Centre for
Smart Infrastructure and Construction
An Innovation and Knowledge Centre

Industrial Information Engineering in Smart Infrastructure & Construction

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Backdrop

From Prof Mair’s Introduction:

*Modern construction and infrastructure needs to be*
- Optimised in terms of efficiency, cost, low carbon footprint and service quality
- Robust, resilient and adaptable to changing patterns
- Innovative across all sectors – driven by business in partnership with government

*Source: A National Infrastructure for the 21st Century. Council for Science and Technology, 2009*

… Modern manufacturing and the industrial supply chains linked to it have faced these challenges continuously over the last 20 years
Some Key Issues in Manufacturing & Supply Chains

- **Industrial Resilience**: Preparing systems for disruption/unexpected change
- "**Servitisation**: Transformation from a manufacturing to service organisation
- **Throughlife management**: Whole life cycle of assets and products
Why an Industrial Information Angle?

- Info/Requirements
- Decision
- Sensing
- Closed Loop
- Operations
- Action

Mercedes Paintline
Heathrow Operations
Walmart Supply Chain
Information Questions in Smart Infrastructure and Construction?

1. Information Requirements: What information is needed?

2. Information Management: How is that information best acquired, stored, maintained and accessed?

3. Information Value: What is the value/impact of the information?

4. Asset Optimisation: How can the information ensure “best” use of key Infrastructure assets?
Effective Management of Information

What are the challenges?

• Appropriate methods for acquisition of data?

• Most effective organisation and management of critical information

• To what extent are existing information systems capable of supporting the information required?

• Reliable means of retrieval of meaningful information
Effective Management of Information

How do we tackle the challenges?

• Analysis of appropriate sensor locations, types, numbers

• Software for distributed data retrieval

• Embedding Information [intelligence] in objects
Effective Management of Information

Issues for Smart Infrastructure and Construction?

- Appropriate acquisition of data
- Most effective organisation and management of critical information
- To what extent are existing information systems capable of supporting the information required?
- Reliable means of retrieval of meaningful information
- Life cycle tracking of construction elements & assets (RFID etc)
- Approaches for managing new and existing information required across the life of complex infrastructure
- Are BIM and other information models appropriate/adequate for life cycle support of key infrastructure
- Mechanisms for accessing appropriate data during construction, refurbish, extension, rebuild

CSIC Cambridge Centre for Smart Infrastructure and Construction
EPSRC Engineering and Physical Sciences Research Council
Technology Strategy Board Driving Innovation
UNIVERSITY OF CAMBRIDGE
Value of Information

What are the challenges?

- How do you calculate the “value add” from improved information?

- How do multiple information sources compare in terms of impact on operations, maintenance etc

- When is it worth investing in new information solutions
Value of Information

How do we tackle the challenges?

• Combining sensors and probabilistic prediction models
• Modeling of impact of improved information on decision making
• Analysis of impact of better decisions on operations/maintenance decision sensing

100% OSA
• Benefits of deploying sensing technologies in construction and infrastructure management
• Comparison of different candidate sensing solutions and/or combinations
• When are today's practices inadequate – e.g. manual inspection processes vs automated monitoring

How do you calculate the "value add" from improved information?

How do multiple information sources compare in terms of impact on operations, maintenance etc?

When is it worth investing in new information solutions?
## Proposed Research in the CSIC

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Summary

• Systematic, standardised approach to integrating new information sources

• Sensing is the first step in the closed loop

• manufacturing & industrial supply chains directly relevant to those in construction & major infrastructure