BIG DATA FOR SMART OPERATIONS AND MAINTENANCE OF BUILDINGS

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This presentation:

1. Introduction

2. Digital transformation in the construction industry

3. Data handling for smart building operations

4. System Modules

5. Case study

6. Conclusions

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Introduction:

DIGITAL TRANSFORMATION

Digitization in the construction industry – Building Europe's road to "Construction 4.0", Roland Berger GMBH (2016)

DIGITAL DATA
Electronic collection and analysis of data

AUTOMATION
Use of new technologies to create autonomous, self-organizing systems
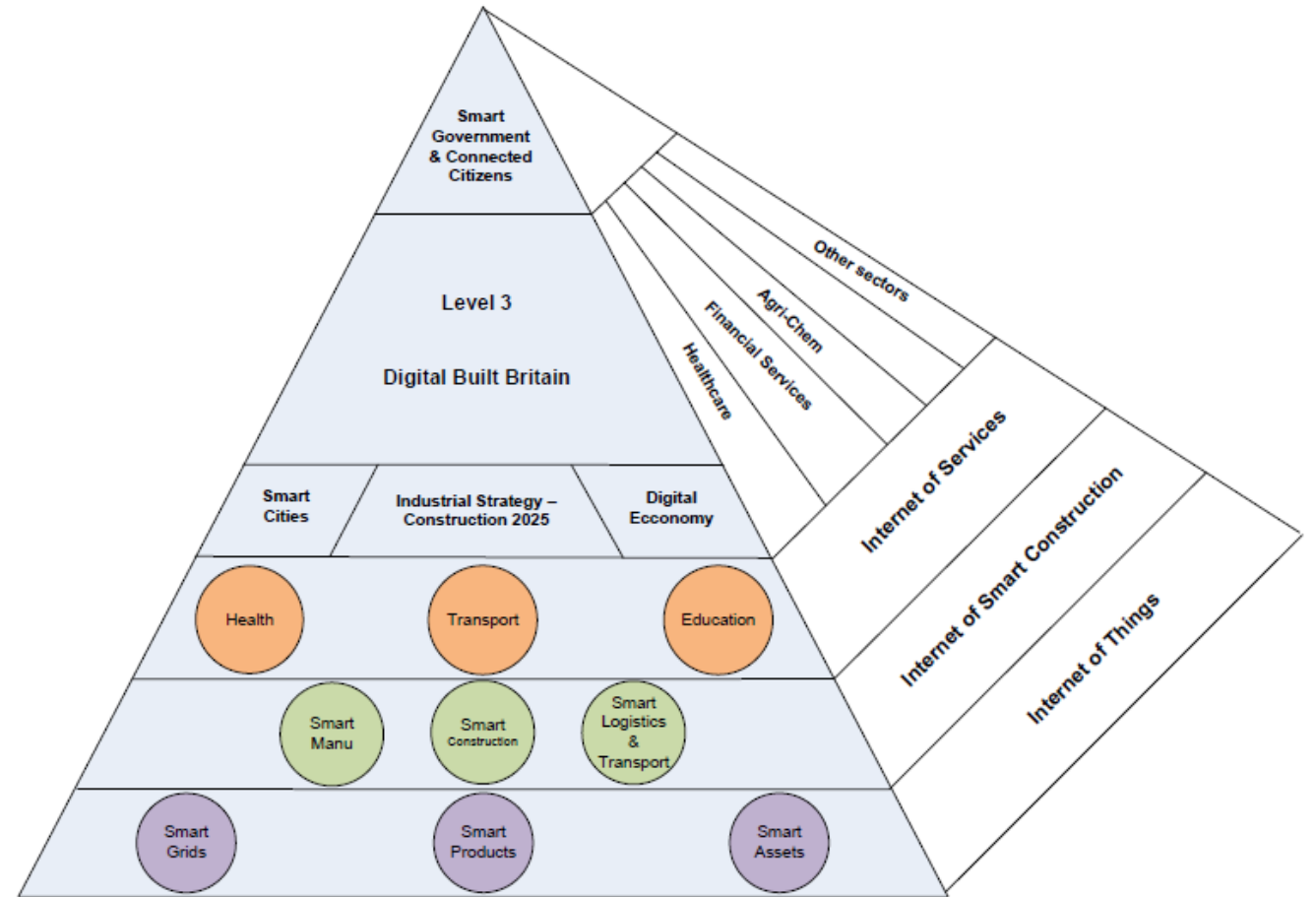
DIGITAL TRANSFOR-MATION

CONNECTIVITY
Connection and synchronization of hitherto separate activities

DIGITAL ACCESS
Mobile access to the internet and internal networks

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Introduction:

"Cross Sector Collaboration Model",
Digital Built Britain (2015)

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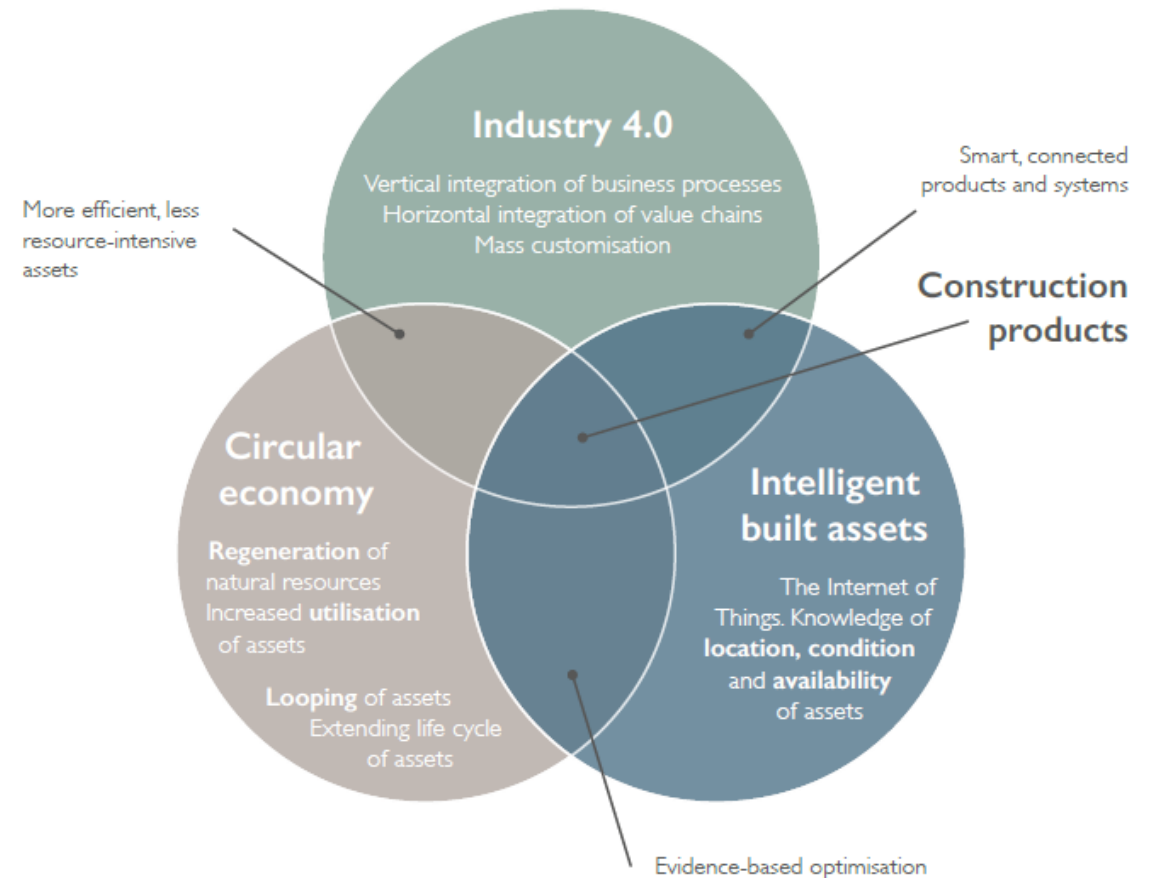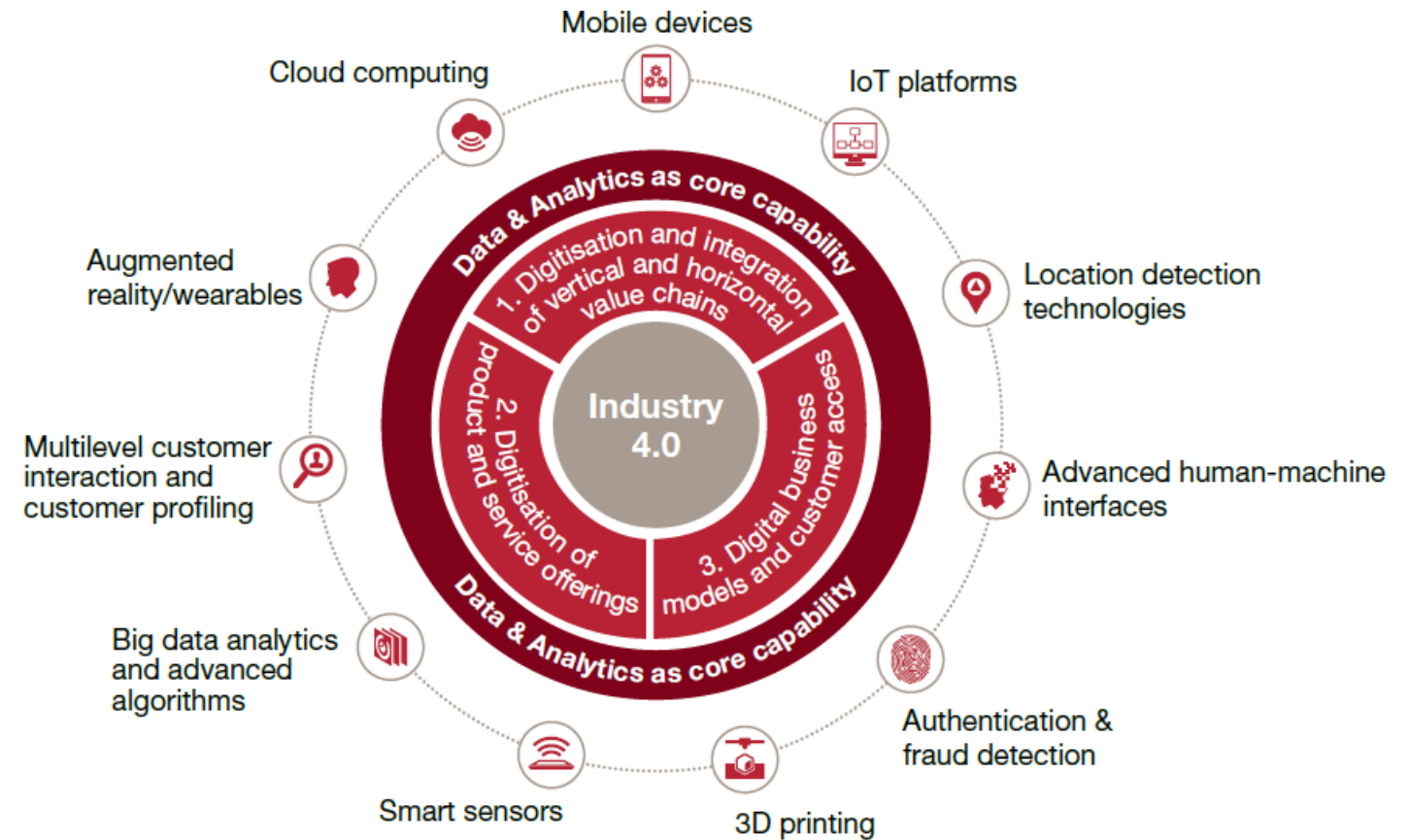
Digital transformation in the construction industry

Industry 4.0, intelligent assets and the circular economy

"The Future for Construction Product Manufacturing", The Construction Products Association (October 2016)

Industry 4.0
Vertical integration of business processes
Horizontal integration of value chains
Mass customisation

Smart, connected products and systems

More efficient, less resource-intensive assets

Construction products

Circular economy
Regeneration of natural resources
Increased **utilisation** of assets
Looping of assets
Extending life cycle of assets

Intelligent built assets
The Internet of Things. Knowledge of **location, condition** and **availability** of assets

Evidence-based optimisation

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Digital transformation in the construction industry

Mobile devices

Cloud computing

IoT platforms

Augmented reality/wearables

Location detection technologies

Multilevel customer interaction and customer profiling

Advanced human-machine interfaces

Big data analytics and advanced algorithms

Authentication & fraud detection

Smart sensors

3D printing

Data & Analytics as core capability

1. Digitisation and integration of vertical and horizontal value chains

Industry 4.0

2. Digitisation of product and service offerings

3. Digital business models and customer access

Data & Analytics as core capability

Industry 4.0

*Industry 4.0: Building the digital enterprise (*Engineering and construction) (2016 PwC)

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Digital transformation in the construction industry

Expected benefits from digitisation over the next five years

Additional revenue — **2.7%** per annum

Cost reduction — **3.4%** per annum
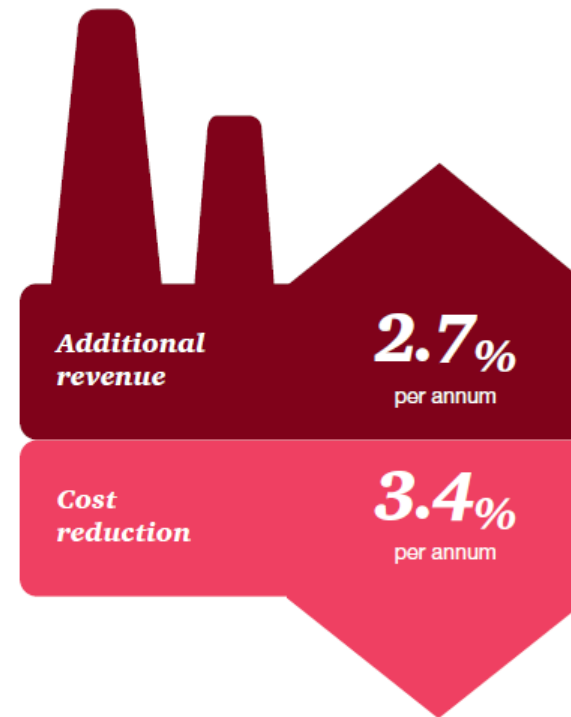
Only 19% of engineering and construction companies have advanced data analytics capabilities

Industry 4.0 and Data Analytics

Industry 4.0: Building the digital enterprise (Engineering and construction) (2016 PwC)

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Data handling for smart building operations

"Physical space is supplanted by cyberspace, and our perceived reality becomes more augmented and digitized"

BIG DATA

People participation **Internet of Things**

BIM

Web 2.0 **Web 3.0**

Structured data **Unstructured data**

Analytics using Knowledge systems

Building Knowledge Modelling

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Big Data and BIM

BIM for 'x' Abilities

Transportation_BIM

Infrastructure_BIM

Disaster Resilience_BIM

Labour Training_BIM

User Behaviour_BIM

Heritage_BIM

H/S_BIM

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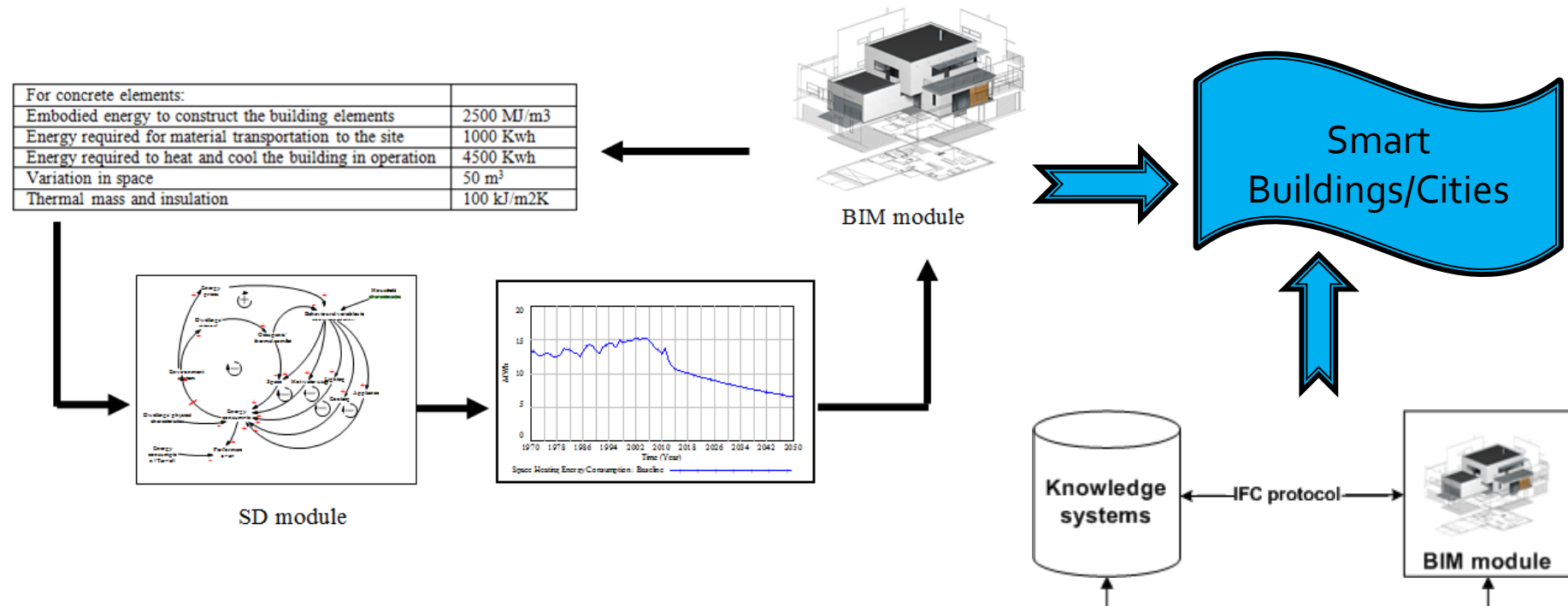
Big Data and BIM

**BIM-based Analytics tools
for better creativity**

Knowledge-based BIM

Agent-based BIM

AI-based BIM

Socio-Tech BIM

Crowdsourcing BIM

Semantic interoperability BIM

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Big Data and BIM (application)

For concrete elements:	
Embodied energy to construct the building elements	2500 MJ/m3
Energy required for material transportation to the site	1000 Kwh
Energy required to heat and cool the building in operation	4500 Kwh
Variation in space	50 m³
Thermal mass and insulation	100 kJ/m2K

BIM module

SD module

Smart Buildings/Cities

Knowledge systems ←IFC protocol→ BIM module

- **Actual Energy usage**
- **Environmental conditions**
- **Economic conditions**
- **Occupants characteristics**
- **Policy issues**

Motawa, I. (2017). Spoken dialogue BIM systems – an application of Big Data in construction. *Journal of Facilities*, DOI : 10.1108/F-01-2016-0001

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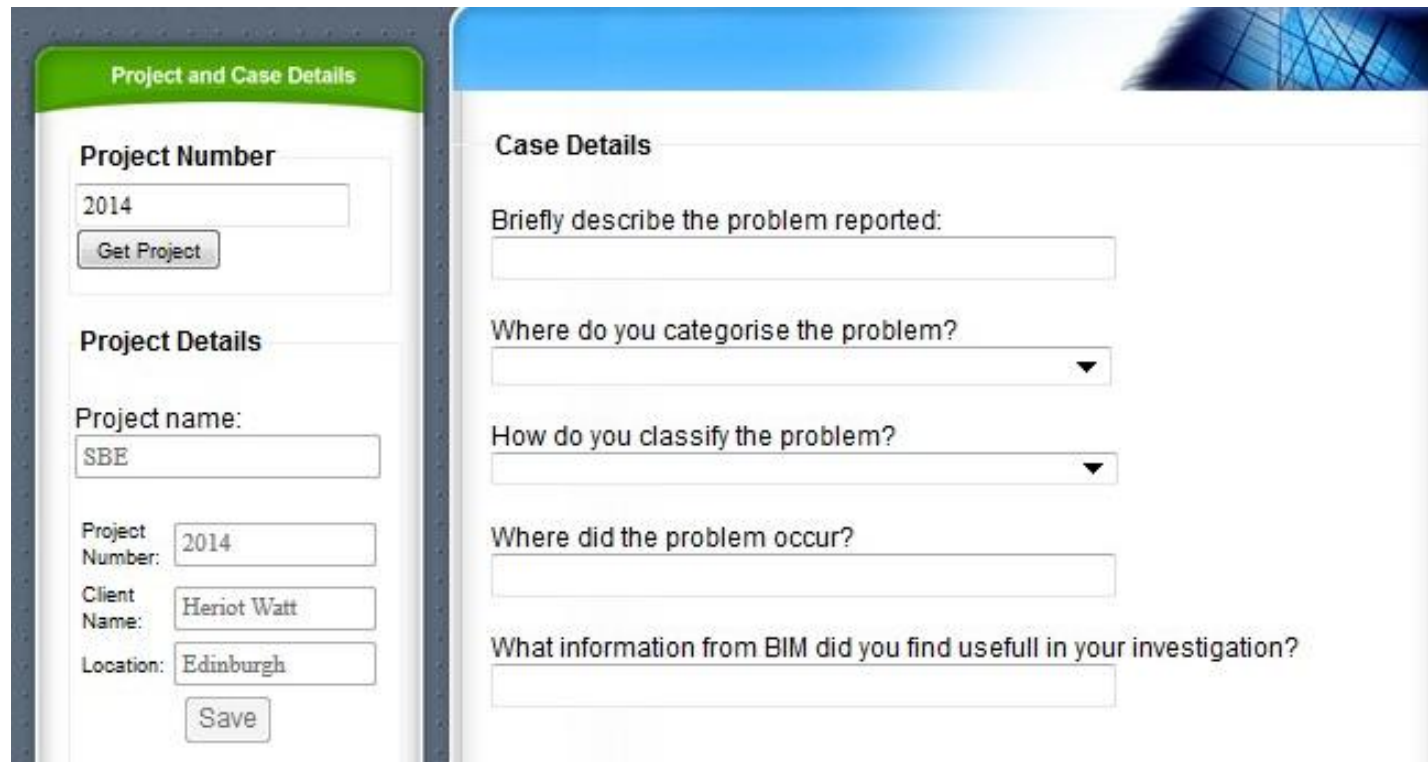
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Big Data and BIM (application) System Modules:

Spoken Dialogue System

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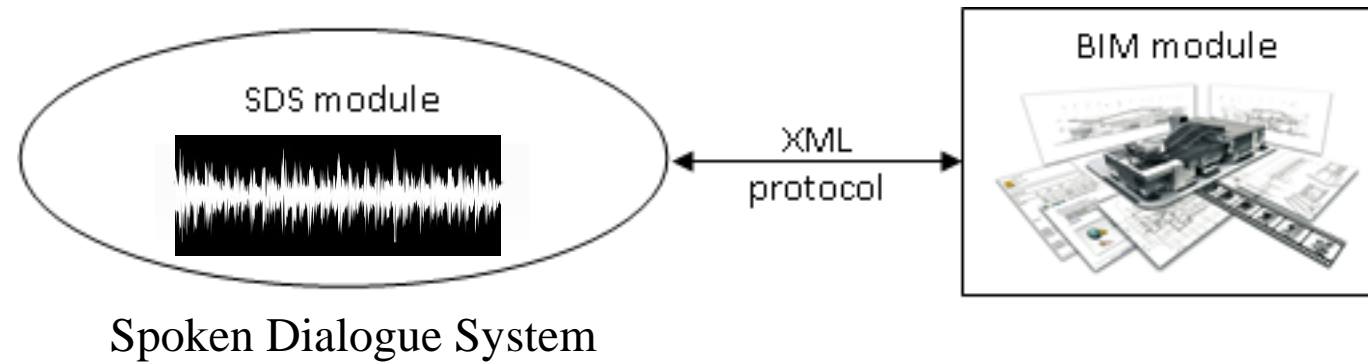
Big Data and BIM (application)
Case study:

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Thank you ……