Open Data and Spatial Data Infrastructure

Guest Lecture

for the Department of Computer Science of

the University of Hong Kong

Presented by TSOI Cheong-wai

Chief Land Surveyor/ Development

Lands Department, 7 January 2021

Spatial Data

An Example of Spatial Data

A nighttime view of the Earth, from data captured by the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument on board the joint NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite. It shows visible light originating from anthropogenic sources (such as city lights and other human-driven patterns). The image composite was assembled from clear, cloud free images for 2012 and 2016. (Source: https://earthobservatory.nasa.gov/features/NightLights)

Another Example of Spatial Data

顯示：第 1 - 432 筆，共 432 筆記錄　特徵 ▼　　註　下載數據 ▼

		按上課地點劃分的於香港院校就讀全日制課程的人口					按性別劃分的勞動人口	
數據集名稱	區議會選區名稱	同區就讀 (3)	跨區就讀（上課地點為香港島）	跨區就讀（上課地點為九龍）	跨區就讀（上課地點為新市鎮）	跨區就讀（上課地點為新界其他地區）	勞動人口	男性	女性
2016 年中期人口統計 - 地區概覽（選區）	沙田 - 沙田市中心	1814 人	124 人	1004 人	376 人	12 人	10513 人	4916 人	5597 人
2016 年中期人口統計 - 地區概覽（選區）	沙田 - 穗禾	1114 人	93 人	457 人	88 人	22 人	6743 人	3296 人	3447 人
2016 年中期人口統計 - 地區概覽（選區）	沙田 - 新田圍	1565 人	54 人	414 人	194 人	34 人	8010 人	4234 人	3776 人

2016 Population By-census - District Profiles (Constituency Areas), Census and Statistics Department

What is Spatial Data?

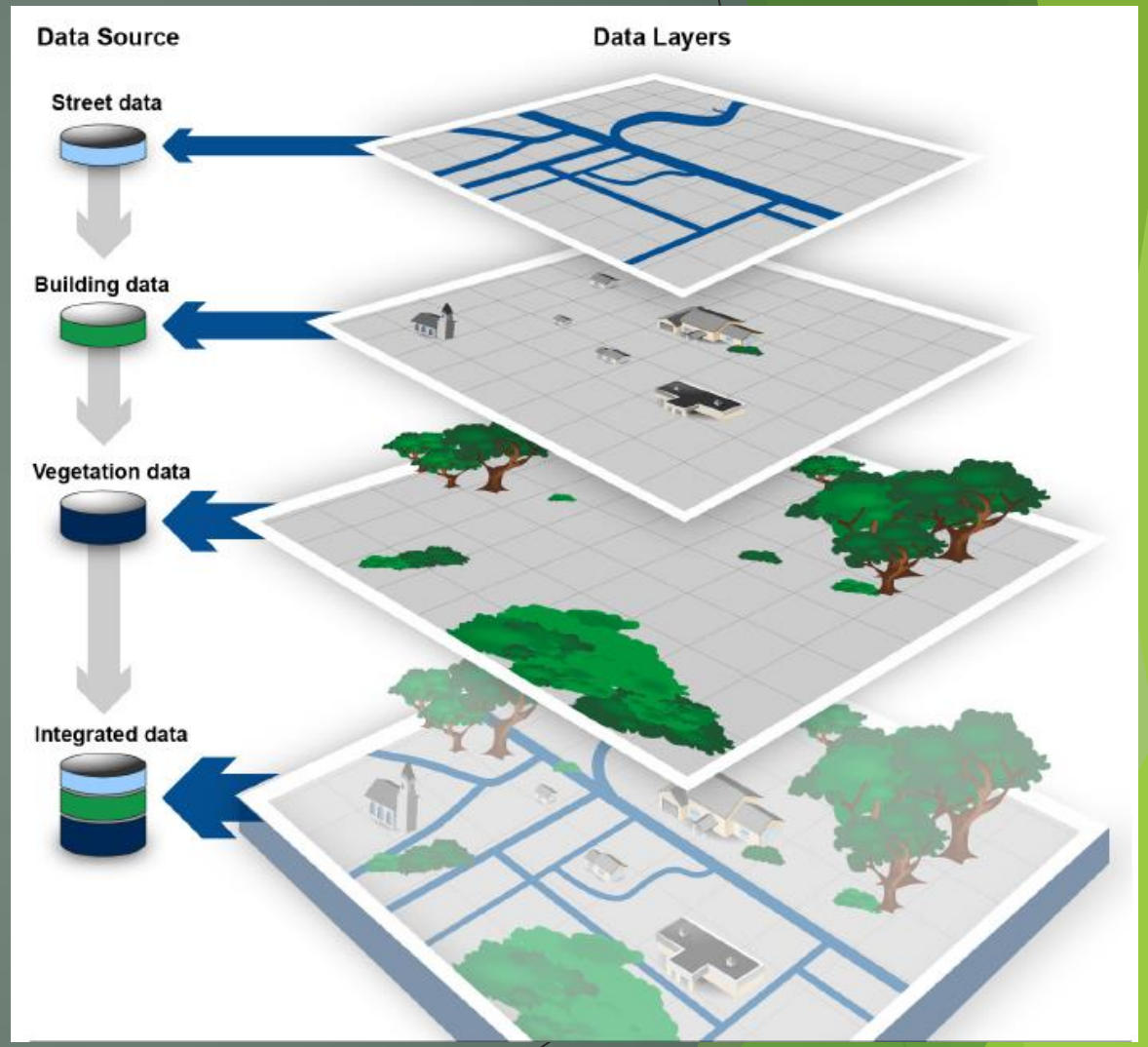
Spatial Data - data describing anything **with spatial extent** (i.e. size, shape or position) *(from W3C Working Group Note)*

Geospatial Data - **Location properties** related to any **terrestrial feature or phenomena**. Location properties may include any information about the location or area of, and relationships among, and **descriptive information about geographic features and phenomena**. This includes remotely sensed data, vector map data, addresses, coordinates, etc. *(from OGC Glossary)*

Sources: https://www.w3.org/TR/sdw-bp/#dfn-spatial-data, https://www.ogc.org/ogc/glossary/g

Types of Spatial Data

- Vector data – points, lines, polygons
- Raster data - a matrix of cells (or pixels) organized into rows and columns where each cell contains a value representing information
- Textual attributes



Source: "Geospatial Data - Progress needed on identifying expenditures, building and utilizing a data infrastructure, and Reducing Duplicative Efforts", US Government Accountability Office, 2015. https://www.gao.gov/assets/670/668494.pdf

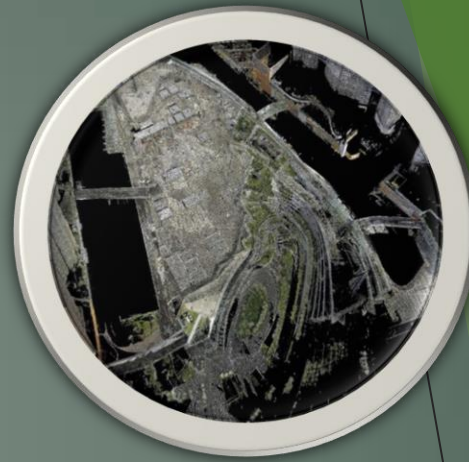
Spatial Data Collection

Some Digital Formats of Spatial Data

GML/FGDB/GeoJSON
(GIS)

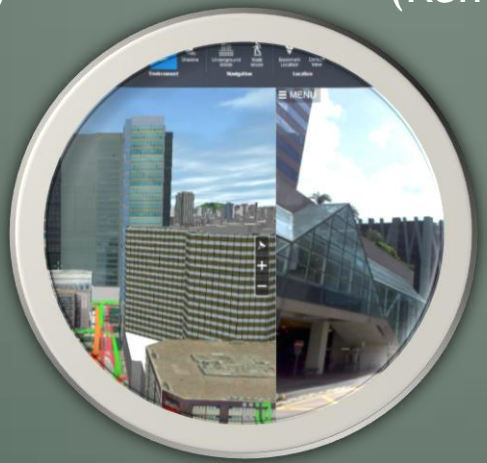
DGN/DXF
(CAD)

GeoTIFF/IMG
(Remote Sensing)

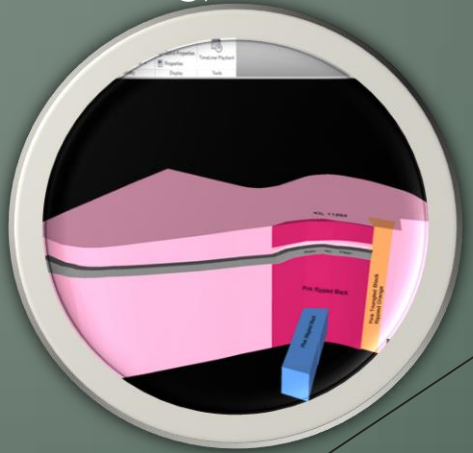


LAS
(Point Cloud)

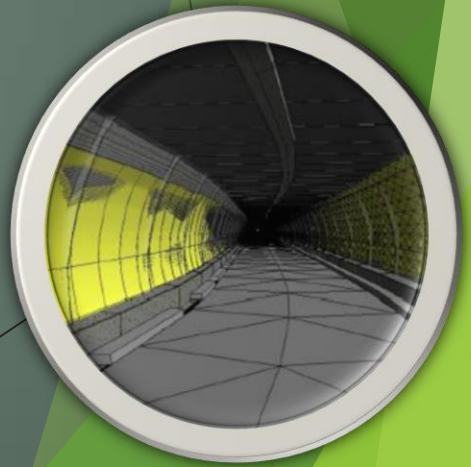
OBJ/3D Tiles
(3D Model)



CSV/MDB/XLS
(Tables)



CityGML/CityJSON
(3D Model)



IFC/RVT
(BIM)

Spatial Data Infrastructure (SDI)

History of SDI

Year	Countries	Events
1986	Australia	Establishment of the Australian Land Information Council (ALIC) was aim to promote the use of spatial data in decision making (ANZLIC 1992, p.1).
1987	United Kingdom	Report of the British Government Committee reflects the need for greater user awareness and the availability of geographic information for particular applications.
1990	United States	Federal Geographic Data Committee was established to coordinate the 'development, use, sharing and dissemination of surveying, mapping and related spatial data'.
1991	Canada	John McLaughlin presented a paper "Toward National Spatial Data Infrastructure".
1993	Europe	The first continental level SDI organisation in the world was set up – European Umbrella Organisation for Geographic Information (EUROGI).
1994	United States	Publication of Executive Order 12906 signed by President Bill Clinton entitled "Coordinating Geographic Data Acquisition and Access: the National Spatial Data Infrastructure".

From:

1) Masser I., (2005) "The Future of Spatial Data Infrastructure", ISPRS Workshop on Service and Application of Spatial Data Infrastructure, Paper presented at the, Hangzhou, China.
2) Schade S. et al. (2020) "Geospatial Information Infrastructures". In: Guo H., Goodchild M.F., Annoni A. (eds) Manual of Digital Earth. Springer, Singapore. Internet Access: https://doi.org/10.1007/978-981-32-9915-3_5

The First NSDI

National Spatial Data Infrastructure (NSDI)

- Aim: To advance the goals of the National Information Infrastructure; and to avoid wasteful duplication of effort and promote effective and economical management of resources

From:

1) Executive Order 12906 (1994), "COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE", Presidential Documents, Federal Register Vol. 59, No. 71, April 13 1994, Internet Access: https://www.archives.gov/files/federal-register/executive-orders/pdf/12906.pdf

Definition of National Spatial Data Infrastructure (NSDI)

- Means the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data

From:

1) Executive Order 12906 (1994), "COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE", Presidential Documents, Federal Register Vol. 59, No. 71, April 13 1994, Internet Access: https://www.archives.gov/files/federal-register/executive-orders/pdf/12906.pdf

Key Elements of NSDI

- Development of a National Geospatial Data Clearinghouse
  - Establishing a electronic National Geospatial Data Clearinghouse
  - Standardized Documentation of Data and making data documentation electronically accessible to the Clearinghouse network
  - Public Access to Geospatial Data

From:

1) Executive Order 12906 (1994), "COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE", Presidential Documents, Federal Register Vol. 59, No. 71, April 13 1994, Internet Access: https://www.archives.gov/files/federal-register/executive-orders/pdf/12906.pdf

Key Elements of NSDI

- Data Standards Activities
  - General Federal Geographic Data Committee (FGDC) Responsibility. The FGDC shall develop standards for implementing the NSDI, in consultation and cooperation with State, local, and tribal governments, the private and academic sectors, and, to the extent feasible, the international community
  - The FGDC will promote the use of such standards and such standards shall be submitted to the Department of Commerce for consideration as Federal Information Processing Standards

From:

1) Executive Order 12906 (1994), "COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE", Presidential Documents, Federal Register Vol. 59, No. 71, April 13 1994, Internet Access: https://www.archives.gov/files/federal-register/executive-orders/pdf/12906.pdf

Key Elements of NSDI

- National Digital Geospatial Data Framework
  - The framework shall include geospatial data that are significant to a broad variety of users within any geographic area or nationwide
- Partnerships for Data Acquisition
  - The Secretary of DOI, under the auspices of the FGDC, shall develop strategies for maximizing cooperative participatory efforts with State, local, and tribal governments, the private sector, and other nonfederal organizations to share costs and improve efficiencies of acquiring geospatial data

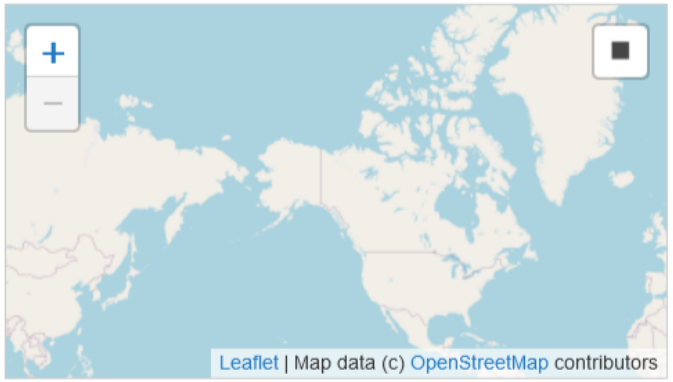
From:

1) Executive Order 12906 (1994), "COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE", Presidential Documents, Federal Register Vol. 59, No. 71, April 13 1994, Internet Access: https://www.archives.gov/files/federal-register/executive-orders/pdf/12906.pdf

GeoPlatform.gov Data.gov Search

Help Sign In

Search by geography



Selected Facets Clear all

Dataset Type "geospatial" ×

— ORGANIZATIONS show all

National Oceanic and Atmospheric Administration, Department of Commerce	81287
Department of the Interior	19100
NSGIC Local Govt | GIS Inventory	9479
Federal Emergency Management Agency, Department of Homeland Security	8109
National Aeronautics and Space Administration	7726

— TAGS show all

—	92250
earth science	56432

HTML Esri REST GeoJSON CSV KML + 1 more

Telecommunications Projects in Loudoun County - Interactive Map

County

Loudoun County, Virginia

This interactive map includes build telecommunication facilities, dark fiber (both future and in progress), and other telecommunication-related data.

HTML Esri REST

Loudoun Metrorail Station Service Districts

County

Loudoun County, Virginia

More Metadata

Loudoun County's Metrorail station service districts were established on December 5, 2012 to fund the construction and maintenance of the

HTML Esri REST GeoJSON CSV KML + 1 more

Ocean currents from lowered acoustic Doppler current profilers (LADCP) of the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP) aboard R/V T.G.Thompson cruise TN366 along WOCE-Line I06S from 2019-04-03 to 2019-05-14 (NCEI Accession 0221750)

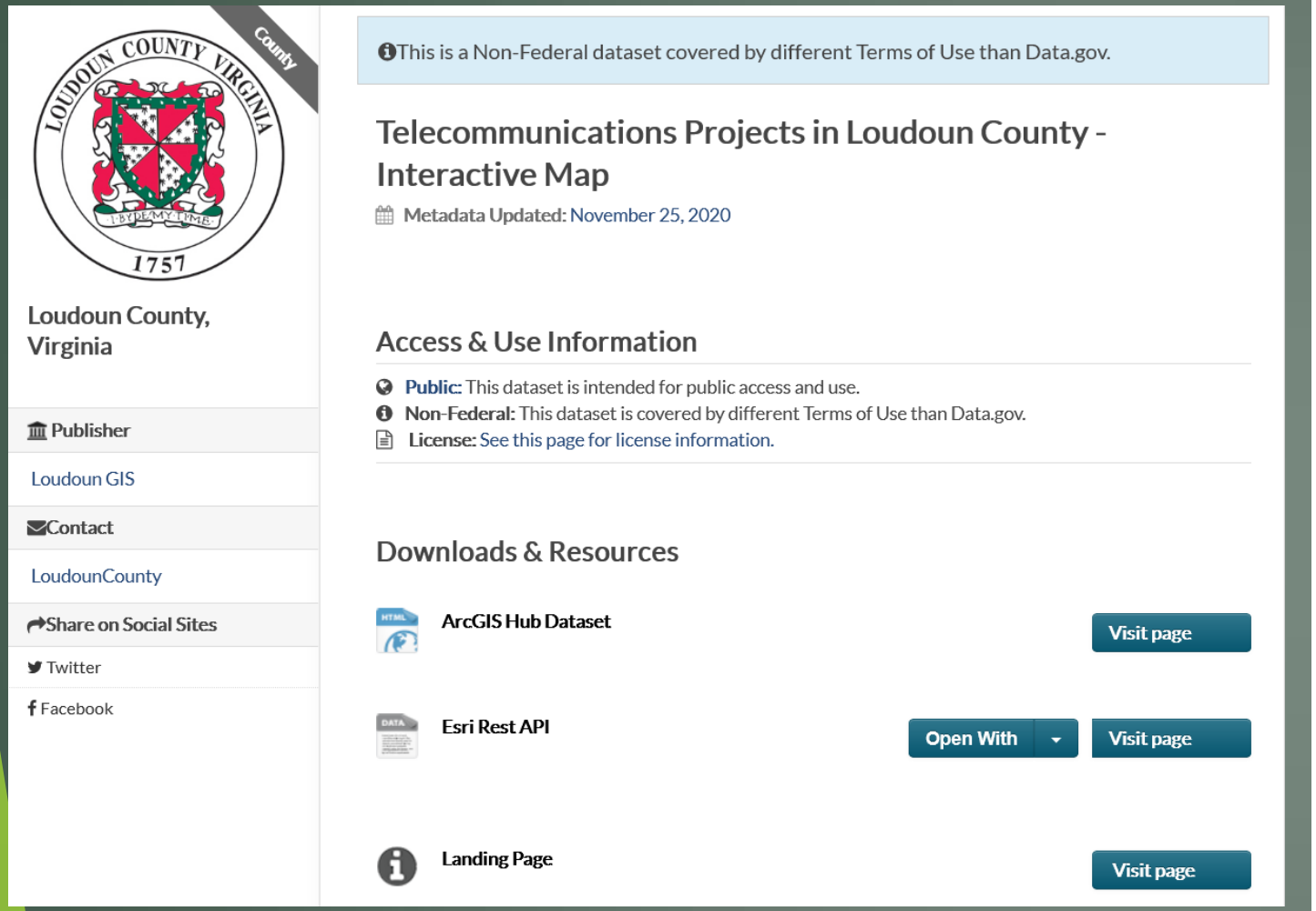
Federal

National Oceanic and Atmospheric Administration, Department of Commerce

This data set contains the Lowered Acoustic Doppler Current Profile (LADCP) estimates of ocean currents and shear in a profile to deep waters from the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP). A raw and a processed version are given in each dataset,

Picture From:

1) https://data.geoplatform.gov/



Loudoun County, Virginia

Publisher

Loudoun GIS

Contact

LoudounCounty

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This is a Non-Federal dataset covered by different Terms of Use than Data.gov.

Telecommunications Projects in Loudoun County - Interactive Map

Metadata Updated: November 25, 2020

Access & Use Information

Public: This dataset is intended for public access and use.

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Downloads & Resources

ArcGIS Hub Dataset — Visit page

Esri Rest API — Open With | Visit page

Landing Page — Visit page

Picture From:

1) https://catalog.data.gov/dataset/telecommunications-projects-in-loudoun-county-interactive-map

Metadata Source

Data.json Metadata

Download Metadata

Harvested from Loudoun County Virginia Data Source

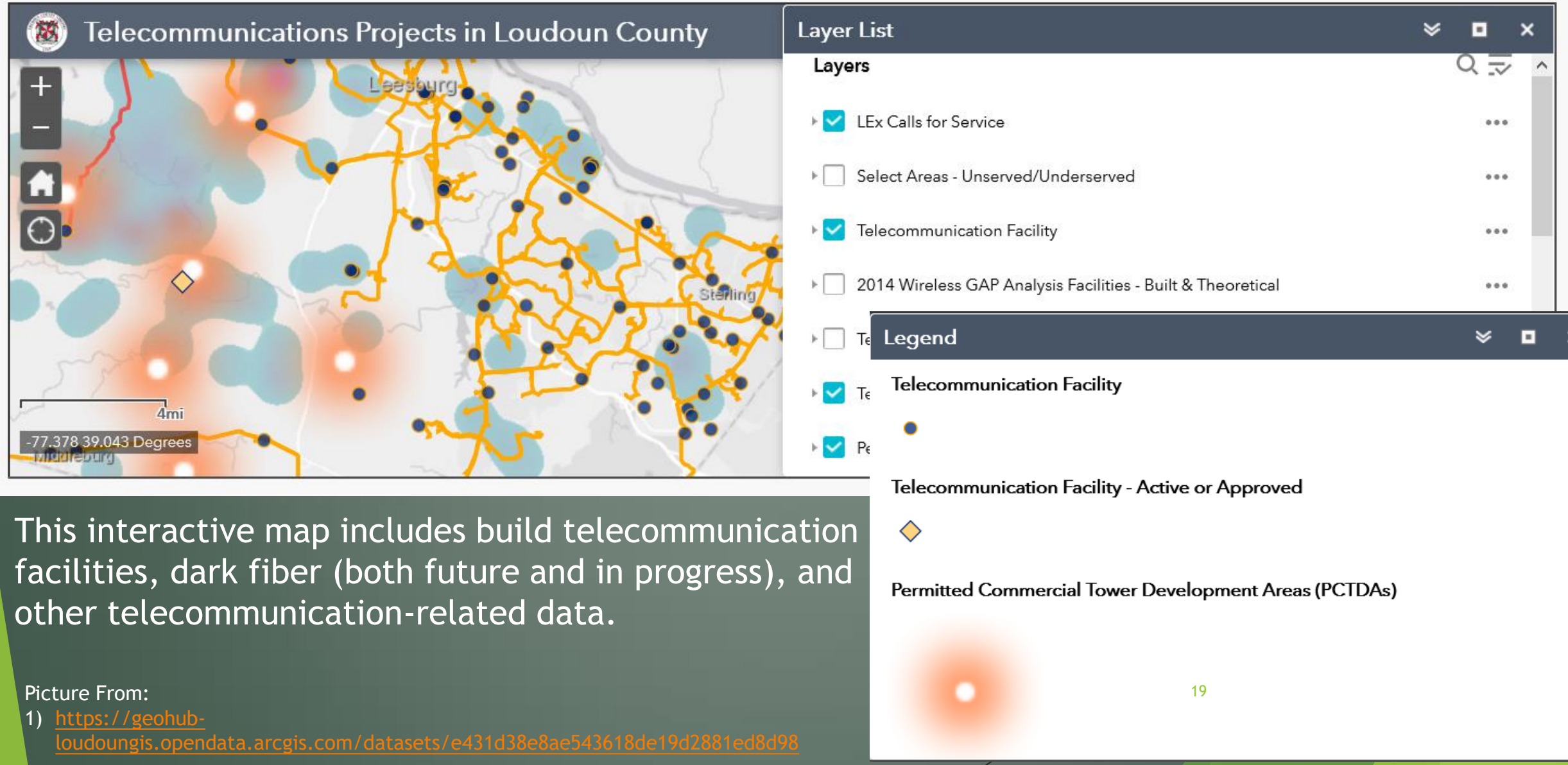
broadband | cable | dark-fiber | planning | telecom | telecom-facilities | telecommunication | tower | utlilties

Additional Metadata

Resource Type	Dataset
Metadata Created Date	November 25, 2020
Metadata Updated Date	November 25, 2020
Publisher	Loudoun GIS
Unique Identifier	https://geohub-loudoungis.opendata.arcgis.com/datasets/e431d38e8ae543618de19d2881ed8d98
Maintainer	mapping@loudoun.gov
Public Access Level	public
Metadata Context	https://project-open-data.cio.gov/v1.1/schema/catalog.jsonld
Schema Version	https://project-open-data.cio.gov/v1.1/schema
Catalog Describedby	https://project-open-data.cio.gov/v1.1/schema/catalog.json
Harvest Object Id	6f2ec140-24eb-4a1a-8e5b-6a3334c22689
Harvest Source Id	b3dfc5f6-ea56-4068-a610-27217b3b24cd
Harvest Source Title	Loudoun County Virginia Data Source
Data First Published	2020-11-11T14:25:32.000Z
Homepage URL	https://geohub-loudoungis.opendata.arcgis.com/datasets/e431d38e8ae543618de19d2881ed8d98
License	https://geohub-loudoungis.opendata.arcgis.com/datasets/e431d38e8ae543618de19d2881ed8d98/license.json
Metadata Type	geospatial
Data Last Modified	2020-11-24T21:43:29.000Z
Source Datajson Identifier	True
Source Hash	9cacb28c9c2572079afaa69137ad3da9c2592b2f
Source Schema Version	1.1
Spatial	-78.874,37.946,-75.93,39.777
Category	geospatial

Telecommunications Projects in Loudoun County - Interactive Map

Last updated 2 days ago



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Picture From:

1) https://geohub-loudoungis.opendata.arcgis.com/datasets/e431d38e8ae543618de19d2881ed8d98

Transnational SDI for the Environment

inspire.ec.europa.eu

Joint Research Centre

Access from: https://youtu.be/xew6qI-6wNk

Quick search
- Data and Service Sharing
- Data Specifications
- Implement
- INSPIRE
- INSPIRE in your Country
- Learn
- Maintenance and Implementation
- Metadata
- MIG Workprogramme
- Monitoring and Reporting
- Network Services
- Participate
- Spatial Data Services
- Use

INSPIRE Directive

The INSPIRE Directive, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment entered into force in May 2007.

INSPIRE is based on the infrastructures for spatial information established and operated by the Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. This makes INSPIRE a unique example of a legislative "regional" approach.

Legislation

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) was published in the official Journal on the 25th April 2007. The INSPIRE Directive entered into force on the 15th May 2007

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). These IRs are adopted as Commission Decisions or Regulations, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Member States and chaired by a representative of the Commission (this is known as the Comitology procedure).

- Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) 14.03.2007
- INSPIRE Metadata Regulation 03.12.2008

Picture From:
1) https://inspire.ec.europa.eu/inspire-directive/2

INSPIRE SDI Definition

- ‘Infrastructure for Spatial Information’ means:
  - metadata, spatial data sets and spatial data services;
  - network services and technologies;
  - agreements on sharing, access and use; and
  - coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the INSPIRE Directive

From:

1) The European Parliament and The Council of the European Union (2007), “Directive 2007/2/EC of the European Parliament and the Council, establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)”, Journal of the European Union, L108/1, 25 April 2007. Internet Access: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007L0002

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2007 "Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)"

- (14) The implementation of the national infrastructures should be progressive and, accordingly, the spatial data themes covered by this Directive should be accorded different levels of priority.
- Article 1 (2.) Inspire shall build upon infrastructures for spatial information established and operated by the Member States
- Article 20. The implementing rules referred to in this Directive shall take due account of standards adopted by European standardization bodies in accordance with the procedure laid down in Directive 98/34/EC, as well as international standards

From:
1) The European Parliament and The Council of the European Union (2007), "Directive 2007/2/EC of the European Parliament and the Council, establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)", Journal of the European Union, L108/1, 25 April 2007. Internet Access: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007L0002

INSPIRE Data Specifications

INSPIRE
Infrastructure for Spatial Information in Europe

D2.8.II.4 Data Specification on *Geology* – Technical Guidelines

Title	D2.8.II.4 INSPIRE Data Specification on *Geology* – Technical Guidelines
Creator	INSPIRE Thematic Working Group *Geology*
Date	2013-12-10
Subject	INSPIRE Data Specification for the spatial data theme *Geology*
Publisher	European Commission Joint Research Centre
Type	Text
Description	This document describes the INSPIRE Data Specification for the spatial data th *Geology*
Contributor	Members of the INSPIRE Thematic Working Group *Geology*
Format	Portable Document Format (pdf)
Source	
Rights	Public
Identifier	D2.8.II.4_v3.0
Language	En
Relation	Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2 establishing an Infrastructure for Spatial Information in the European Comm (INSPIRE)
Coverage	Project duration

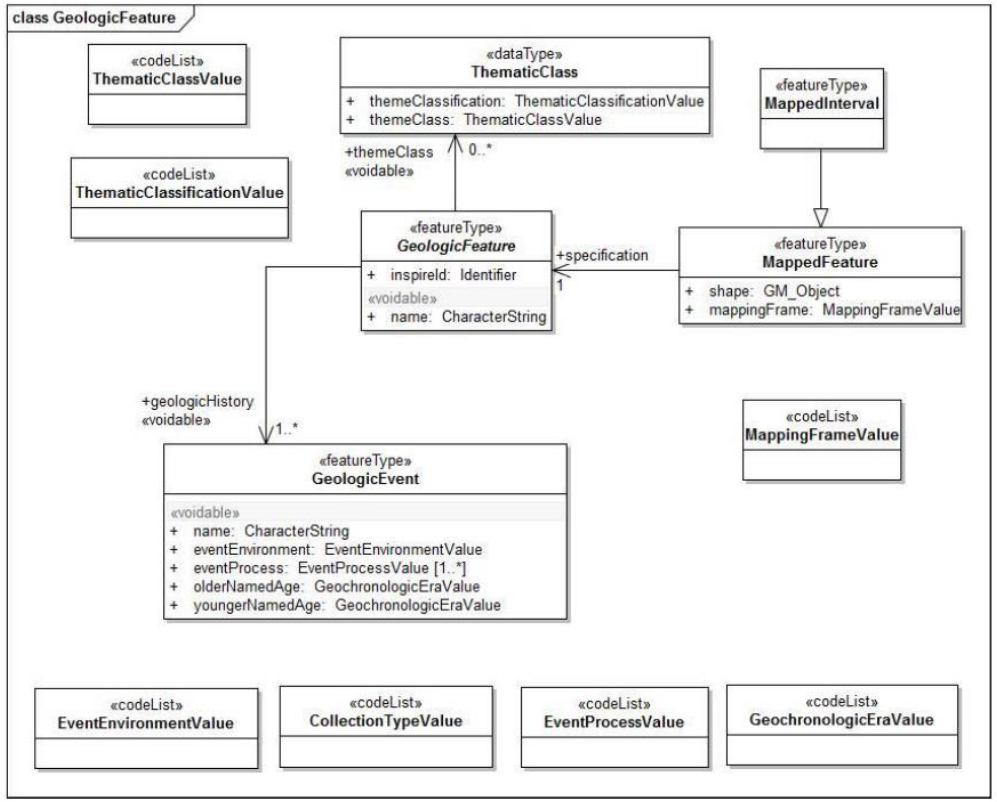

Figure 5 – UML class diagram: GeologicFeature, MappedFeature, GeologicEvent, ThematicClass

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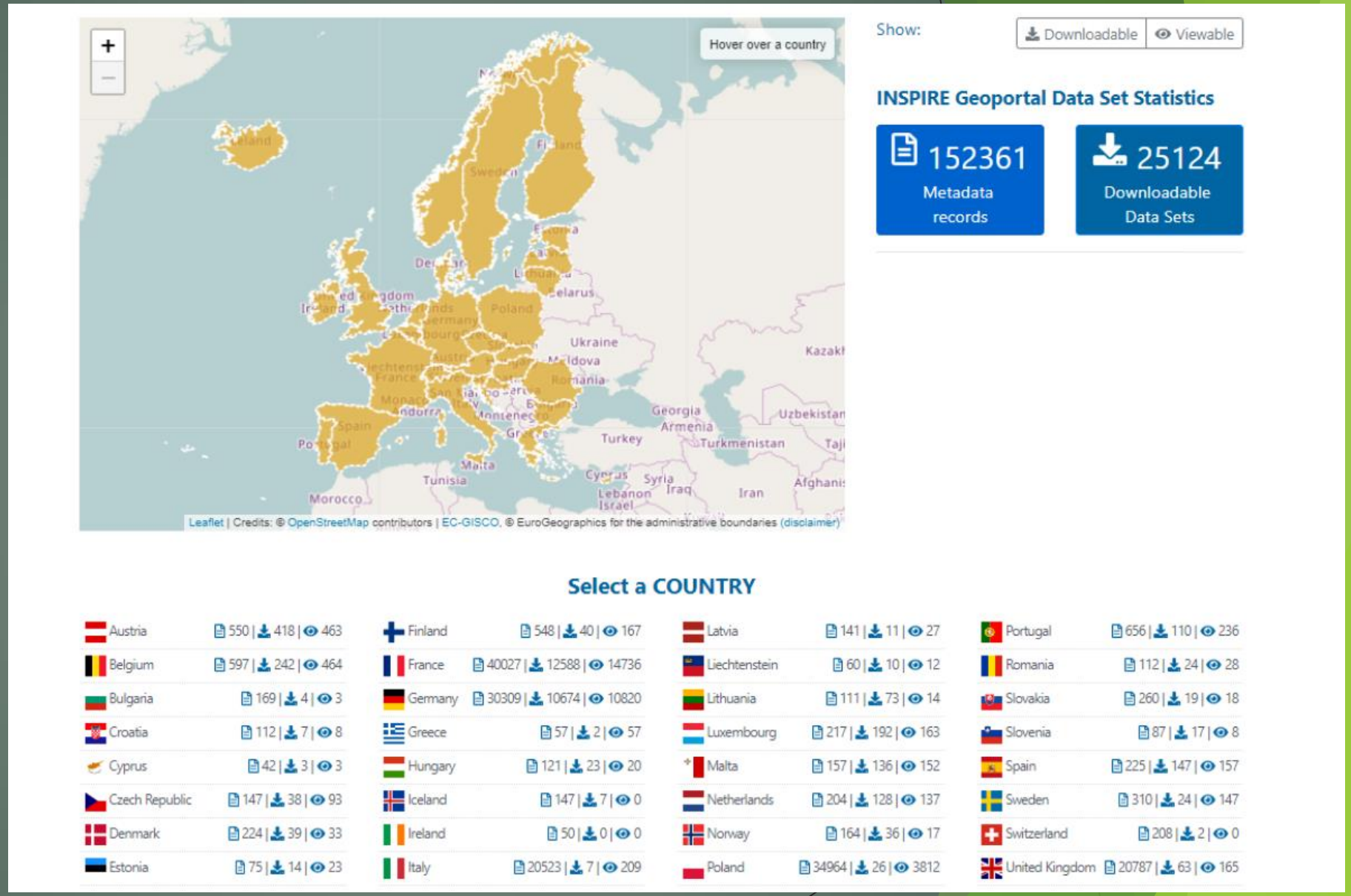
From:

1) European Commission Joint Research Centre (2013), "INSPIRE Data Specification on Geology – Technical Guidelines", December 10, 2013, Internet Access: https://inspire.ec.europa.eu/id/document/tg/ge

Data Availability in the European INSPIRE Geoportal as of October 2019

1. no. of datasets for which a metadata record exists
2. no. of datasets for which an INSPIRE View Service exists
3. no. of data sets for which an INSPIRE Download Service exists



From:

1) Kotsev, A. et al, (2020) “From Spatial Data Infrastructures to Data Spaces — A Technological Perspective on the Evolution of European SDIs”, ISPRS Int. J. Geo-Inf. 2020, 9, 176

Technologies underpinning SDI Development

Technologies Relevant to SDI

- Land Survey and Mapping
- Remote Sensing (RS)
- Geographic Information System (GIS)
- Mobile Mapping System (MMS)
- 3D City Models, Building Information Models (BIM)
- Machine learning, Artificial Intelligence (A.I.)
- Sensor Webs, Internet of Things (IoT)
- Big Data
- Cloud Computing, etc.

Interoperability and SDI

Interoperability

- Key element to support sharing and accessibility of spatial data is standard. It is the definition of common interfaces to enable interoperability.

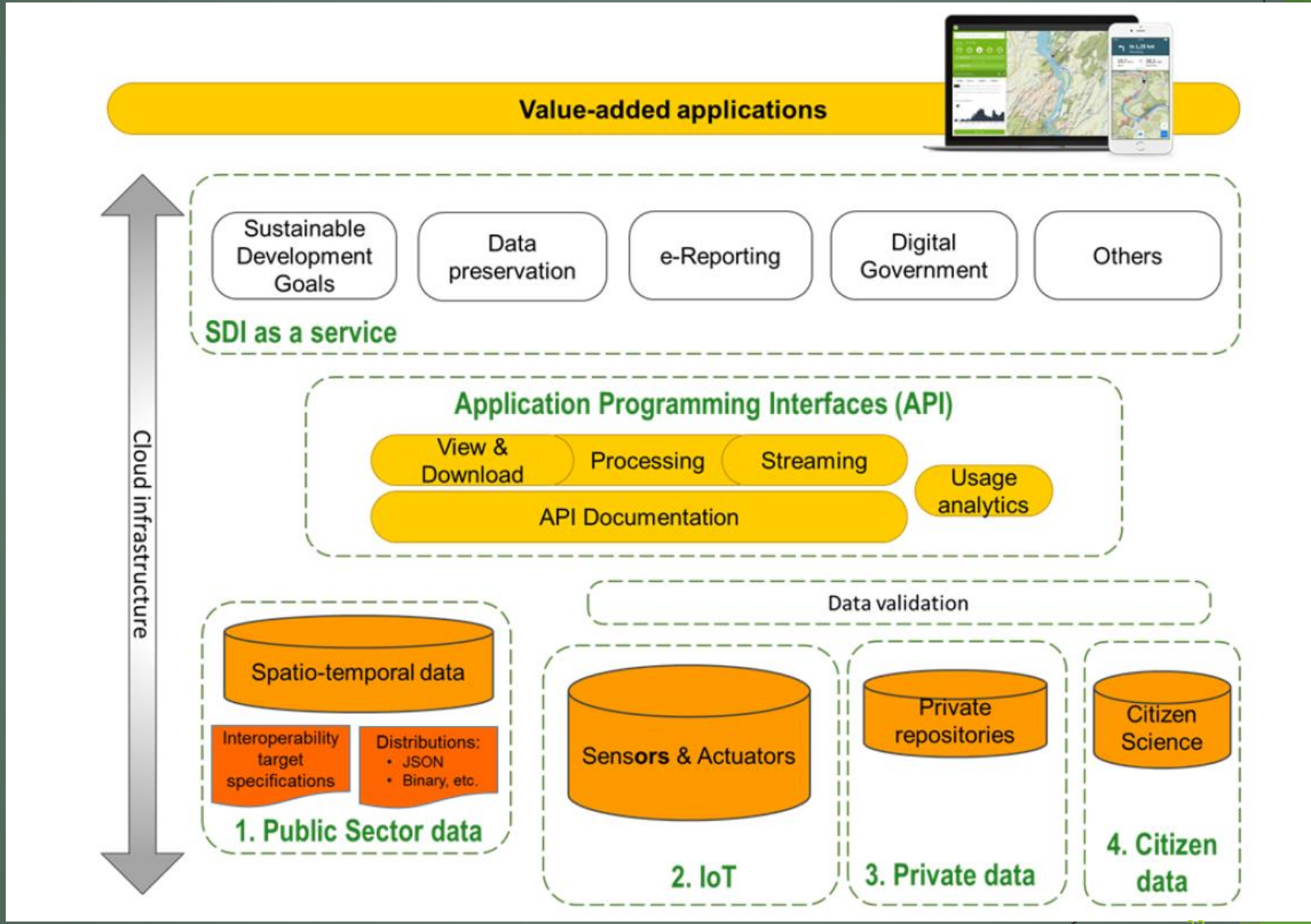
- Interoperability definition: “The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units” *(ISO/IEC 2382-1:1993(en) Information technology — Vocabulary)*

- (e.g. European Union INSPIRE Directive emphasizing ISO and OGC standards for improved interoperability)

OGC and ISO Standards Relevant to SDI

- Discovery service:
  - OGC Catalogue Service for the Web (CSW)
- View service:
  - ISO 19128 : WMS (Web Map Service)
- Download service:
  - Web Feature Service: OGC WFS / ISO 19142
- Coordinate Transformation service:
  - This standard addresses a key requirement for overlaying views of geodata (“maps”) from diverse sources: the ability to perform coordinate transformation in such a way that all spatial data are defined relative to the same spatial reference system (https://www.ogc.org/standards/ct)
- etc.

A Modern Architecture of SDI



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SDI Endeavors in Hong Kong

Issues Affecting Spatial Data Sharing in Government

- Data scattered in different departments
- Data stored in different formats, structures and IT systems
- Data control by different data creators/managers
- Data creation or updating workflows not always enforced
- Departments have different job priorities
- Departments have different views on data sharing
- (e.g. quality, completeness, liability)

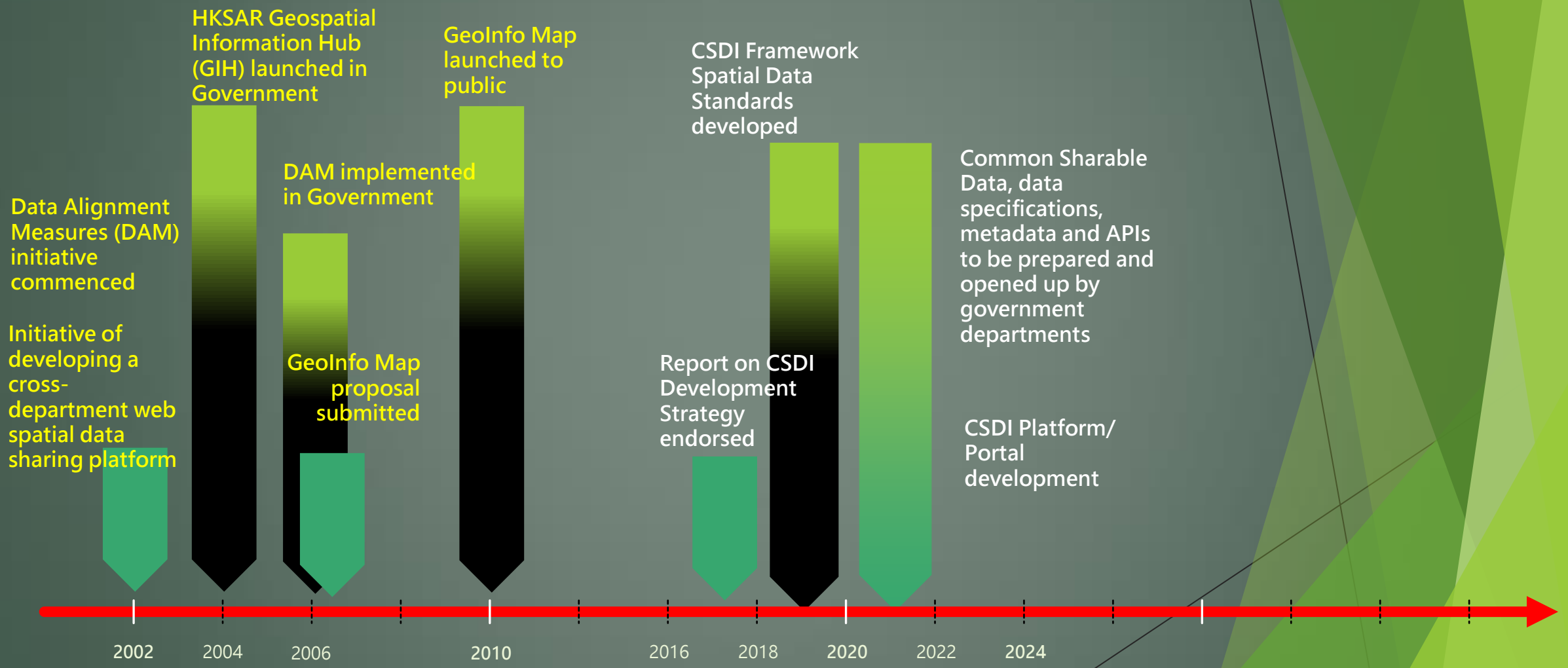
Implications

- Possible duplication of effort in data processing
- Possible duplication of effort in data capture
- Possible duplicative resource input in system development
- Data request, retrieval and provision → time consuming
- Not every officers can access to spatial data conveniently

Large Scale Spatial Data Sharing Initiatives in Hong Kong

	Coverage	Commence	Roll out
HKSAR Geospatial Information Hub (GIH)	Cross-government bureau/departments	2002	2004
Data Alignment Measures (DAM)	Cross-government bureau/departments	2002	2006
GeoInfo Map	Cross-government bureau/departments, Open to public	2006	2010
Common Spatial Data Infrastructure (CSDI)	Cross-government bureau/departments, Open to public	2017	…

Major Spatial Data Sharing Initiatives in Hong Kong



HKSAR Geospatial Information Hub (GIH)

- Concept of building a web-based interactive common platform for discovery and access to spatial data within HKSAR government originated in 2002
- A bottom-up spatial data sharing initiative - aim at breaking institutional silos and enabling “joined-up” public services across the government

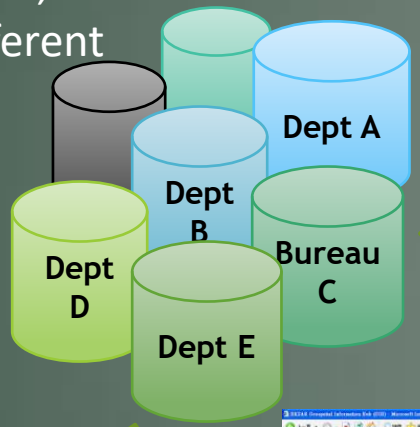
TSOI, Cheong-wai, “HKSAR Geospatial Information Hub (GIH) - A Common Geospatial Information Platform and Spatial Data Portal”, 2007. (https://www.fig.net/resources/proceedings/fig_proceedings/fig2007/papers/ts_4h/ts04h_02_tsoi_1672.pdf)

GIH - A Continuously Evolving Spatial Data Sharing Platform

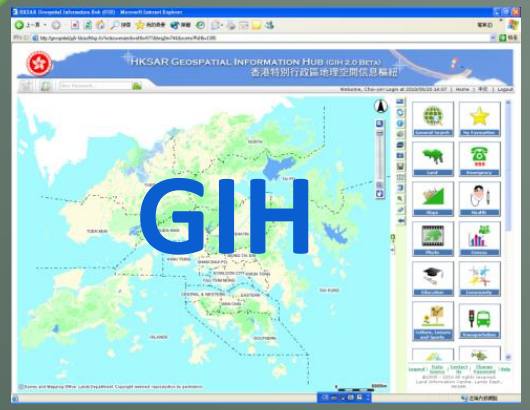
Phase	Objective	Users	Spatial Data
1	• Improving availability and accessibility of spatial data within Lands Department	• Land Administration Office, LandsD • Survey and Mapping Office, LandsD	• Mainly survey, mapping and land administration related data
2	• Expanding the spatial data access and sharing service to support the whole government	• 20+ Bureaux and departments (FEHD, REO, HAD, etc.)	• With more spatial data from multiple domain areas – e.g. public health, election, heritage preservation, education, etc.

HKSAR Geospatial Information Hub (GIH)

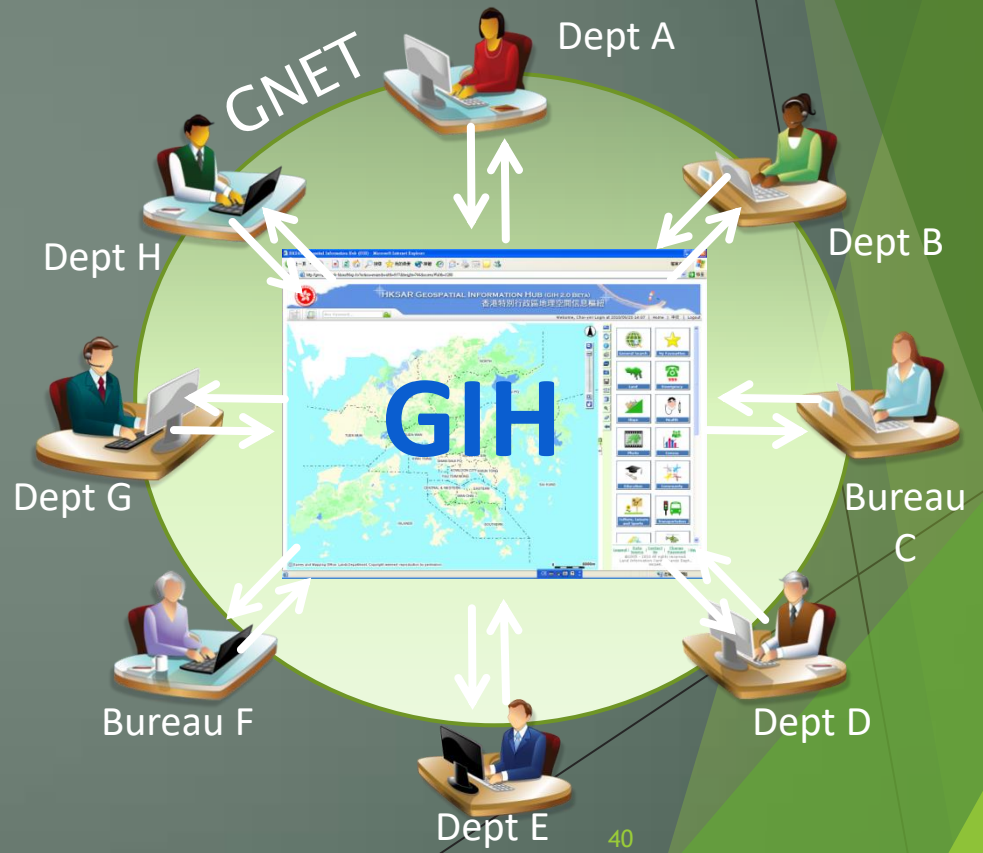
1. Scattered spatial data owned by different B/Ds, different formats, different definitions, different readiness



2. Data processing, integration and dissemination



3. Readily available spatial data (with discovery and application functions) for sharing among different bureaux / department



— A New Way of Sharing and Accessing spatial Information within the Government in early 2000

Benefits of Making Spatial Data Accessible through GIH

- Ready and convenient access to many types of spatial data
- Integrated data under a common coordinate reference system
- Reduced development effort
- Minimize duplication of resource input
- Better and quicker information for better and quicker decisions
- Support multi-disciplinary operations

Data Alignment Measures (DAM)

- GIS and CAD data are separately collected, stored or produced in individual departments. Improvements are required to address deficiencies arising from data definition, data in digital format, compatibility of data format, data quality, data cost and turn around time
- HPLB started an initiative to align the exchange of PLW Data among different participating departments in early 2000
- Participating bureaux/departments: ArchSD, BD, C&SD, CED, DSD, EMSD, HyD, LandsD, LR, PlanD, RVD, TDD, WSD, ITSD, HPLB, ETWB and CITB

From:

1) HKSAR Government (2004), "Final Report on Implementation of Data Alignment Measures for the Alignment of Planning, Lands and Public Works Data", Internet Access: https://www.devb.gov.hk/en/publications_and_press_releases/studies_and_reports/final_report_on_implementation_of_data/index.html

Scope of DAM

- DAM 1: Common Spatial Units (CSU) – to establish CSU's for solving the data definition problems of the most commonly exchanged geospatial data among PDs. Five CSUs have been identified. They include Slope, Building, Lot, Road Centreline and Tertiary Planning Units/ Street Blocks (TPU/SB)
- DAM 2: Standardisation of symbology for graphic entities
- DAM 3: Standards on the file formats for exchanging data
- DAM 4: Policy on exchange of data in electronic form
- DAM 5: Metadata catalogue service
- DAM 6: Metadata production tools

Sharing of Common Spatial Unit (CSU) data under DAM

- Slope CSU
- Building CSU
- Lot CSU
- Road Centreline CSU
- Tertiary Planning Units/Street Blocks CSU
- All DAM CSU governed by Specification which covers:
  - CSU Definition
  - Workflow on implementation of CSU
  - CSU Data Interface Requirements
  - Maintenance of CSU

Roles of Participating Departments under DAM

	Slope CSU	Building CSU	Lot CSU	Road Centreline CSU	TPU/SB CSU
ArchSD	Data Owner, Data User	Data Owner			
BD	Data User	Data Owner, Data User	Data User		Data User
C&SD		Data User			Data User
CEDD	Data Agent, Data Owner, Data User	Data User	Data User	Data User	Data User
DSD	Data Owner, Data User		Data User	Data User	Data User
EMSD		Data User	Data User	Data User	
EPD		Data User	Data User	Data User	Data User
HyD	Data Owner, Data User			Data User	
HD	Data User	Data User	Data User	Data User	Data User
LandsD	Data Owner, Data User	Data Agent, Data Owner, Data User	Data Agent, Data Owner, Data User	Data Agent, Data Owner, Data User	Data User
LR			Data Owner		
PlanD	Data User	Data Owner, Data User	Data User	Data User	Data Agent, Data Owner, Data User
RVD		Data Owner, Data User	Data User		Data User
TD		Data User		Data User	
WSD	Data Owner, Data User	Data User	Data User	Data User	Data User

HD, EPD and TD joined as PDs from August 2005 onwards

GeoInfo Map - Vision and Belief

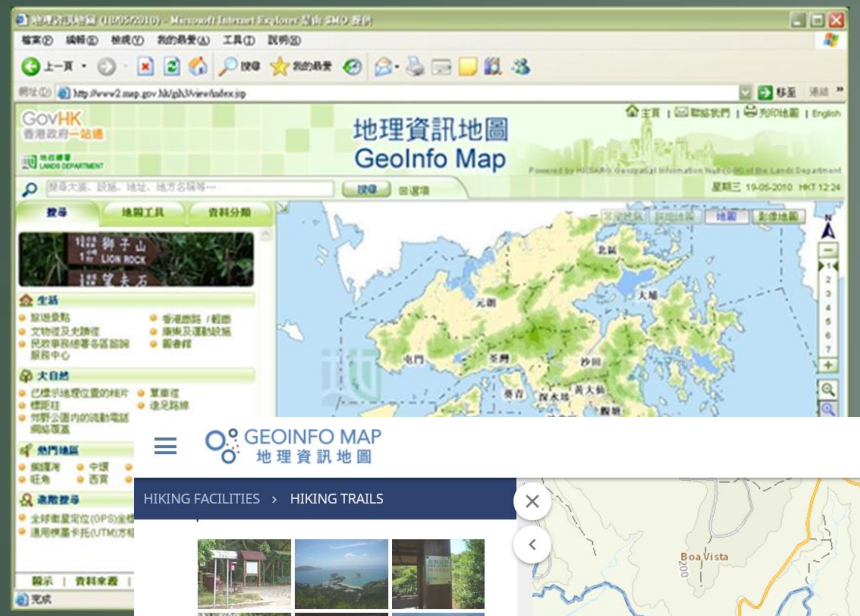
- Geographic or spatial information **accessible to the public**
- Convenient and user-friendly to the public
- Diverse and reliable spatial information
- Alleviating the need for individual B/Ds to set up their own systems for geoprocessing, thereby improving effectiveness through economy of scale
- Foster collaboration among government departments
- Promotion of a data sharing and open data culture in the government

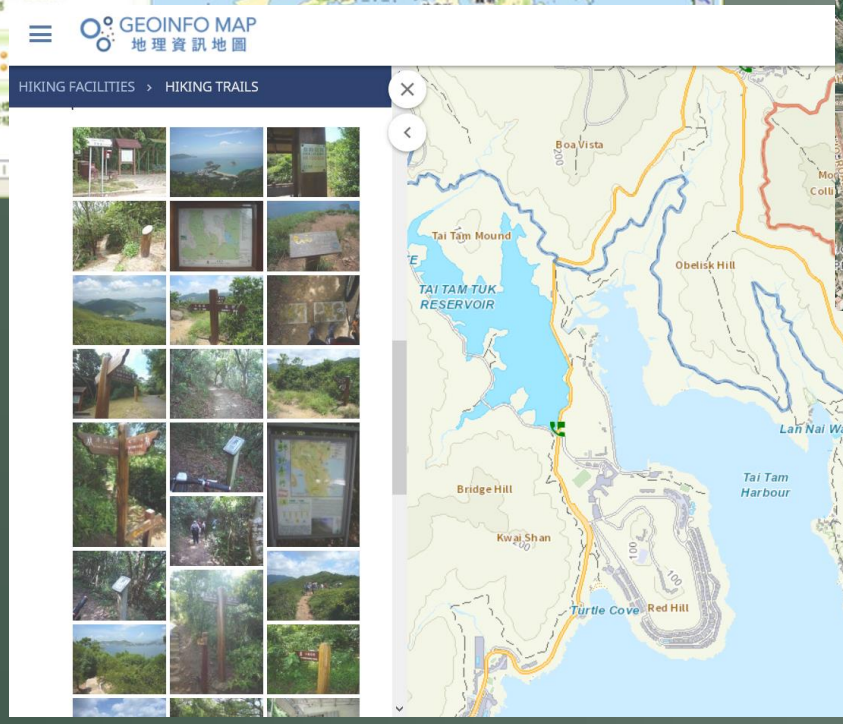
"Public service enhanced through sharing geospatial data", Civil Service Bureau, 2011 (https://www.csb.gov.hk/hkgcsb/csn/csn83/83e/pdf/p8.pdf)

GeoInfo Map – Making Spatial Data Accessible to the Public

- Launched on Internet in 2010
- A spatial data discovery, view and download platform for the public
- Vast amount of integrated spatial data from different departments (AFCD, DH, HA, HAD, HKPost, ImmD, LD, OFTA, EDB and LCSD joined the first phase of the initiative)
- Enable users to search and view information associated with land, environment, education, election, country parks, hospitals, social welfare, leisure, cultural and sports facilities, etc.
- Interface with government websites, enhance usability of government websites through the provision of static maps and interactive maps
- With useful search, measurement, UTM search, WGS84 search, ortho-photo, share maps and spatial data download functions (2010-2018)

Continuous Enrichment of Spatial Data and Geo-processing Functions on GeoInfo Map





Common Spatial Data Infrastructure (CSDI)

Common Spatial Data Infrastructure (CSDI)

- Smart City Blueprint released in December 2017: "… develop Common Spatial Data Infrastructure (CSDI) by 2023 to facilitate sharing of geo-spatial data across government departments and government-to-business (G2B) applications, including the launch of CSDI portal, 3D digital map …"
- Fund earmarked in the 2019-2020 Budget
- Institutional arrangement – "… a new Common Spatial Data Steering Committee (CSDSC) co-chaired by DEVB and ITB and attended by key government spatial data owners will be set up to provide strategic directions for CSDI development, build an active data sharing and collaboration landscape within the Government, and oversee the progress of CSDI development …"

1) HKSAR Government (2017), "Hong Kong Smart City Blueprint", Internet Access: https://www.smartcity.gov.hk/download-area.html
2) HKSAR Government (2019), "Budget Speech 2019-2020", Internet Access: https://www.budget.gov.hk/2019/eng/budget35.html
3) HKSAR Government (2019), "Development of Common Spatial Data Infrastructure and 3D Digital Map", Legislative Council Panel on Development, LC Paper No. CB(1)1181/18-19(05), 25 June 2019, Internet Access: https://www.legco.gov.hk/yr18-19/english/panels/dev/papers/dev20190625cb1-1181-5-e.pdf

Key building blocks of CSDI in Hong Kong

- Leadership and governance
- Fundamental and common sharable data
- Operation and technology
- Funding and charging
- Capacity building, outreach and partnership

Two Tiers of Spatial Data

- Framework (Fundamental/Core) Data
  - In Hong Kong CSDI, called **Framework Spatial Data**
- Thematic Data
  - In Hong Kong CSDI, called **Common Sharable Data**

Framework Data

- The set of continuous and fully integrated geospatial data that **provide context and reference information** for the country
- Expected to be **widely used** and generally applicable, either underpinning or enabling geospatial applications
- Why are framework data so important?
  - Framework data function as important **"anchors"** for the development of integrated data sets for data collection, reporting and analytical processes

Source:
GeoConnections (2009), "Canadian Geospatial Data Infrastructure Information Product 9 – GeoConnections Framework Data Guide", Natural Resources Canada (2009), https://ftp.maps.canada.ca/pub/nrcan_rncan/publications/STPublications_PublicationsST/288/288855/cgdi_ip_09_e.pdf

Spatial Data Infrastructure (SDI) Manual for the Americas, Permanent Committee for Geospatial Data Infrastructure of the Americas, 2013

Framework Spatial Data under CSDI

- Coordinate Reference System
- Geographic Name
  - Place Name
  - Hydrographic Name
  - Relief Name
  - Street Name
- Administrative Area
  - HKSAR Boundary
  - 18 District Council Districts
  - Tertiary Planning Unit
- Land Parcel
  - Lot
  - Short Term Tenancy (STT)
  - Government Land Allocation (GLA)
  - Licence
  - Slope Maintenance Responsibility Boundary

Framework Spatial Data under CSDI

- Building
  - Building Footprint
  - Building Shell
  - Floor
  - Unit
- Transportation
  - Road Centreline
  - Road Network
  - Digitised Traffic Aids Drawings
  - Traffic Census
- Address
  - Reference to the schema of the Common Address Database of ADI

Framework Spatial Data under CSDI

- 7 Framework Spatial Data themes
- Data Specifications for Framework Spatial Data were developed and defined through working groups with representatives from government departments
- International SDI Expert engaged

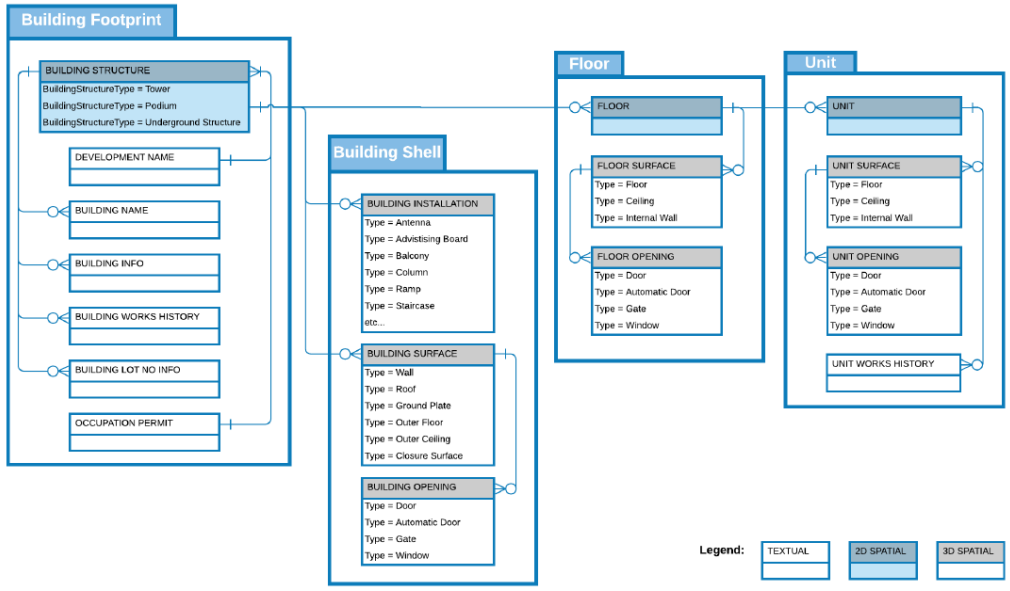


Figure 1 : Logical Data Structure – Building Theme

Name	Definition
Metadata	Root entity which defines metadata about a resource or resources
applicationSchemaInfo	Provides information about the conceptual schema of a dataset
characterSet	Full name of the character coding standard used for the metadata set.
contact	Party responsible for the metadata information
contentInfo	Provides information about the feature catalogue and describes the coverage and image data characteristics
dataQualityInfo	Provides overall assessment of quality of a resource(s)
dataSet	Identifies the location (URL) of the dataset to which the metadata applies
dateStamp	Date that the metadata was created
distributionInfo	Provides information about the distributor of and options for obtaining the resource(s)
fileIdentifier	Unique identifier for this metadata file
hierarchyLevel	Scope to which the metadata applies.
hierarchyLevelName	Name of the hierarchy levels for which the metadata is provided
identificationInfo	Basic information about the resource(s) to which the metadata applies
language	Language used for documenting metadata
metadataConstraints	Provides restrictions on the access and use of metadata
metadataExtensionInfo	Information describing metadata extensions
metadataMaintenance	Provides information about the frequency of metadata updates, and the scope of those updates
metadataStandardName	Name of the metadata standard (including profile name) used
metadataStandardVersion	Version (profile) of the metadata standard used
parentIdentifier	File identifier of the metadata to which this metadata is a subset (child)
portrayalCatalogueInfo	Provides information about the catalogue of rules defined for the portrayal of a resource(s)
referenceSystemInfo	Description of the spatial and temporal reference systems used in the dataset
spatialRepresentationInfo	Digital representation of spatial information in the dataset

Thematic Data (Common Sharable Data)

- Thematic data are those datasets that describe the characteristics of geospatial features or **provide information on specific topics or themes** (e.g. forest types, water contamination, historical flood areas, or disease patterns and trends)
- Thematic data are data that has **more narrow and specific applications**

Sources:
GeoConnections Framework Data Guide, Natural Resources Canada, 2009
Spatial Data Infrastructure (SDI) Manual for the Americas, Permanent Committee for Geospatial Data Infrastructure of the Americas, 2013

Common Sharable Data under CSDI in Hong Kong

- Through joint effort of departments, 320 sets of Common Sharable Data identified
- Common Sharable Data to be prepared, opened up and updated by over 30 B/Ds in coming years

Source: The Tentative List of About 320 Spatial Datasets to be Opened Up on the CSDI Portal by End 2022 (consolidated by SDO as at November 2020)

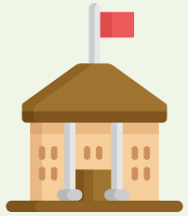
Number of Spatial Datasets to be Opened up by each Department

Contributed By	Number of Dataset
Social Welfare Department	45
Drainage Services Department	35
Lands Department	35
Planning Department	30
Leisure and Cultural Services Department	28
Highways Department	25
Education Bureau	18
Transport Department	18
Census and Statistics Department	12
Home Affairs Department	12
Other B/Ds	About 60

Different Categories of Spatial Data to be Opened Up

Categories	Related Spatial Datasets to be opened up by 2022
 Geography and Development	• Digital Topographic Map • Slope Data
 Land Information	• Public Facilities • 3D Visualization Map • Vacant Government Site
 Utilities	• Pipes & Manhole(Stormwater & Sewage) • Service Reservoirs • Pumping Station
 Transportation	• Bus Route & Stop • Parking Vacancy Data • 3D Pedestrian Network
 Population Census / By-census	• Population Census Data

Different Categories of Spatial Data to be Opened Up

Categories	Related Spatial Datasets to be opened up by 2022
 Education	• Schools (i.e.: Primary School, Secondary School, UGC-Funded Institutions) • Kindergartens
 Government	• Public Open Space • District Council Ordinary Election Constituency Boundary • Annual Statistics from RVD
 Environment	• Country Parks • Marine Reserve • Recycling Organizations and Collection Points
 Health	• Hospitals & Clinics • Details of probable/confirmed cases of COVID-19 infection in HK

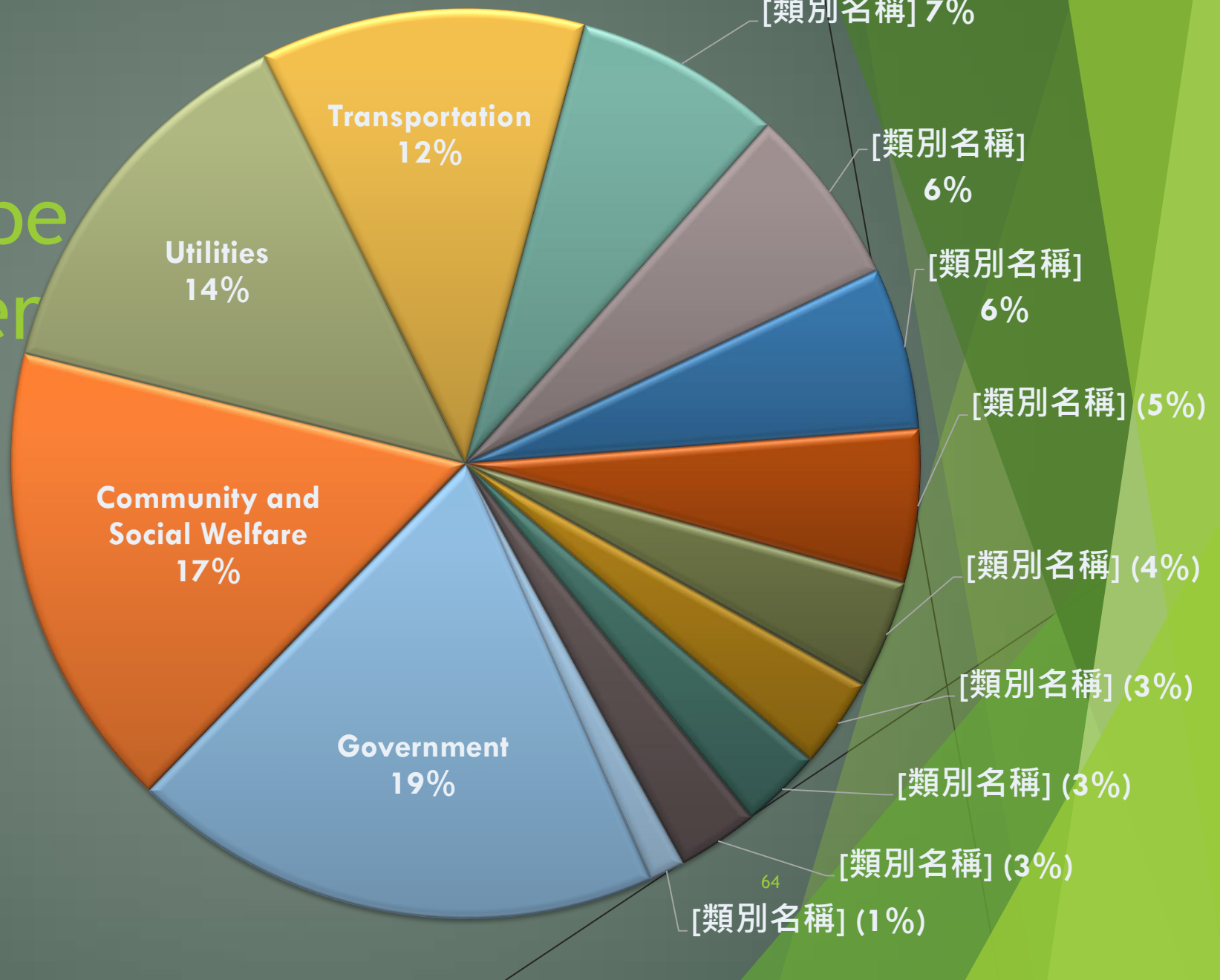
Different Categories of Spatial Data to be Opened Up

Categories	Related Spatial Datasets to be opened up by 2022
 Recreation & Culture	• Camp Sites • Libraries • Parks, Zoos and Gardens
 Community & Social Welfare	• Child Care Centres • Community Centres • Care and Attention Home for Severely Disabled Persons
 Technology	• Wi-Fi.HK Location • HK SatRef GNSS Raw Data • Multi-functional Smart Lampposts
 Sport	• Sport Centres • Swimming Pools • Beaches

Number of Spatial Datasets to be Opened Up under each Category

Categories	Number of Datasets
Government	59
Community and Social Welfare	52
Utilities	43
Transportation	36
Land Information	23
Sports	20
Education	18
Recreation and Culture	17
Population Census / By-census	12
Geography and Development	10
Environment	9
Health	9
Technology	4

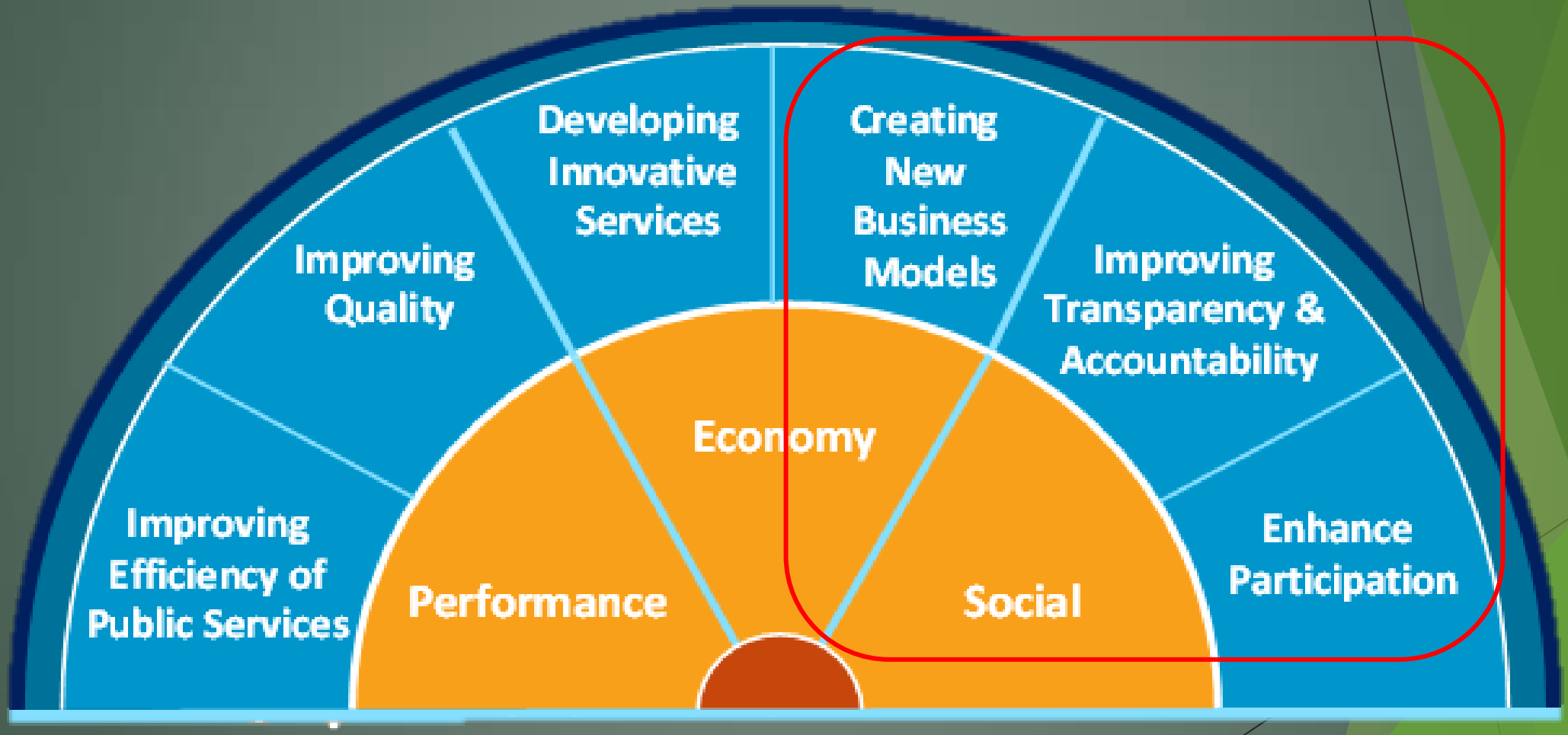
Different Categories of Spatial Data to be Opened up under CSDI



Open Data

https://youtu.be/bwX5MAZ6zKI

Need for Open Data



From:
1) European Data Portal, “What is Open Data”, Internet Access: https://www.europeandataportal.eu/en/training/what-open-data

Concepts of Open Data

Definition of Open Data:

Open data is data that can be **freely used, re-used and redistributed** by anyone – subject only, at most, to the requirement to attribute and sharealike

~Open Data Handbook (2020)

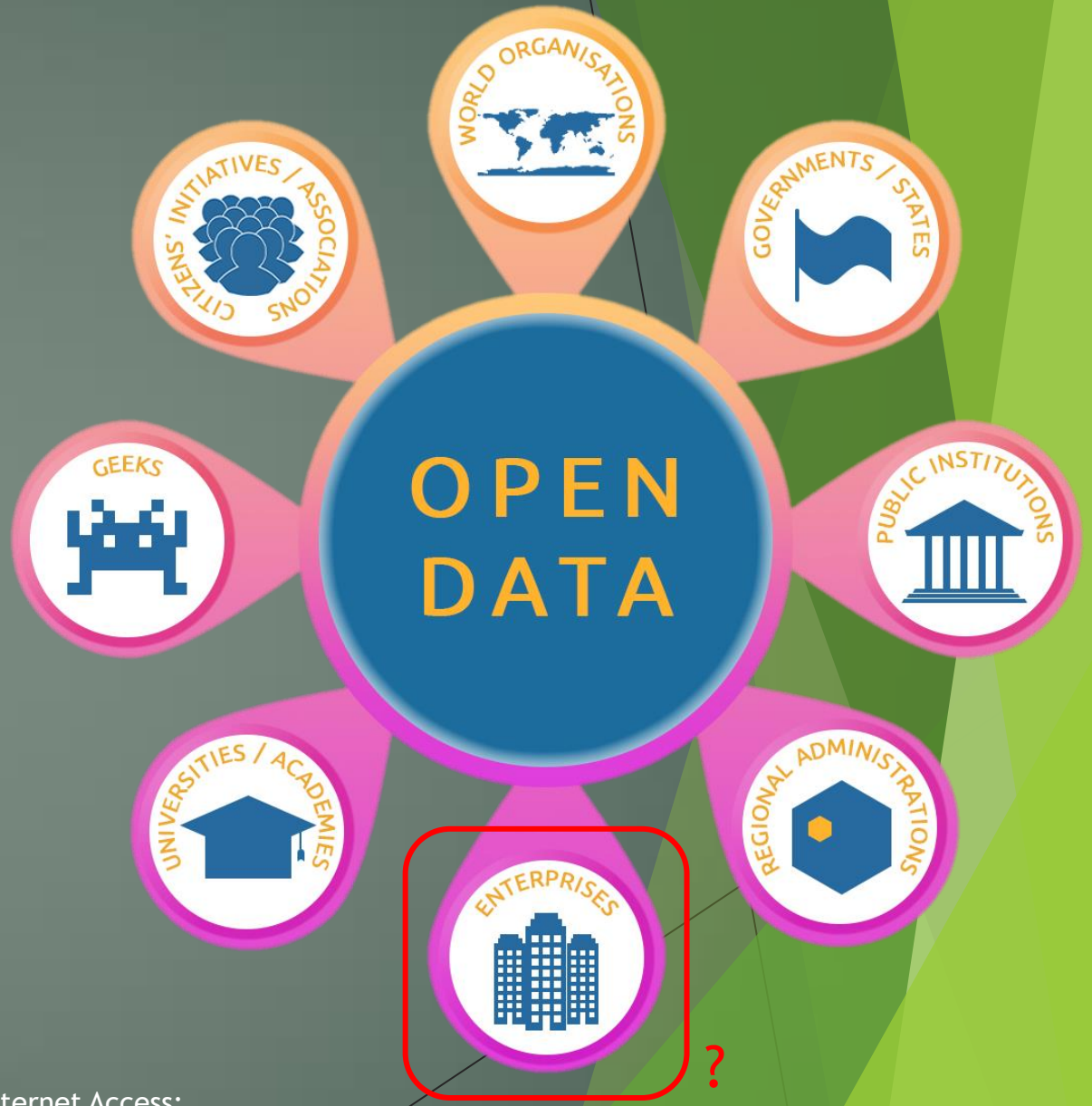
- Availability and Access
- Re-use and Redistribution
- Universal Participation

Interoperability

From:

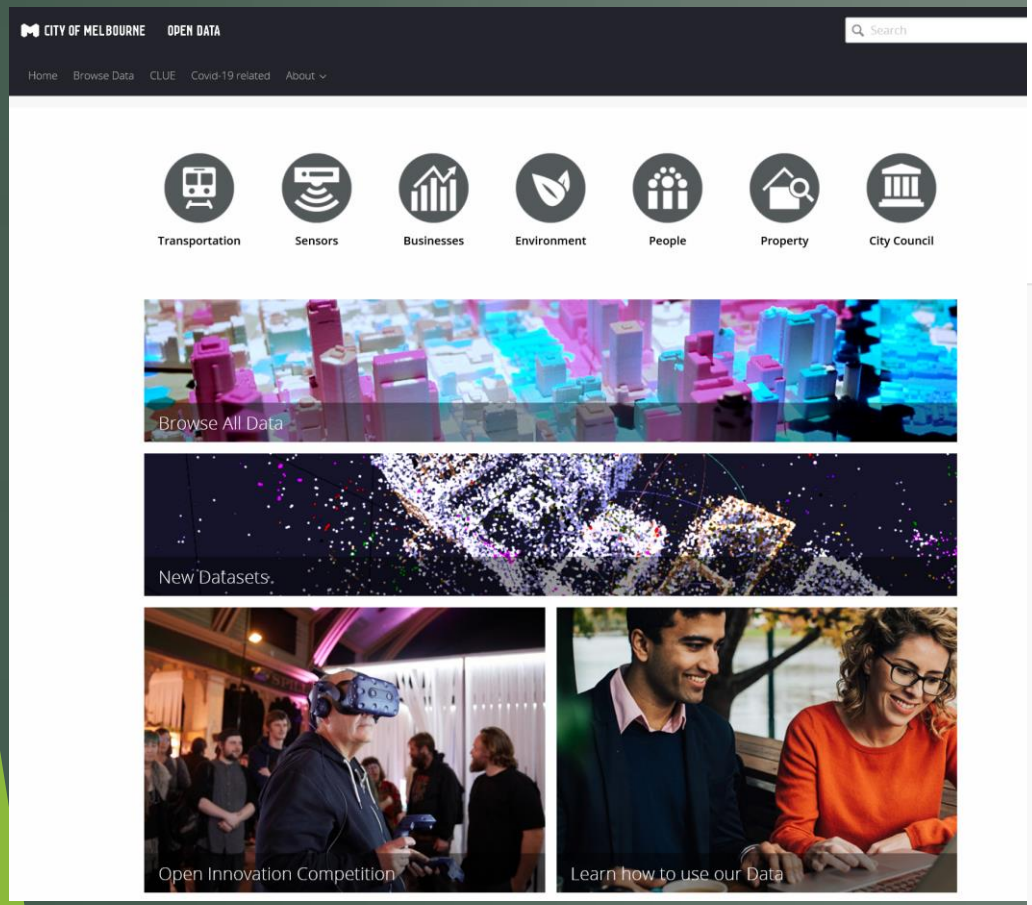
1) Open Knowledge Foundation (2020) "Open Data Handbook - Why Open Data?", Internet Access: https://opendatahandbook.org/guide/en/why-open-data/
2) Grothe M. (2014), "SDI and Open Data Developments in the Netherlands", Presentation on Enlargement and Integration Workshop Belgrade, 4 November 2014.

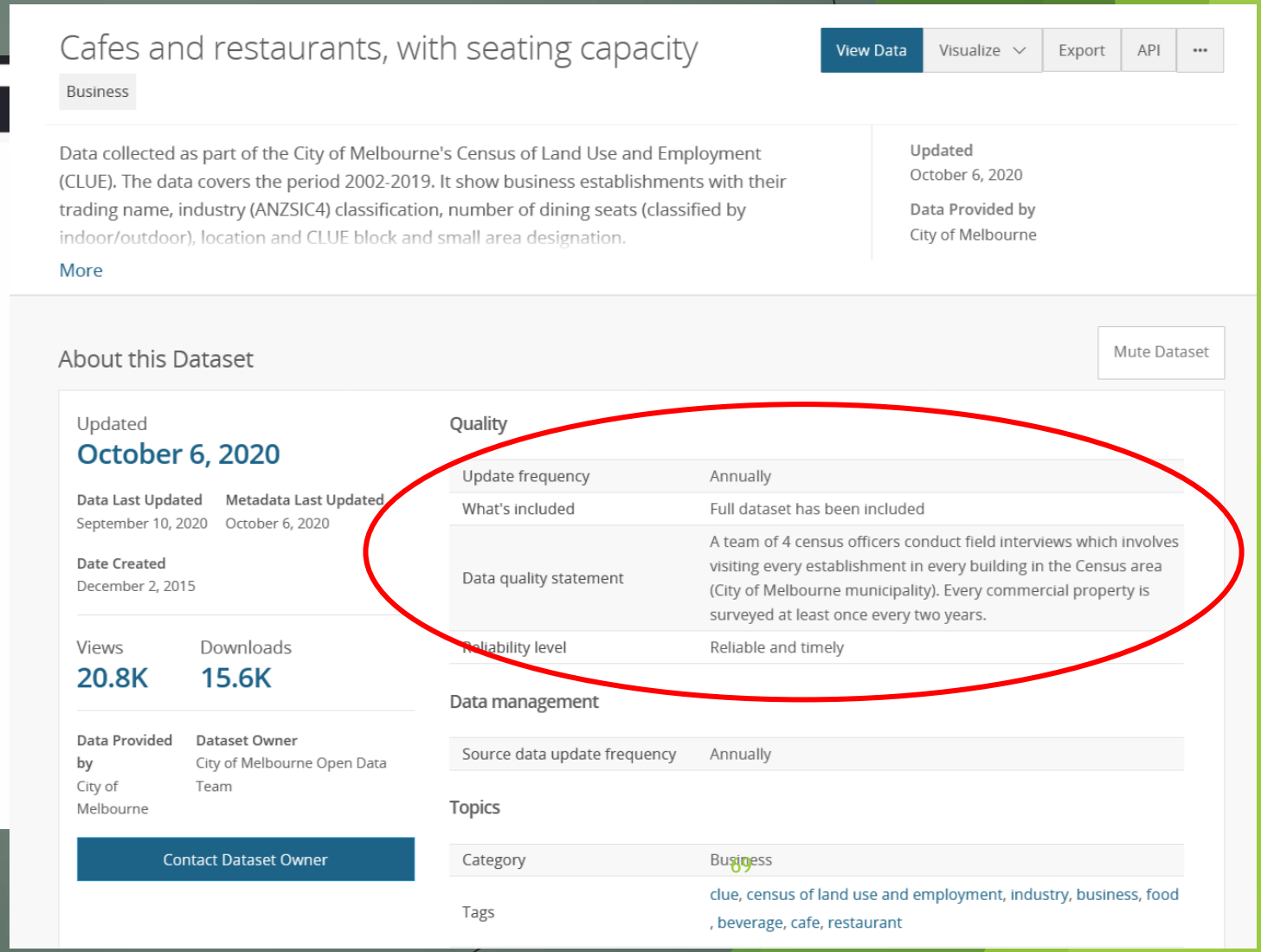
Sources of Open Data



From:
1) Octvae.io (2020), "FOCUS COVID-19: where are the main open-data sources?", Internet Access: https://octaveio.zendesk.com/hc/en-gb/articles/360013354440-FOCUS-COVID-19-where-are-the-main-open-data-sources-
Picture from:
1) Web Icon Sets for You (2020), Access from: https://www.webiconset.com/hand-drawn-sketch-icon-set/

City of Melbourne – Open Data





https://data.melbourne.vic.gov.au/

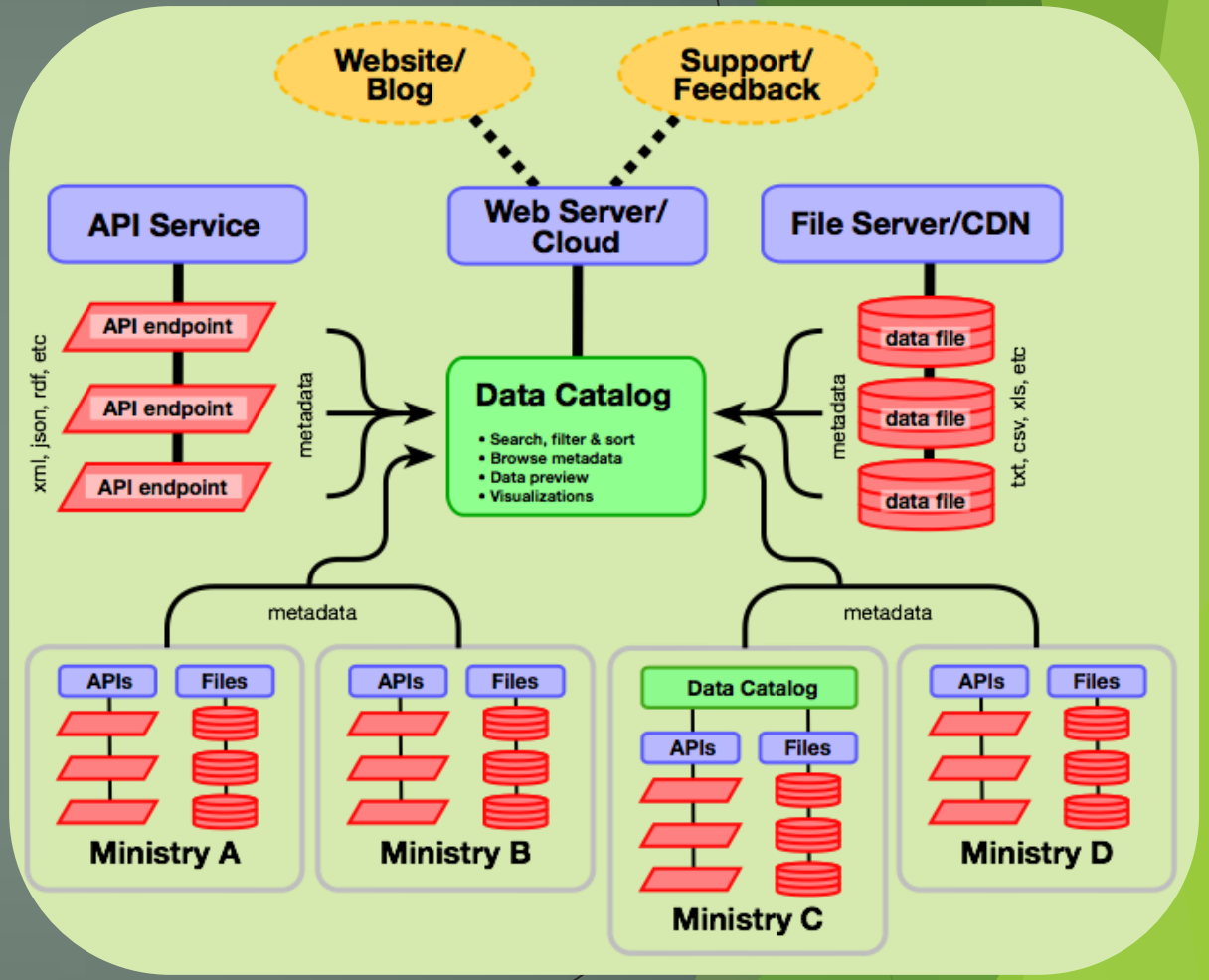
Benefits of Open Data

From:

1) Open Knowledge Foundation (2020) “Open Data Handbook - Why Open Data?”, Internet Access: https://opendatahandbook.org/guide/en/why-open-data/
2) Studios N. (2020) “Open Government – Making Open Awareness – Advocacy and Support”, Internet Access: https://nookstudios.com/advocacy

Technologies for Open Data

- A data catalog
  - Easy Access, Search, Machine-readable data access, Metadata, Clear data licenses, Data preview/visualization, Standards compliance, Application Programming Interface (API) & Security
- A platform
  - Comprehensive Knowledge Archive Network (CKAN) + PostgreSQL database
  - Cloud-based
  - GeoNode (an open source framework designed to build geospatial content management systems and SDI nodes)
- A portal



From:

1) The World Bank “Starting an Open Data Initiative – Technology Options”, Internet Access: http://opendatatoolkit.worldbank.org/en/technology.html

Data that Might Not be Opened

- Privacy: A dataset or information that contains personal information about an individual must not be released. e.g. information about race, national or ethnic origin, religion, age, marital status, and medical, criminal or employment history, etc.
- Security: Information or data that may pose security risks to the institution, to the government, or to vulnerable or targeted individuals or organizations must not be released
- Confidentiality: Information or data that impairs the government's ability to make some decisions cannot be released
- Legacy information or data: Sometimes there is a substantive cost to making the resource eligible for release (for example, digitizing the resource, formatting it, ensuring it's accessible and in both official languages) and there may not be a huge demand from the public to justify the cost
- Legal and contractual limitations: A dataset may be subject to legal or contractual agreements that prevent it from being released e.g. third party data, non-disclosure agreement, etc.

Source: Open Government, Government of Canada. (2013, May 17). *Open Data 101*. Internet Access: http://open.Canada.ca/en/open-data-principles

What is the meaning of Smart Cities?

A sustainable city?

An environmentally friendly city?

- Reduce Carbon Emissions
- Support Energy Efficiency
- Improve Urban Solid Waste Management
- Real-time Monitoring and Management of Energy and Environment
- Smart Cities Can Spark Citizen Engagement

From:
1) Mapanauta (2018). *"5 Epic Ways Smart Cities Can Help the Environment"*, Access from: https://medium.com/@mapanauta/5-epic-ways-smart-cities-can-help-the-environment-7192d77ff702

Picture from:
1) https://www.alamy.com/stock-photo-ecological-city-conceptsmart-city-concept-and-green-energy-with-different-122771703.html

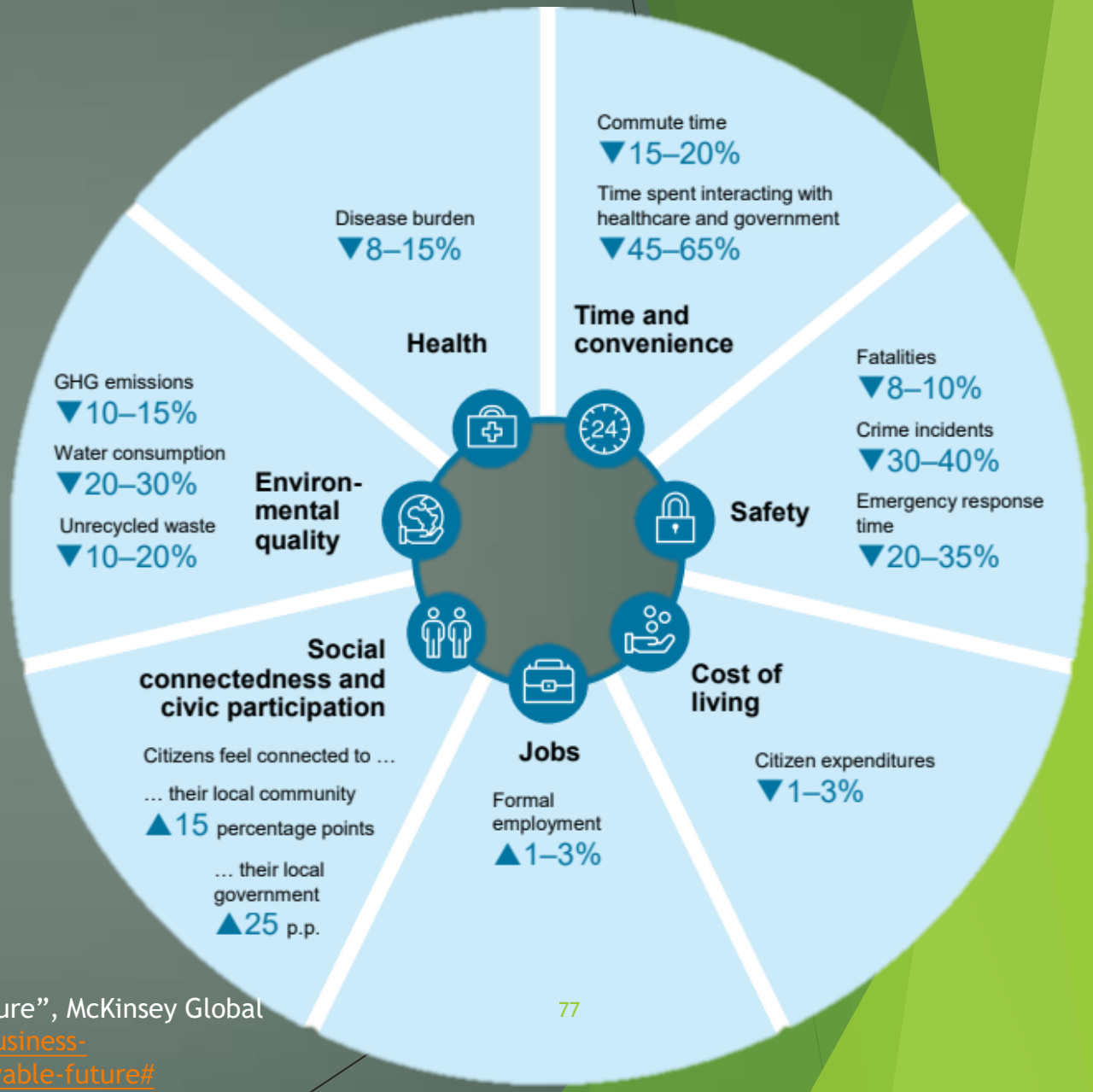
An elderly friendly city?

- Smart Buildings
- Making Transport Simpler & Roads better
- Looking at Medical Facilities
  - Adequate health support
  - Conveniently located healthcare services
  - Residential medical facilities
  - Doctors-on-call
  - More centers to serve the elderly
  - Special centers to take care diseases like Alzheimer's and Parkinson's elderly
  - Connecting the patient remotely
- Keeping Seniors Active

From:
1) Abbas M. (2019). *"Ageing in Smart Cities"*, Internet Access: http://open.canada.ca/en/story/interactive-pipeline-map-visual-tool-open-data
Picture from:
1) https://www.tantiv4.com/insights/iot-big-stories/how-can-smart-cities-improve-the-lives-of-senior-citizens

A liveable city?

- Smart-city technologies have substantial unrealized potential to improve the urban quality of life
- Applications can help cities fight crime and improve other aspects of public safety
- Smart-city technologies can make daily commutes faster and less frustrating
- Cities can be catalysts for better health
- Smart cities can deliver a cleaner and more sustainable environment
- Smart cities can create a new type of digital urban commons and enhance social connectedness



From:

1) Woetzel J. et al. (2018), "Smart cities: Digital solutions for a more livable future", McKinsey Global Institute, Executive Summary, Internet Access: https://www.mckinsey.com/business-functions/operations/our-insights/smart-cities-digital-solutions-for-a-more-livable-future#

Open Spatial Data and Smart City Development

Example 1: Tackle Climate Change

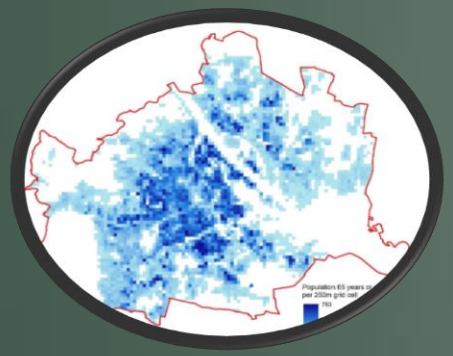
Environment Agency (EA) in England

- EA has 1,700 defined datasets
- 2010: stopped charging for non-commercial use of their data
- 2018: committed to releasing all of its commercial datasets

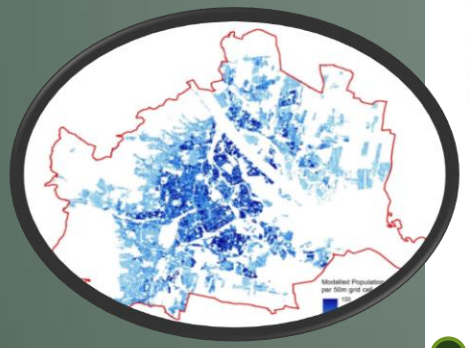
From:

1) Open Data Institute (2015) "Environment Agency: Going open." London, UK. Available at ea-going-open-summary: https://theodi.org/article/environment-agency-going-open-2/

Example 2: Support Aged Population



Realty (250m²)



Model (50m²)

Home » News Archive » Space to help support us as we get older

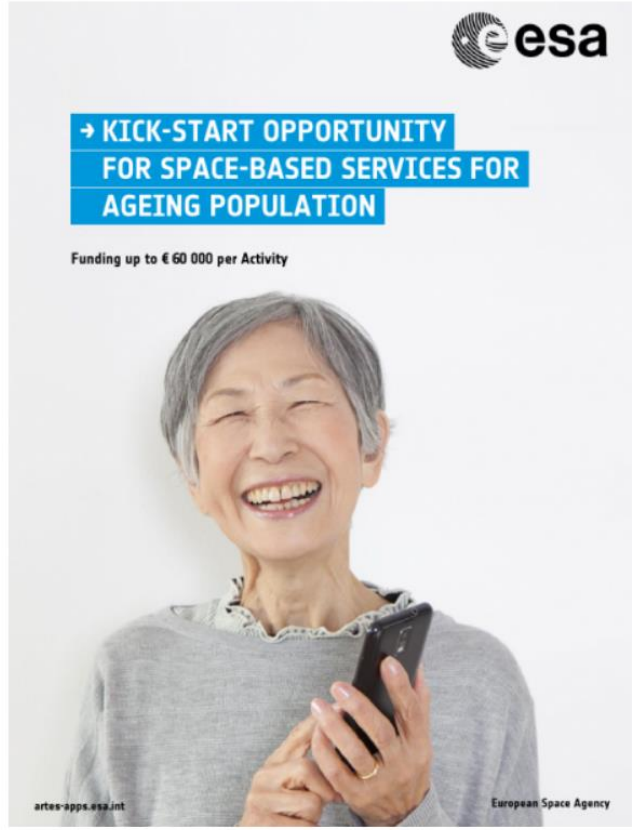
Europeans are living longer and healthier lives. The European population aged 65+ is projected to increase from 93 million to 125 million by 2030. Shrinking labour forces and skills shortages are other concerns caused by changing demographics. As the population ages, more public spending in healthcare, long-term care, pension spending and infrastructure is required to take care of elderly people.

Innovation and technology represent key ingredients to deal with the challenges of these changing demographics and to take advantage of opportunities that they create. The ageing society requires new approaches to meet their needs, with an improved efficiency of service provision. Ageing in good health can be achieved through appropriate changes in health and social care, which allows seniors to travel, work longer, continue to learn, share knowledge and live independently.

Under the thematic area of Ageing Population, ESA Business Applications launched a Call for Kick-start Activities in May 2017 aimed at fostering innovation in this field. The Call was open to ideas for services for the ageing population offered by local authorities, carers, the (national) health and social care system, residential homes, technology and service providers and others in this sector. Types of services include, for example:

- Healthcare: mobile health, tele-home, remote monitoring, fall prevention, wearable devices;
- Independent living: smart home, home automation, lifestyle intervention, remote workplace, personal assistance;
- Safety and security: surveillance, emergency response, extreme weather and pollution alerts;
- Social, leisure and education: social interaction, remote education, remote occupation, entertainment, (outdoor) mobility.

As part of the preparation for the Kick-start competition, ESA presented at the Neighbourhoods of the Future (NotF) conference held at NatWest HQ in London on 10th to 11th May 2017, organised by the Agile Ageing Alliance and Swiss Re.



From:

1) Hamel K., Fenz K., and Walli A. (2018), "Innovations in geo-spatial demography offer solutions for aging populations", Brookings – Future Development, Internet Access: https://www.brookings.edu/blog/future-development/2018/03/27/innovations-in-geo-spatial-demography-offer-solutions-for-aging-populations/

Example 3: Enable Effective Infrastructure Design, Construction and Urban Planning

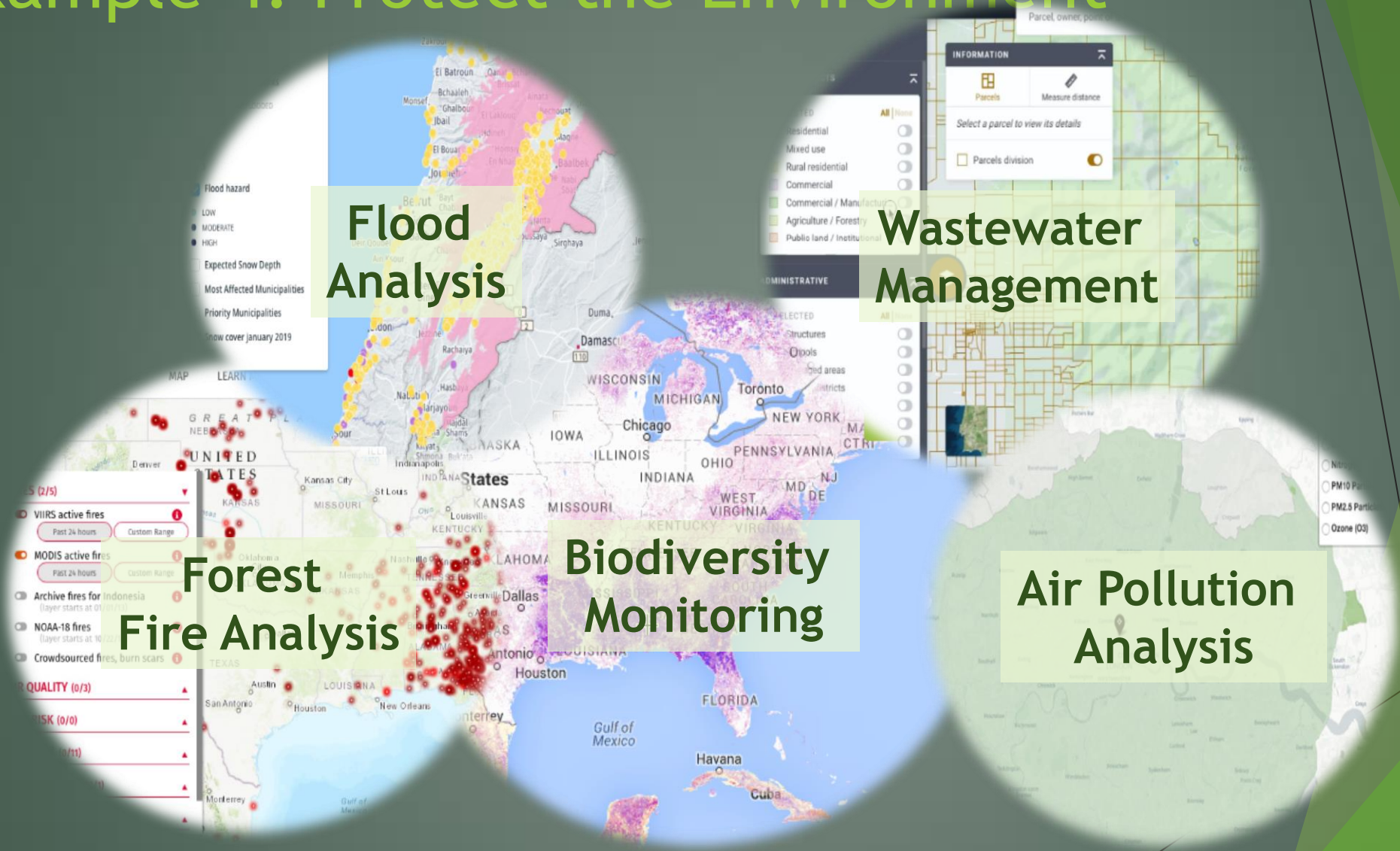
- Implement the end to end planning systems (e2e)
  - Making the whole process of planning electronically

- Decrease the cost before and after the project implementation
- Reduce man power and personal visits to planning offices
- Save citizens and construction industry due to no travel costs and minimise disputes

From:

1) Schmid G., Coote A., and Smart A. (2012), Presentation of "The Value of Geospatial Information in Local Public Service Delivery", Socio-economic Benefits Workshop, 2012

Example 4: Protect the Environment



From:

1) Carto (2020), "Environmental Management", Internet Access: https://carto.com/solutions/environmental-management/
2) Carto (2020), "Environmental & Natural Resources", Internet Access: https://carto.com/industries/environmental-and-natural-resources/

Example 5: Protect Public Health

Source: Johns Hopkins University, https://coronavirus.jhu.edu/map.html

Example 6: Support Retail, Commerce, Logistics and Business

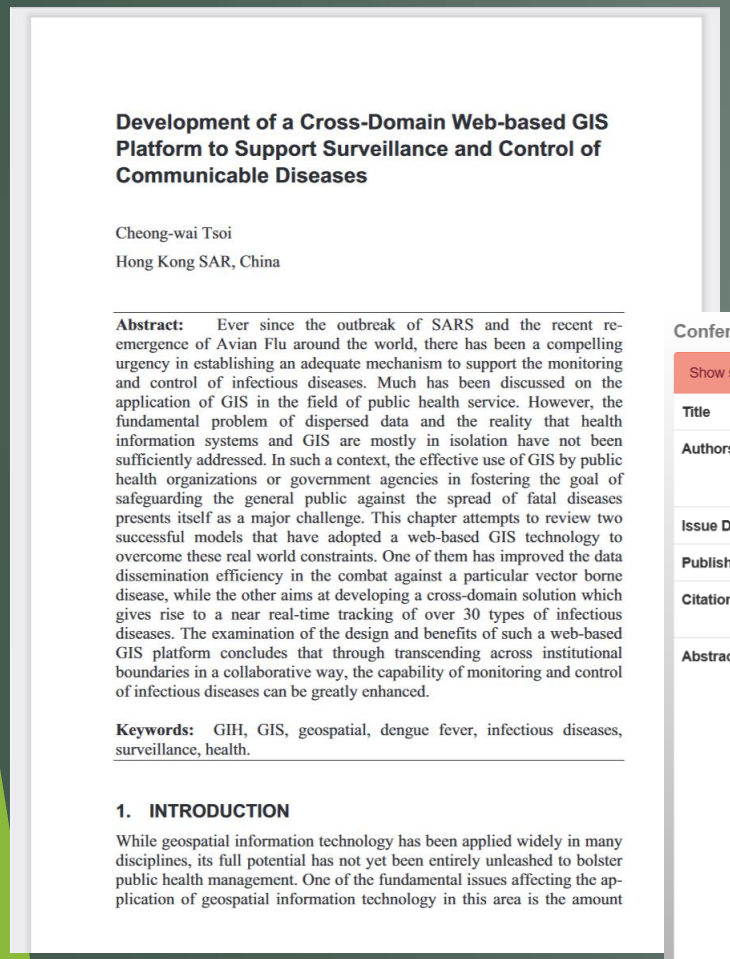
Case Study: Daventry saving in waste collection (U.K.)

Use of open geospatial information to optimize refuse (waste) collection routes

- Save mileage reduction of 12-13%
- Spare capacity to allow for vehicle washing
- Reduce manpower
- Better estimate on purchasing smaller new vehicles for waste collection
- Minimize 18 to 16 collection rounds and to 4 days working week

From:
1) Schmid G., Coote A., and Smart A. (2012), Presentation of "The Value of Geospatial Information in Local Public Service Delivery", Socio-economic Benefits Workshop, 2012

Example 7: Support Scientific/ Academic Research and Innovation



Development of a Cross-Domain Web-based GIS Platform to Support Surveillance and Control of Communicable Diseases

Cheong-wai Tsoi

Hong Kong SAR, China

Abstract: Ever since the outbreak of SARS and the recent re-emergence of Avian Flu around the world, there has been a compelling urgency in establishing an adequate mechanism to support the monitoring and control of infectious diseases. Much has been discussed on the application of GIS in the field of public health service. However, the fundamental problem of dispersed data and the reality that health information systems and GIS are mostly in isolation have not been sufficiently addressed. In such a context, the effective use of GIS by public health organizations or government agencies in fostering the goal of safeguarding the general public against the spread of fatal diseases presents itself as a major challenge. This chapter attempts to review two successful models that have adopted a web-based GIS technology to overcome these real world constraints. One of them has improved the data dissemination efficiency in the combat against a particular vector borne disease, while the other aims at developing a cross-domain solution which gives rise to a near real-time tracking of over 30 types of infectious diseases. The examination of the design and benefits of such a web-based GIS platform concludes that through transcending across institutional boundaries in a collaborative way, the capability of monitoring and control of infectious diseases can be greatly enhanced.

Keywords: GIH, GIS, geospatial, dengue fever, infectious diseases, surveillance, health.

1. INTRODUCTION

While geospatial information technology has been applied widely in many disciplines, its full potential has not yet been entirely unleashed to bolster public health management. One of the fundamental issues affecting the application of geospatial information technology in this area is the amount

https://link.springer.com/chapter/10.1007/978-3-540-71318-0_4

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0196845

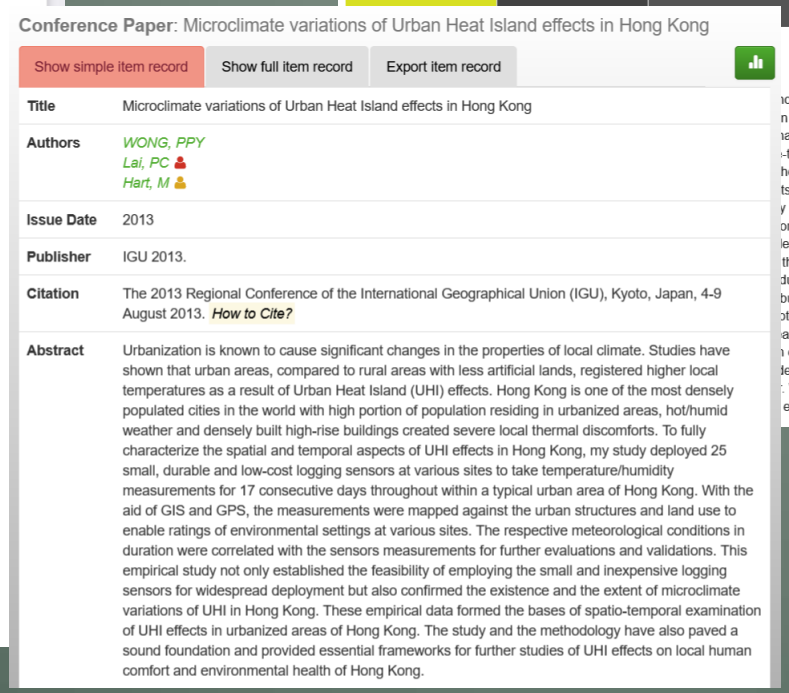
Spatiotemporal characteristics of elderly population's traffic accidents in Seoul using space-time cube and space-time kernel density estimation

Youngok Kang, Nahye Cho, Serin Son

Published: May 16, 2018 • https://doi.org/10.1371/journal.pone.0196845

Article | Authors | Metrics | Comments | Media Coverage

how the spatiotemporal characteristics of traffic
n in Seoul are changing by time period. We applied
alyses to analyze the spatial characteristics of elderly
-time cube, emerging hotspot, and space-time kernel
he spatiotemporal characteristics. In addition, we
ts by dividing cases into those in which the drivers were
y people were victims of traffic accidents, and used the
or analysis. The main findings were as follows: (1) the
lents differed according to whether they were drivers or
that the hotspots for elderly drivers' traffic accidents are
during the period from morning to afternoon, whereas
buted over a wide area from daytime to evening. (3)
ots are weak during winter and summer, whereas they
as in Seoul during spring and fall. Further, elderly
elderly drivers' hotspots. (4) The analysis for the entire
dents involving elderly people are increasing in specific
. We expect the results of this study to aid in reducing
elderly people in the future.



Conference Paper: Microclimate variations of Urban Heat Island effects in Hong Kong

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Title	Microclimate variations of Urban Heat Island effects in Hong Kong
Authors	*WONG, PPY* *Lai, PC* *Hart, M*
Issue Date	2013
Publisher	IGU 2013.
Citation	The 2013 Regional Conference of the International Geographical Union (IGU), Kyoto, Japan, 4-9 August 2013. *How to Cite?*
Abstract	Urbanization is known to cause significant changes in the properties of local climate. Studies have shown that urban areas, compared to rural areas with less artificial lands, registered higher local temperatures as a result of Urban Heat Island (UHI) effects. Hong Kong is one of the most densely populated cities in the world with high portion of population residing in urbanized areas, hot/humid weather and densely built high-rise buildings created severe local thermal discomforts. To fully characterize the spatial and temporal aspects of UHI effects in Hong Kong, my study deployed 25 small, durable and low-cost logging sensors at various sites to take temperature/humidity measurements for 17 consecutive days throughout within a typical urban area of Hong Kong. With the aid of GIS and GPS, the measurements were mapped against the urban structures and land use to enable ratings of environmental settings at various sites. The respective meteorological conditions in duration were correlated with the sensors measurements for further evaluations and validations. This empirical study not only established the feasibility of employing the small and inexpensive logging sensors for widespread deployment but also confirmed the existence and the extent of microclimate variations of UHI in Hong Kong. These empirical data formed the bases of spatio-temporal examination of UHI effects in urbanized areas of Hong Kong. The study and the methodology have also paved a sound foundation and provided essential frameworks for further studies of UHI effects on local human comfort and environmental health of Hong Kong.

http://hub.hku.hk/handle/10722/190760

Spatial obfuscation methods for privacy protection of household-level data

Dara E. Seidl [a], Gernot Paulus [b], Piotr Jankowski [a, c], Melanie Regenfelder [b]

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Highlights

- Four privacy obfuscation techniques are tested on residential point data.
- We introduce a new geomasking technique, Voronoi masking.
- Weighted random perturbation and Voronoi masking maintain point clustering.
- Voronoi masking performs best in privacy and spatial information preservation.

Abstract

The topic of geoprivacy is increasingly relevant as larger quantities of personal location data are collected and shared. The results of scientific inquiries are often spatially suppressed to protect confidentiality, limiting possible benefits of public distribution. Obfuscation techniques for point data hold the potential to enable the public release of more accurate location data without compromising personal identities. This paper examines the application of four spatial obfuscation methods for household survey data. Household privacy is evaluated by a nearest neighbor analysis, and spatial distribution is measured by a cross-k function and cluster analysis. A new obfuscation technique, Voronoi masking, is demonstrated to be distinctively equipped to balance between protecting both household privacy and spatial distribution.

https://www.sciencedirect.com/science/article/abs/pii/S0143622815001666

Benefits of SDI

Benefits of SDI – to Government

Better Decision Making

Improve Quality of Services

Improve Policy Formulation

Shorten Responding Time

Increase Operational Efficiency

Asset Management

From:
1) PWC (2018), "Final Report - Consultancy Study on Development Strategy of a Common Spatial Data Infrastructure", The Development Bureau of the HKSAR Government.
2) Tonchovska R. et al. (2012), "Spatial Data Infrastructure and INSPIRE" Europe & Central Asia Vol (55), The World Bank, 2012.

Pictures from:
1) https://discovery.rsm.nl/articles/70-understanding-marketing-decision-making/
2) https://viraldigimedia.com/different-forms-of-quality-services/
3) https://www.freepik.com/free-vector/construction-with-building-crane-excavator-yellow-background-cartoon_2873801.htm
4) http://jp-consultancy.com/en.html
5) https://housing.umn.edu/files/policy-icon
6) https://blog.grantmcgregor.co.uk/2018/what-is-an-information-asset-register

Benefits of SDI – to Government

- Provide better/ more comprehensive spatial data for decision making
- Improve the quality of services in the field of land administration and management
- Increase operational efficiency in civil engineering projects
- Shorten responding time for public queries
- Improve policy formulation, public service delivery and inter-governmental collaboration
- Improve the asset management to record site conditions and planning work flows

From:
1) PWC (2018), "Final Report - Consultancy Study on Development Strategy of a Common Spatial Data Infrastructure", The Development Bureau of the HKSAR Government.
2) Tonchovska R. et al. (2012), "Spatial Data Infrastructure and INSPIRE" Europe & Central Asia Vol (55), The World Bank, 2012.

Benefits of SDI – to Society

- Create significant economic and public gains through consolidation of various types of spatial data
- Have a significant impact on transparency, service provision, and economic growth
- Enhance competitiveness of the society with better land use planning and development, asset management and transportation
- Get ready for smart city development and management
- Strengthen location-based tax compliance, emergency preparedness and response
- Protect the environment and alleviate the pollution problems
- Driven the opportunities to research and innovation

From:

1) PWC (2018), "Final Report - Consultancy Study on Development Strategy of a Common Spatial Data Infrastructure", The Development Bureau of the HKSAR Government.
2) Tonchovska R. et al. (2012), "Spatial Data Infrastructure and INSPIRE" Europe & Central Asia Vol (55), The World Bank, 2012.

Challenges of SDI Implementation

Challenges

- Self-taught experts dominated discussions about SDI development, rather than the necessary highly trained technical informatics experts who fully understood and SDI and who were committed to its successful implementation.
- Data management was seen as an inherently tedious and unproductive task and received lower priority.
- The expectations and timeline were too ambitious, and the resources necessary to carry out the goals were underestimated.

From:

1) National Research Council (2012), "*Advancing Strategic Science: A Spatial Data Infrastructure Roadmap for the U.S. Geological Survey*", Washington, DC: The National Academies Press. Fourteen international organizations were examined (e.g. Geoscience Australia, British Geological Survey, Infrastructure for Spatial Information in the European Community, National Aeronautics and Space Administration, US National Geospatial Intelligence Agency, the Consortium of Universities for the Advancement of Hydrologic Science, etc.)

Challenges

- Missing Incentive – Data creators are doing it to meet particular operational goals that are specific to themselves. Publishing their data to the rest of the world is a pure cost center to them
- Most SDI implementations still lack access to some of the most informative, up-to-date information
- The most valuable information for sharing and decision making – the data creators hold it close, and only share it in traditional ways using traditional business models

From:
1) Ramsey, P. (2006), "Why SDIs Fail", Internet Access: http://blog.cleverelephant.ca/2006/09/why-sdis-fail.html

Challenges

- GeoPrivacy

"Why does geoprivacy matter? The scientific publication of confidential data presented on maps", 2014. (https://pubmed.ncbi.nlm.nih.gov/25747295/)

"The Ethics of Geospatial – The Four E's", 2020. (https://www.edparsons.com/2020/06/the-ethics-of-geospatial-the-four-es/)

"Norway suspends virus-tracing app due to privacy concerns", 2020. (https://www.theguardian.com/world/2020/jun/15/norway-suspends-virus-tracing-app-due-to-privacy-concerns)

"OGC addresses the Ethics of Geo as part of its Future Directions September Programming", 2020. (https://www.ogc.org/blog/3398)

Next Generation SDI

Spatial Data Infrastructure (SDI) 3.0

- SDI 3.0 continues operational functioning for data clearinghouse management. Accurate, up to date, reliable data provides enabling environment for informed decision making. Also builds on interdisciplinary foundations towards more collaborative and systemic planning, policy making and coordinated interventions. **Location-enabled social networking, global connectivity and free flow of information, opinions and ideas provides a fertile opportunity to recraft and retool government engagement with constituencies.**

From:
1) Sorensen, M., (2013), "SDI 3.0 Delivering Place -Transforming Government" presented in ESRI User Conference in San Diego, California, 23-27 July 2012, Internet Access: https://proceedings.esri.com/library/userconf/proc12/papers/1142_236.pdf

SDI 3.0

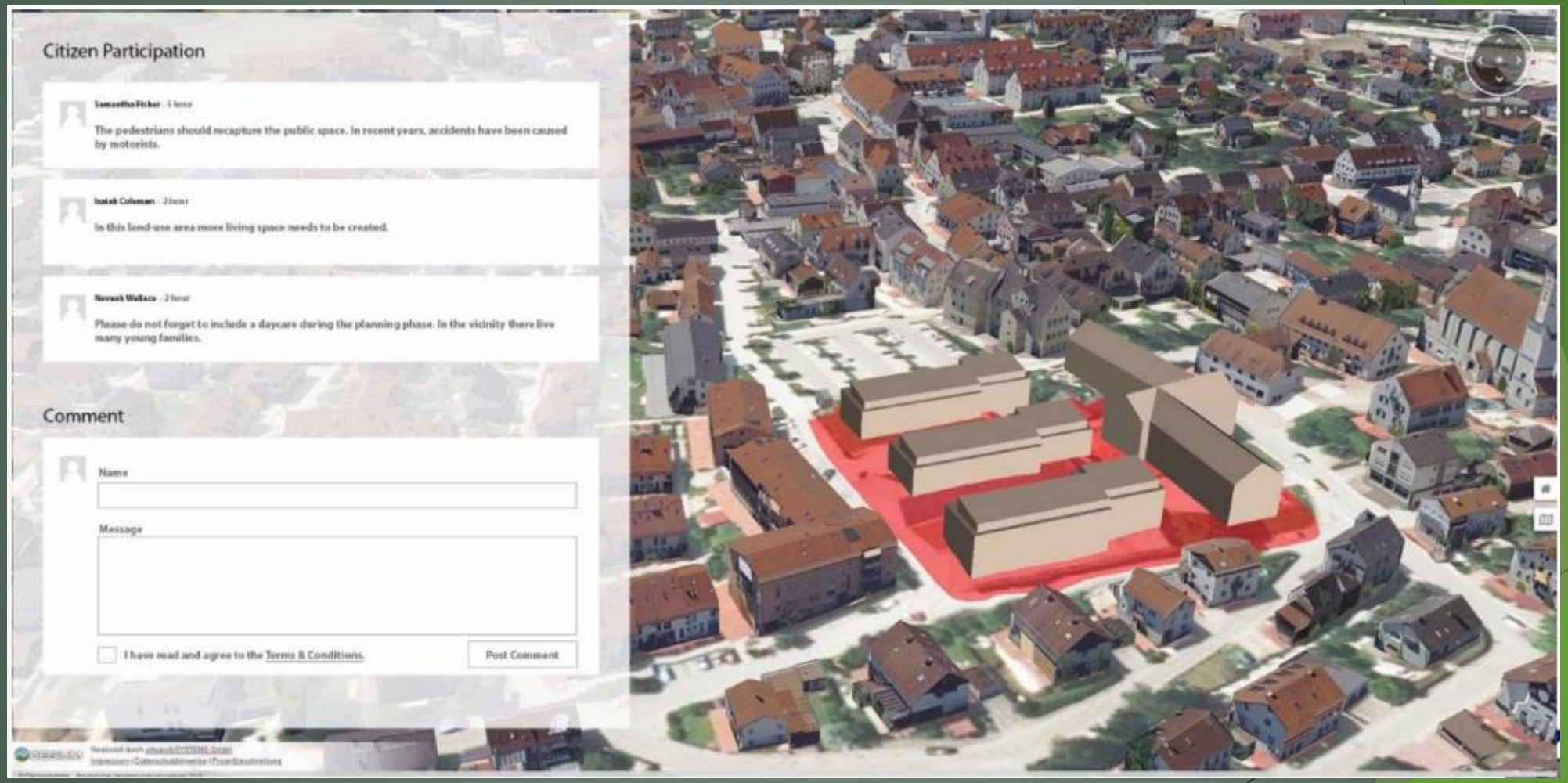
- Convergence of telecommunications, location based services, mobile computing, , sensing networks, volunteered geographic information from citizens and a growing field of intelligent infrastructure technologies all provide a rich and diverse information environment that can be tapped into with new tools and techniques for deriving useful results. This environment also provides a basis for establishing and multiple channels of two-way engagement with the public, private sector enterprises, institutional and civil society sectors in a manner that will likely transform how government actually functions.
- Through such a massively connected and dynamic information environment it should be possible to identify environmental and socioeconomic trends and their multiple causative factors and interdependent issues far enough in advance to initiate the coordinated interventions needed to avoid problems and take advantage of opportunities, thus strengthening the basis for the elusive community sustainability and resilience characteristics.

From:
1) Sorensen, M., (2013), "SDI 3.0 Delivering Place -Transforming Government" presented in ESRI User Conference in San Diego, California, 23-27 July 2012, Internet Access: https://proceedings.esri.com/library/userconf/proc12/papers/1142_236.pdf

Crowdsourcing and Citizen-based Science

- Crowd-sourcing and citizen-based science also offers further opportunities for further community engagement as part of the design and decision making process, while also complementing traditional geospatial data information through citizen feedback and monitoring

Example 8: Citizen Participation - using 3D City models to Gather Feedback on a New Plan in Rotterdam



Picture From:

1) van Ree, H. J., (2018), “The Rotterdam 3D city model-a digital twin”, Internet Access: https://d1rkab7tlqy5f1.cloudfront.net/BK/Over_de_faculteit/Afdelingen/OTB_-_Research_for_the_built_environment/Onderwijs/Presentaties%20OTB-studiedagen/2018/1.%20Jane%20van%20Ree%20181019_Rotterdam%203D%20city%20model.pdf

Example 9: Building a Community Engagement Platform with Spatial Data

- Researchers and professionals based in Helsinki offer a platform for anyone to create their own map-based questionnaires
- Aim at helping people to engage with and influence the future of their surroundings, creating more livable and lovable cities – together

The Stockholm government taps into residents' collective knowledge to plan and build a liveable city. A community engagement platform with spatial data was used to gathering residents' ideas and opinions about public place designs in the Södra Värtan harbor area. The results have helped Stockholm's planners to better understand the priorities of the people.

https://maptionnaire.com/best-participation-practices/online-public-participation-survey

https://youtu.be/CmnObLsnoVc

Q & A