

邁向智慧化的土木工程

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智慧 =

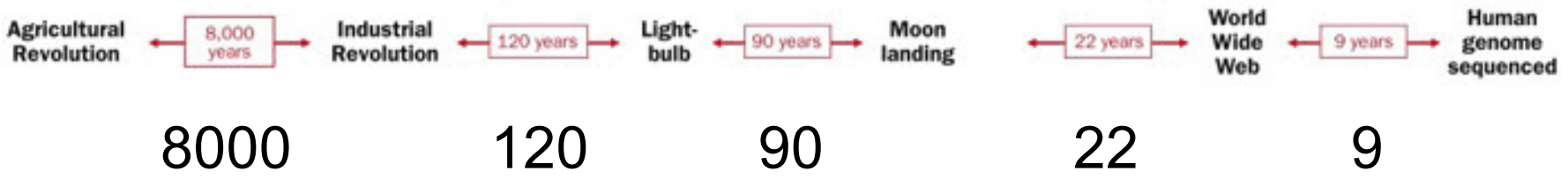
Smart or Intelligent?

Smart vs. Intelligence

- Smart is an earned status.
- Intelligence is something with which you are born. It is the measurement of your ability to become smarter through learning.

Ref.: <http://www.differencebetween.net/miscellaneous/difference-between-smart-and-intelligent/#ixzz5XvsrZle4>

1 The accelerating pace of change ...

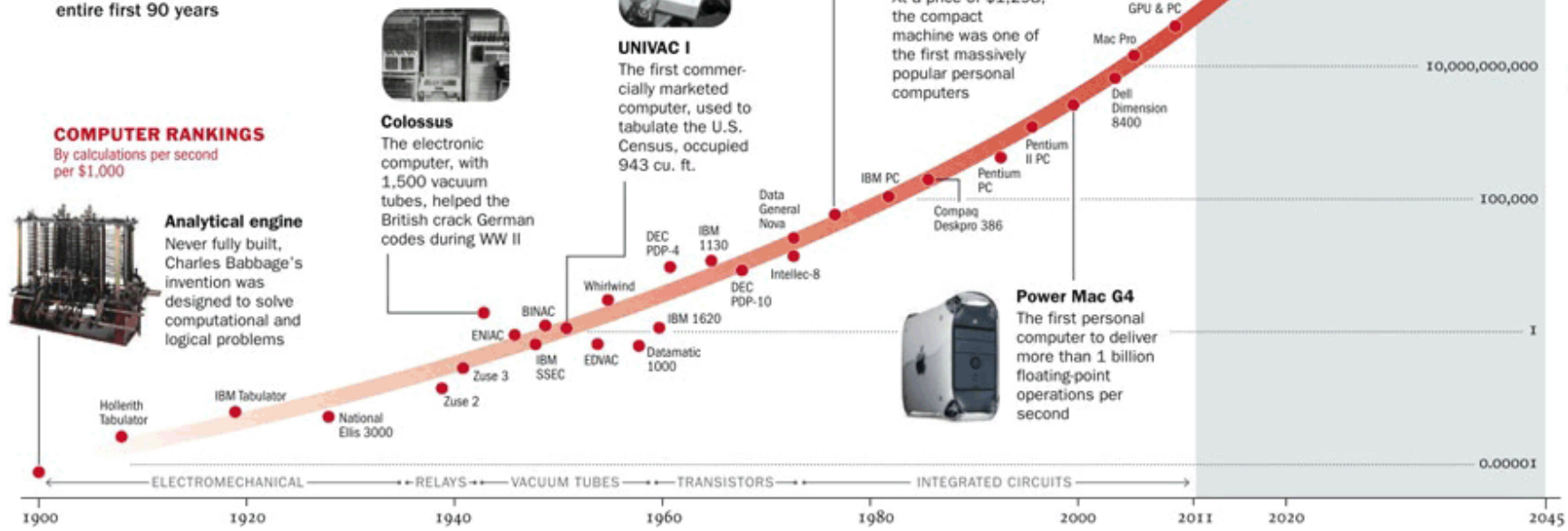


1 The accelerating pace of change ...



2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years



Von Industrie 1.0 zu Industrie 4.0

Smart Factory

Mechanization

Water/steam power



Erster mechanischer Webstuhl
1784

Erste Industrielle Revolution durch Einführung mechanischer Produktionsanlagen mithilfe von Wasser- und Dampfkraft

Ende 18. Jhdt

Industrialization

Production line
Mass production



Erstes Fließband, Schlachthofe von Cincinnati
1870

Zweite Industrielle Revolution durch Einführung arbeitsteiliger Massenproduktion mithilfe von elektrischer Energie

Beginn 20. Jhdt

Automation



Erste Speicherprogrammierbare Steuerung (SPS), Modicon 084
1969

Dritte Industrielle Revolution durch Einsatz von Elektronik und IT zur weiteren Automatisierung der Produktion

Computer control
Manufacturing with precision

Beginn 70er Jahre 20. Jhdt



Vierte Industrielle Revolution auf Basis von Cyber-Physical Systemen

Cyber physical systems

Mass customization

heute

Grad der Komplexität

Zeit

Quelle: DFKI (2011)

Forschungsunion

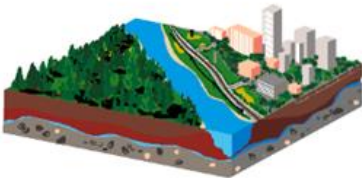
Wirtschaft und Wissenschaft begleiten die Hightech-Strategie

<http://www.plmportal.org/news-in-detail/items/comment-on-industry-40-strategy-recommendation-of-the-forschungsunion-falls-short.html>

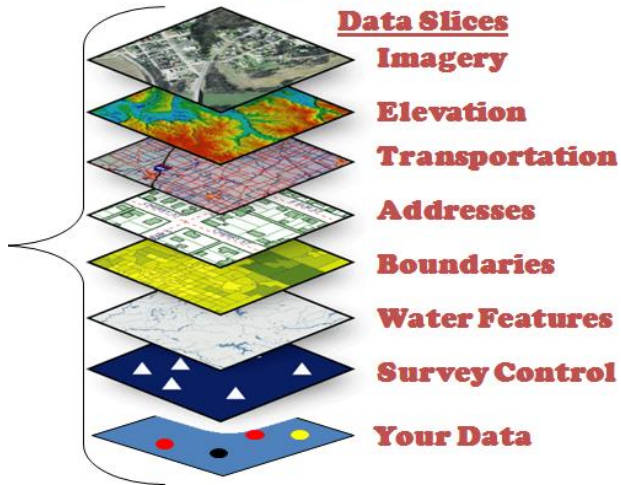


Cyber-Physical Integration

The Real World



GIS World Model



Data Slices

Imagery

Elevation

Transportation

Addresses

Boundaries

Water Features

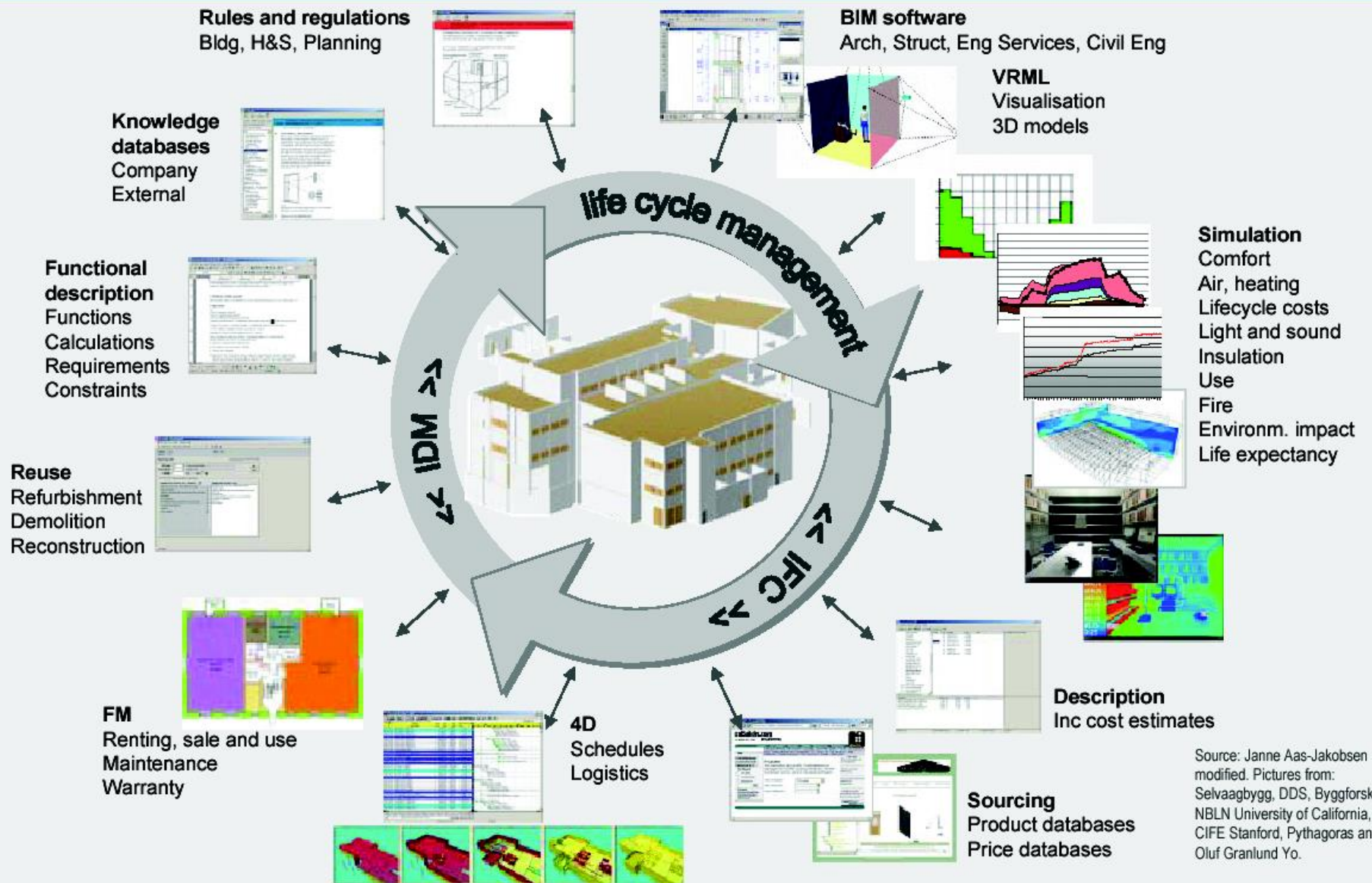
Survey Control

Your Data

GIS

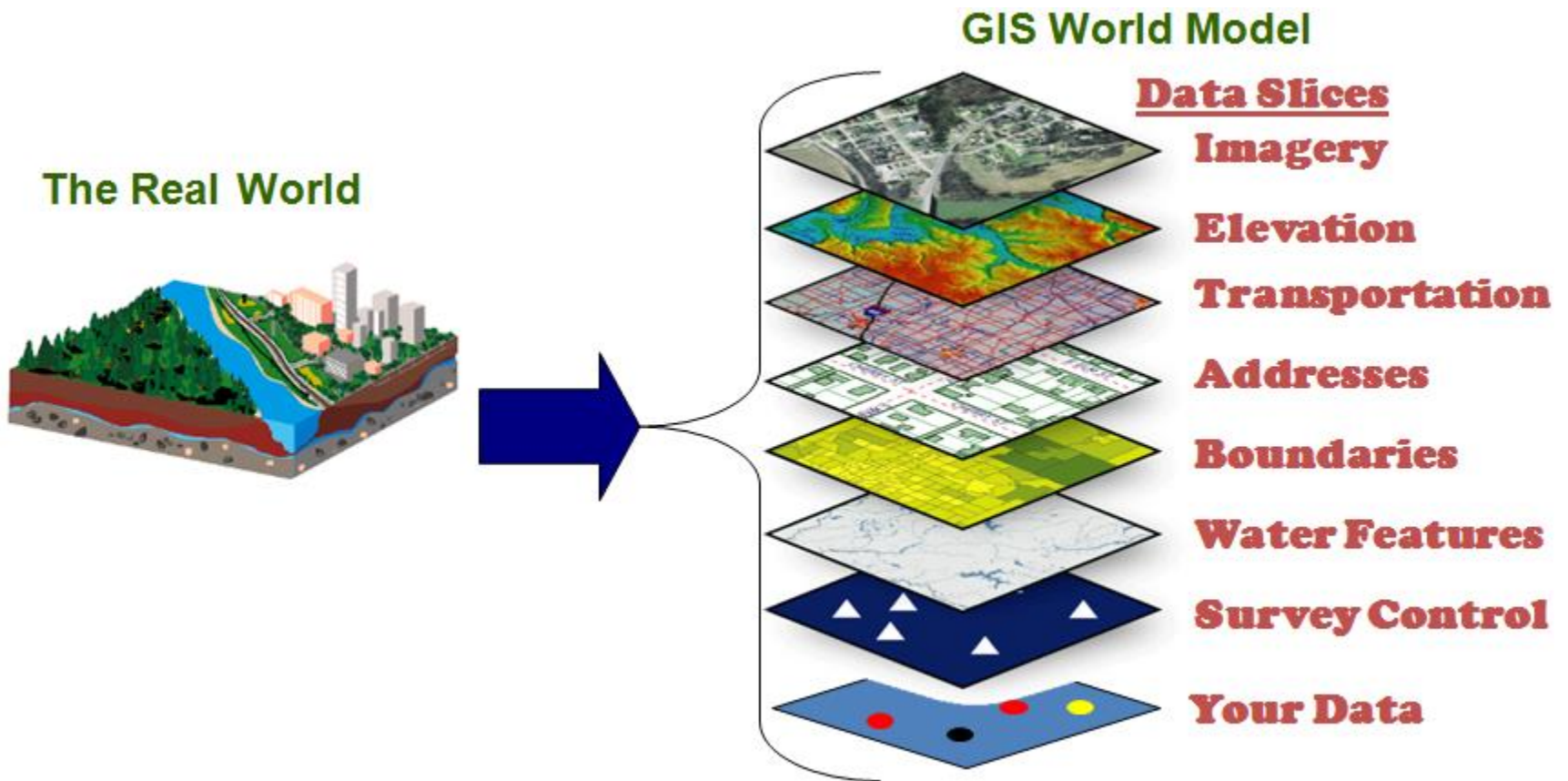


BIM促成營建產品資訊生命週期共享之實現



Source: Janne Aas-Jakobsen modified. Pictures from: Selvaagbygg, DDS, Byggforsk, NBLN University of California, CIFE Stanford, Pythagoras and Oluf Granlund Yo.

GIS Modeling



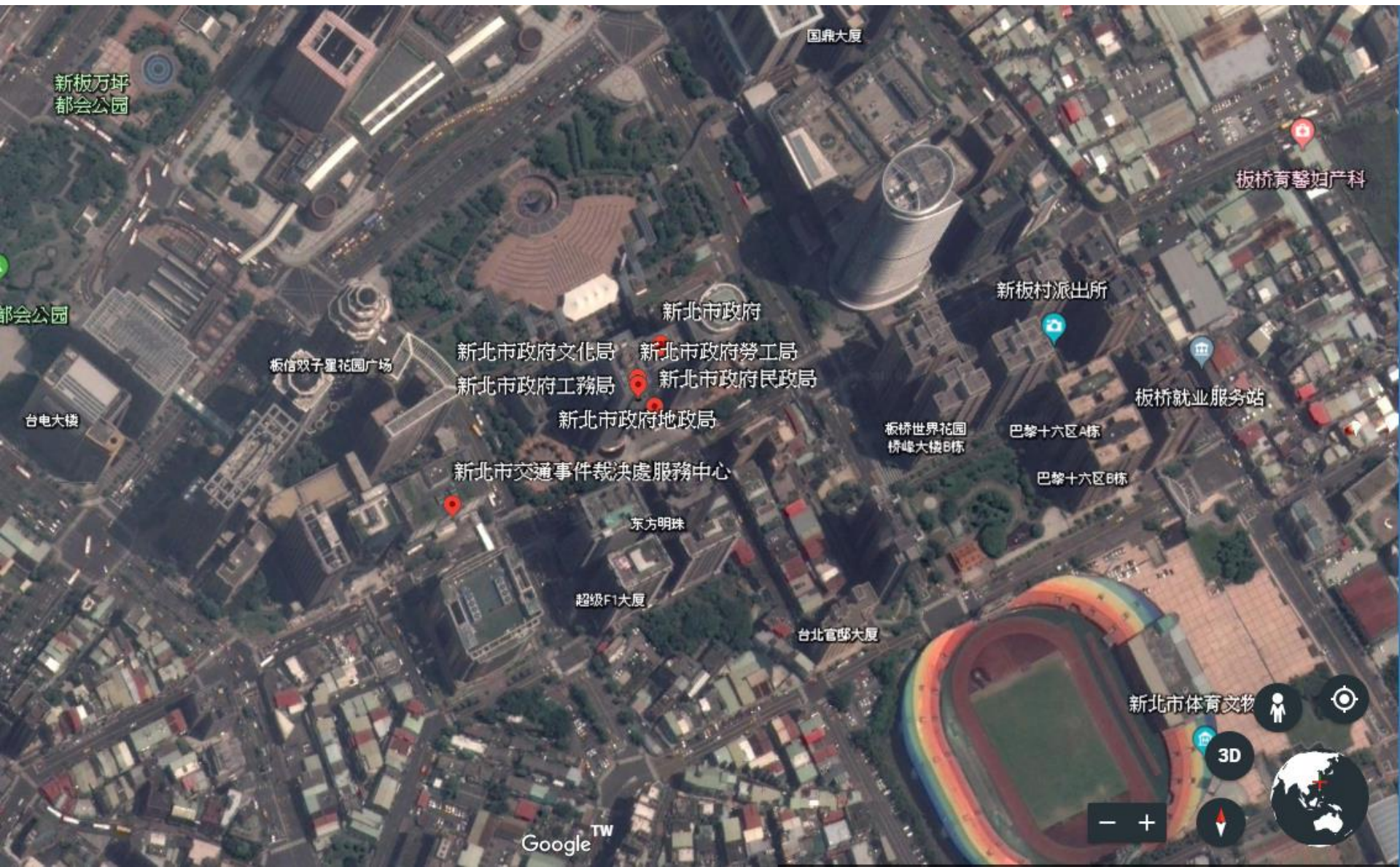
Google Map

The screenshot shows a Google Maps interface with a search for "new taipei city hall". The left sidebar contains the following information:

- Search bar: new taipei city hall
- Back to results
- New Taipei City Government (新北市市政府)
- 4.2 ★★★★★ · 317 reviews
- City Government Office
- Actions: SAVE, NEARBY, SEND TO YOUR PHONE, SHARE
- History: You visited 2 months ago
- Address: No. 161, Section 1, Zhongshan Road, Banqiao District, New Taipei City, 220
- Full Address: 220新北市板橋區中山路一段161號
- Coordinates: 2F68+X7 Taipei
- Website: ntpc.gov.tw
- Phone: 02 2960 3456
- Status: Closed. Opens at 8:00 AM
- Option: Add a label
- Bottom: SUGGEST AN EDIT

The map shows the location of New Taipei City Government, marked with a red pin. The map includes labels for various landmarks and businesses in the Banqiao area, such as Banqiao Station, Mega City, and New Taipei City Plaza. The map also shows the surrounding streets and landmarks.

Google Earth



Google 街景

全景相片



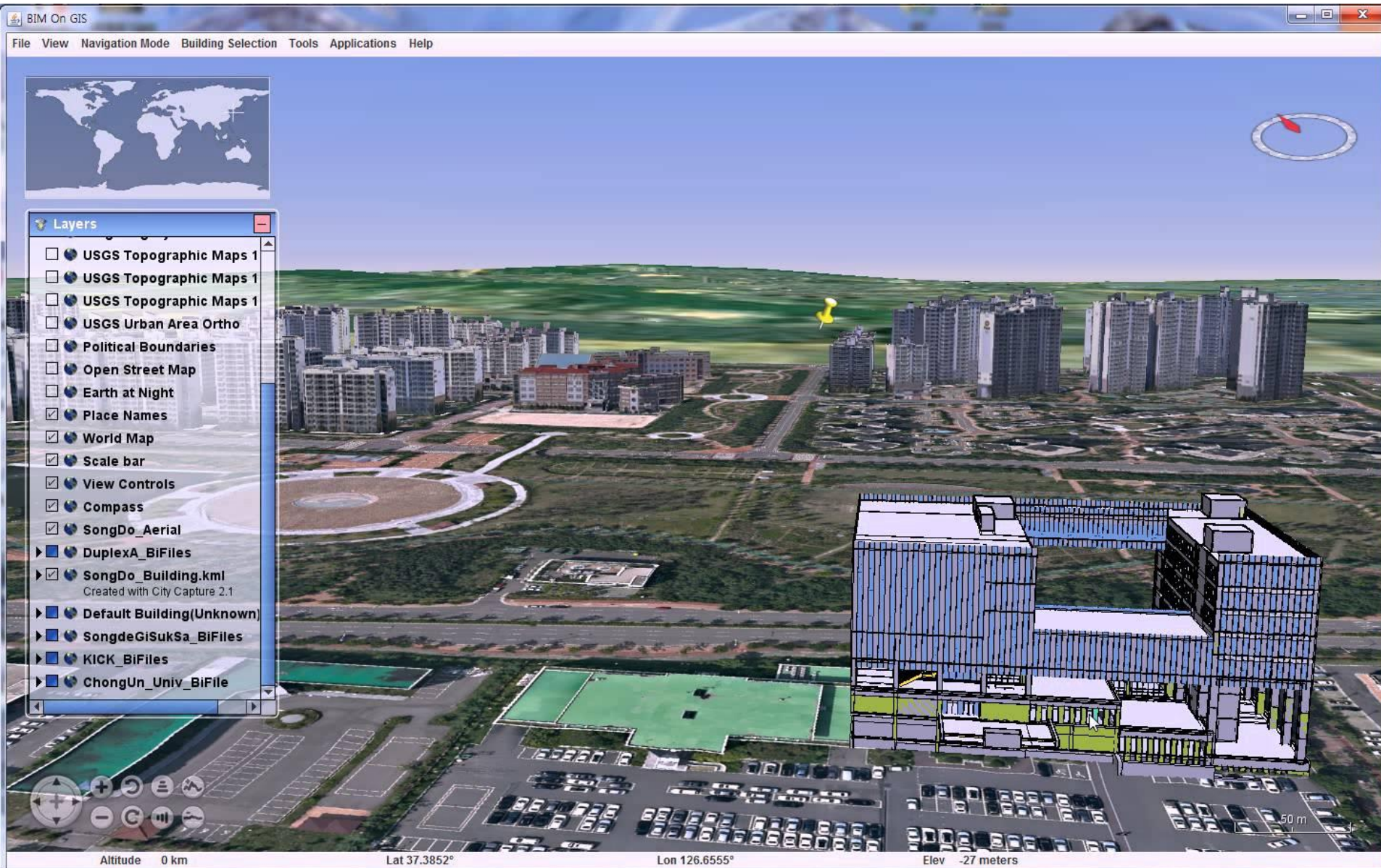
新北市政府
25.01°N, 121.47°E

Google™

3D GIS



BIM on GIS

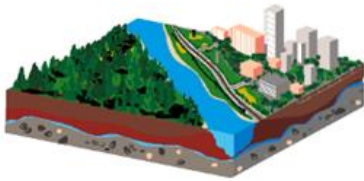


**BIM + GIS:
the Knowledge Base of
the built environment**

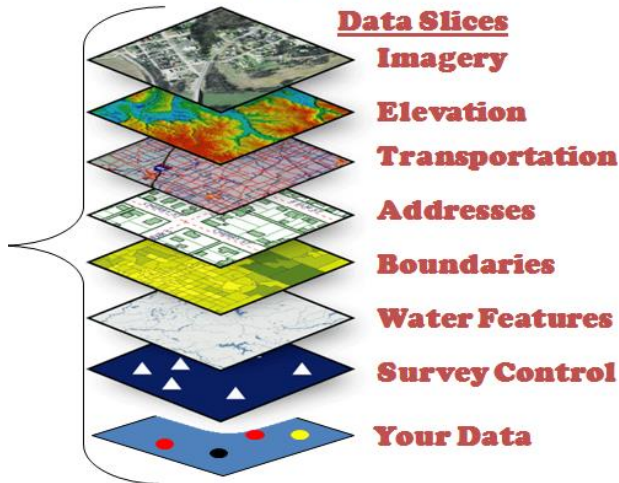
Cyber-Physical Integration



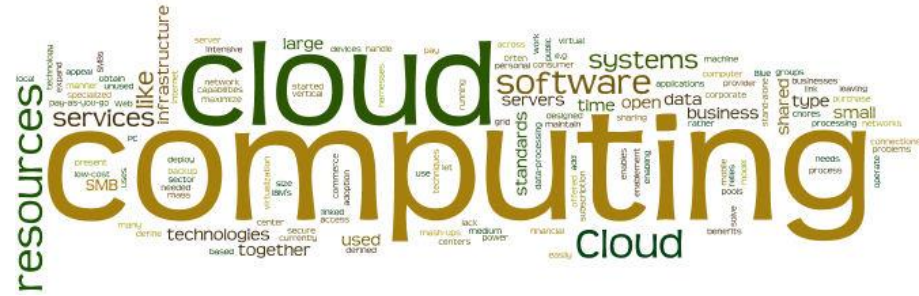
The Real World



GIS World Model



AI



GIS

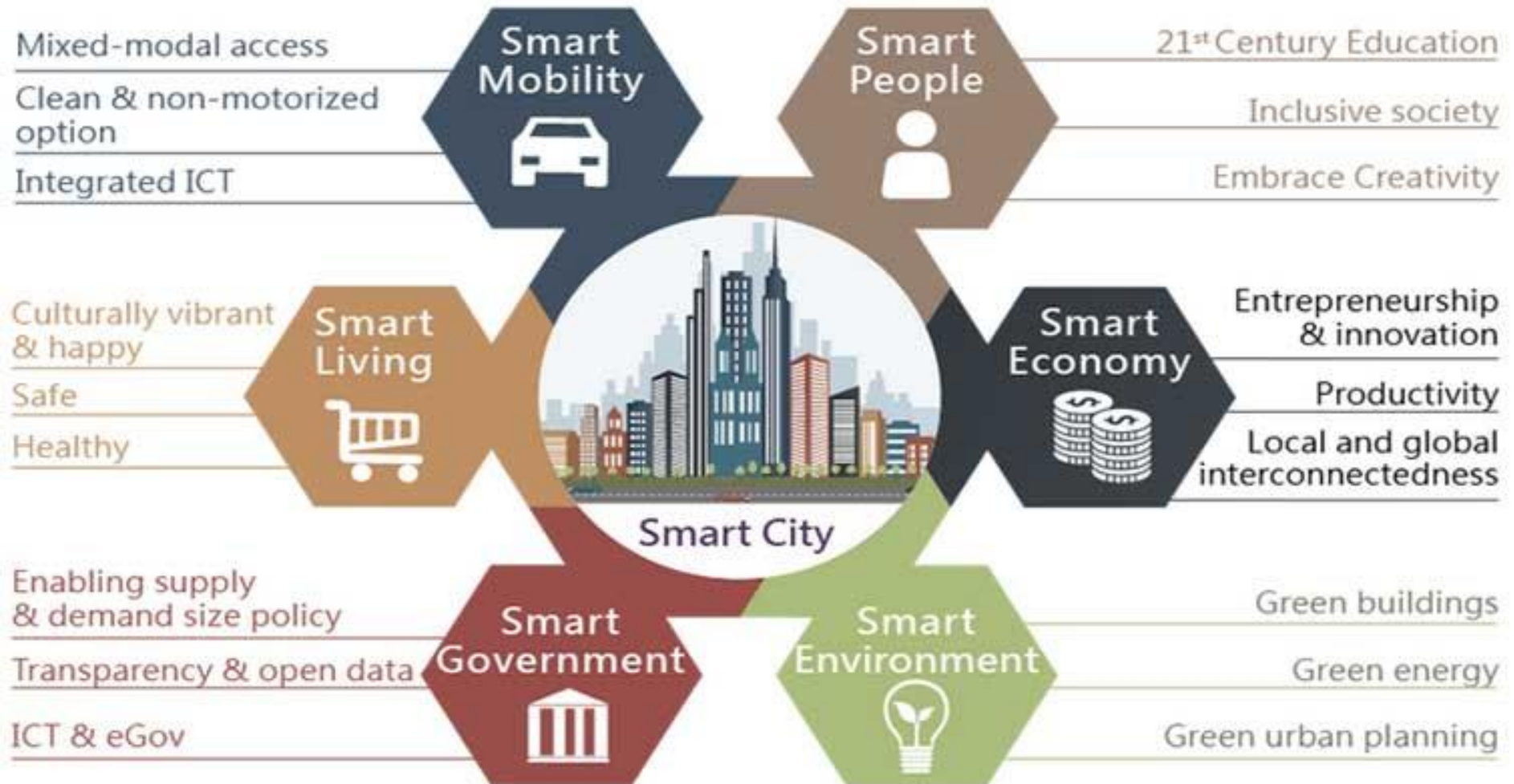


Smart City

- A smart city is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently. ...
The smart city concept integrates information and communication technology (ICT), and various physical devices connected to the network (the Internet of things or IoT) to optimize the efficiency of city operations and services and connect to citizens. Smart city technology allows city officials to interact directly with both community and city infrastructure and to monitor what is happening in the city and how the city is evolving.

~Wikipedia (2018)

Smart City



AI驅動的智慧化應用

- 資訊蒐集與萃取

- IOT, Sensing network, Social network, ...
- Data/Knowledge Mining, Pattern recognition, ...

- (異質)資訊整合

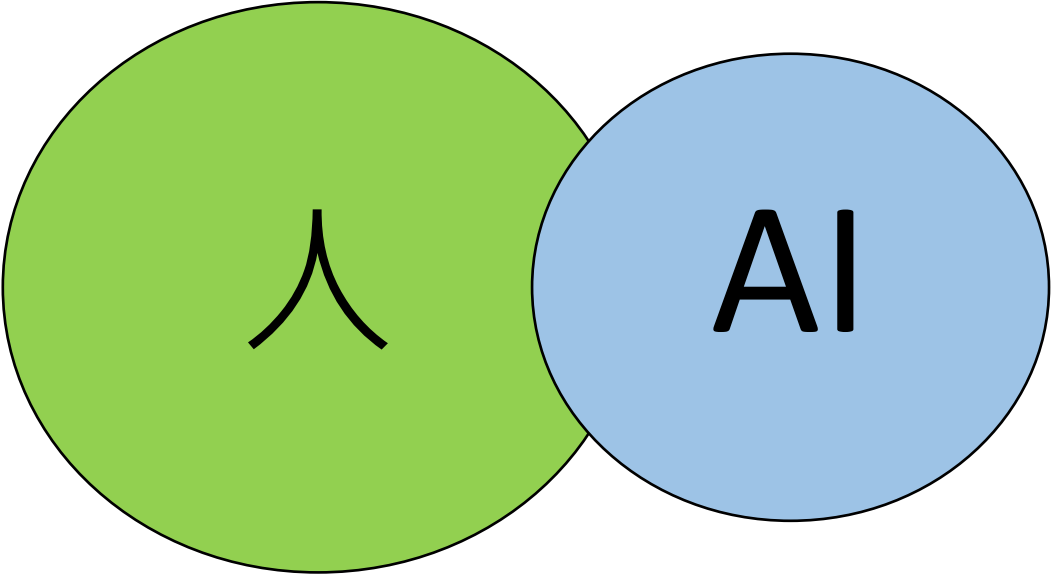
- Data fusion/integration

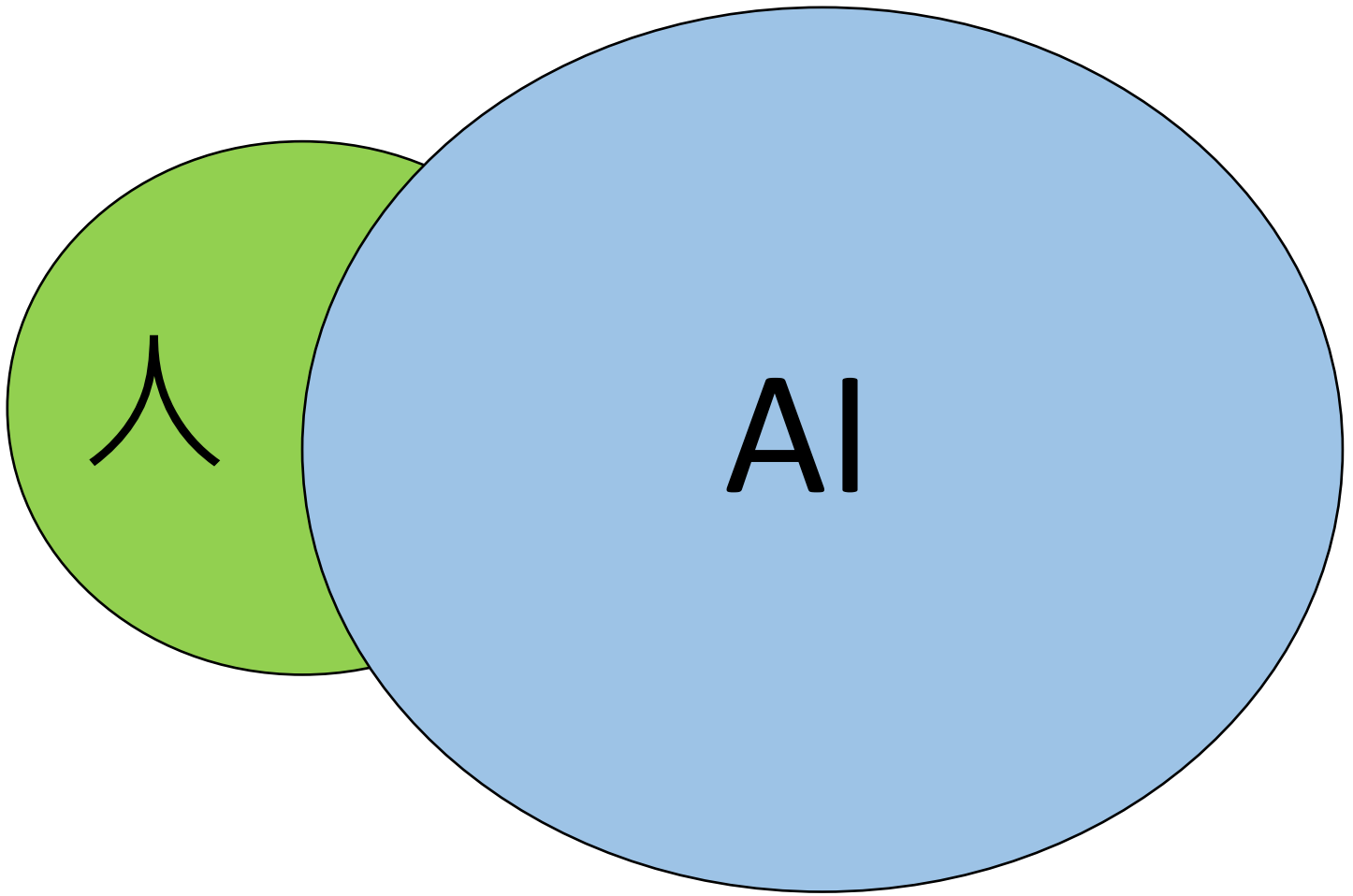
- 資訊加值應用

- Statistical analysis, Risk analysis...
- Machine learning/reasoning, Deep learning...

- 決策輔助

- Multi-objectives optimization
- Expert system, Intelligent agents, ...
- Scenario simulation





Intelligence vs. Wisdom

- The main difference between intelligence and wisdom is that **intelligence** means implementing the gain knowledge wisely and perfectly and it can learned by gaining more experience of a field while **wisdom** is something that can never come with age.
- Wisdom means to apply your knowledge, information, data and experience wisely and intelligently. It is the art to distinct between right and wrong, wishes and necessities, bad and good.

Ref.: <https://www.quora.com/What-is-the-difference-between-intelligence-wisdom>

What is Wisdom ?

- 辨別輕重緩急的能力
 - 有廣泛的理解力 (系統思考的能力)
- 對於人類生命的各種結局具有一定的警覺
 - 覺知力、洞察力
- 智慧的精髓在於解放，盡可能地從當前的桎梏中解放出來
 - 創造力、創意思考力

(羅素的回憶：來自記憶裡的肖像—羅素 著，容士毅 譯)

人 + AI

Smart City

must be

Sustainable

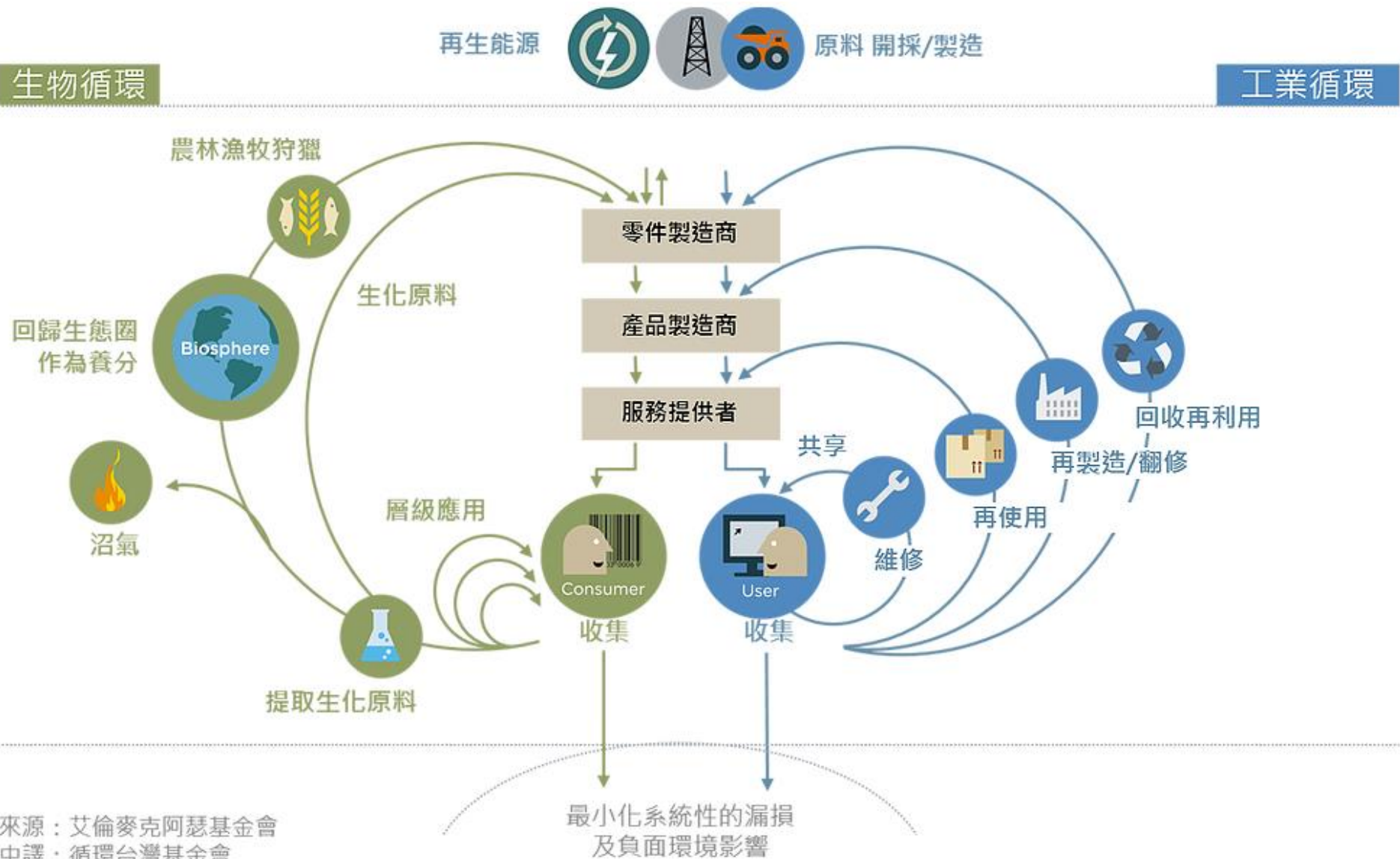
Sustainable City



Smart resilient City

智慧韧性城市

循環經濟系統圖



Smart circular City

智慧循環城市

Thanks for your attention!

感謝聆聽！