information is key for Evidence-based Decision Making
- Driver: “Data Revolution”... “Big Data”

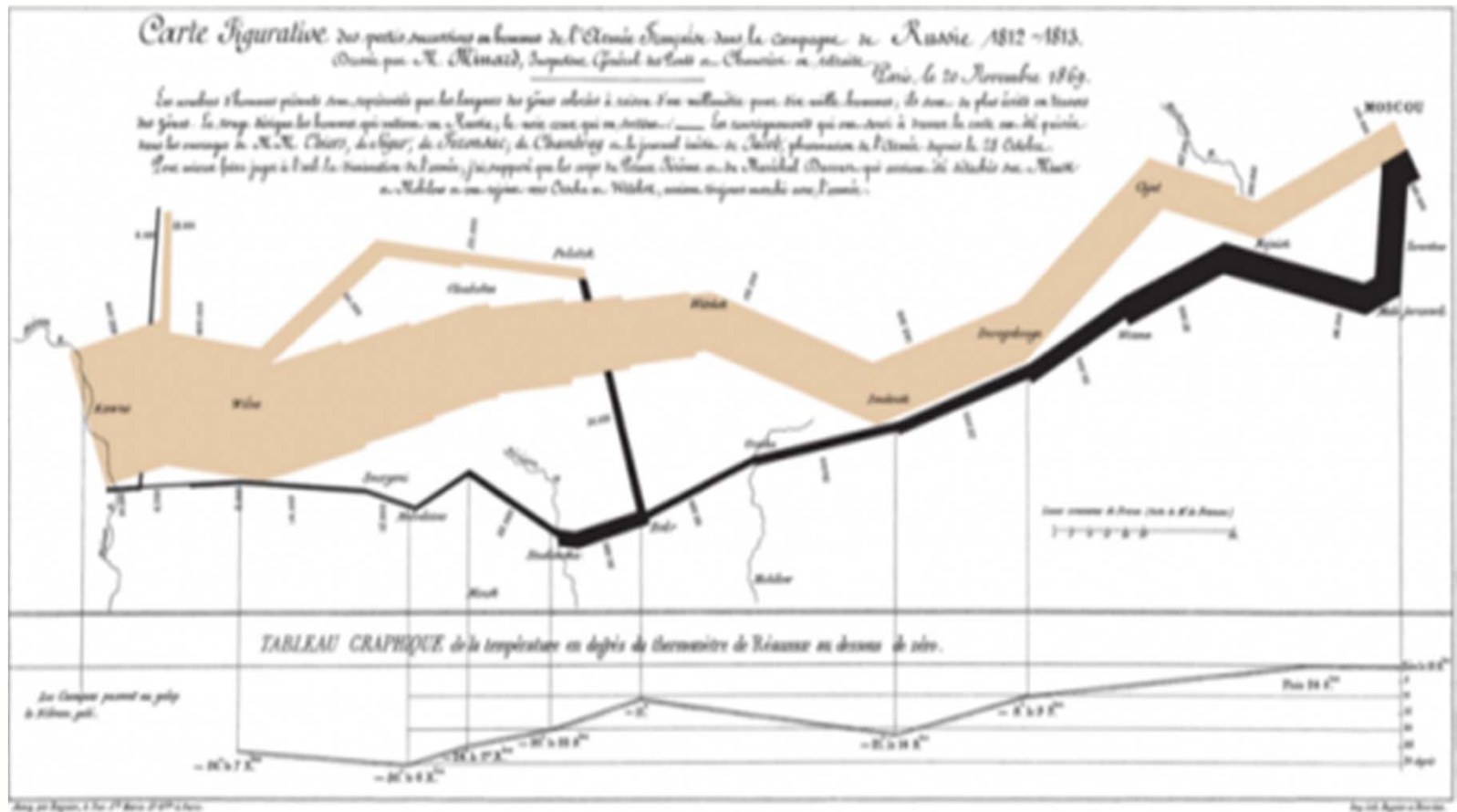


# Paradigm shift: Location is the 4<sup>th</sup> dimension of decision making





# Vital Statistics of a Deadly Campaign: the Minard Map



**THANK YOU !!**

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