

An Integrated Future

CITA
BIM Gathering 2015

BIM and Knowledge based Risk Management System

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CITA BIM GATHERING 2015

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Research background

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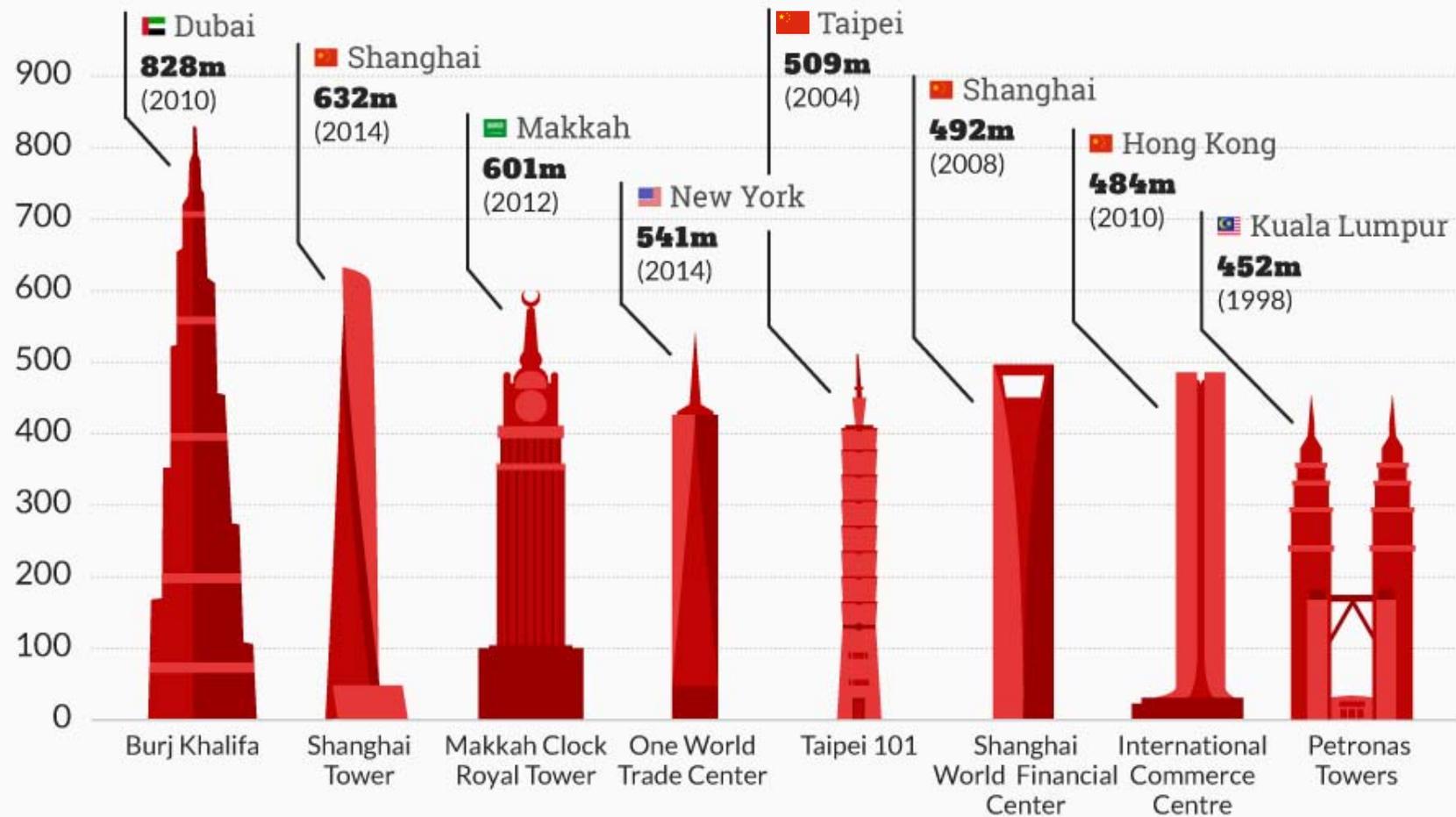
The problem to be solved

3

Research findings and future plan

One World Trade Center is the world's fourth tallest building

The tallest buildings worldwide (in metres)



@StatistaCharts Source: Emporis

i100

from The INDEPENDENT

statista

Risk Management is still a global challenge



Examples

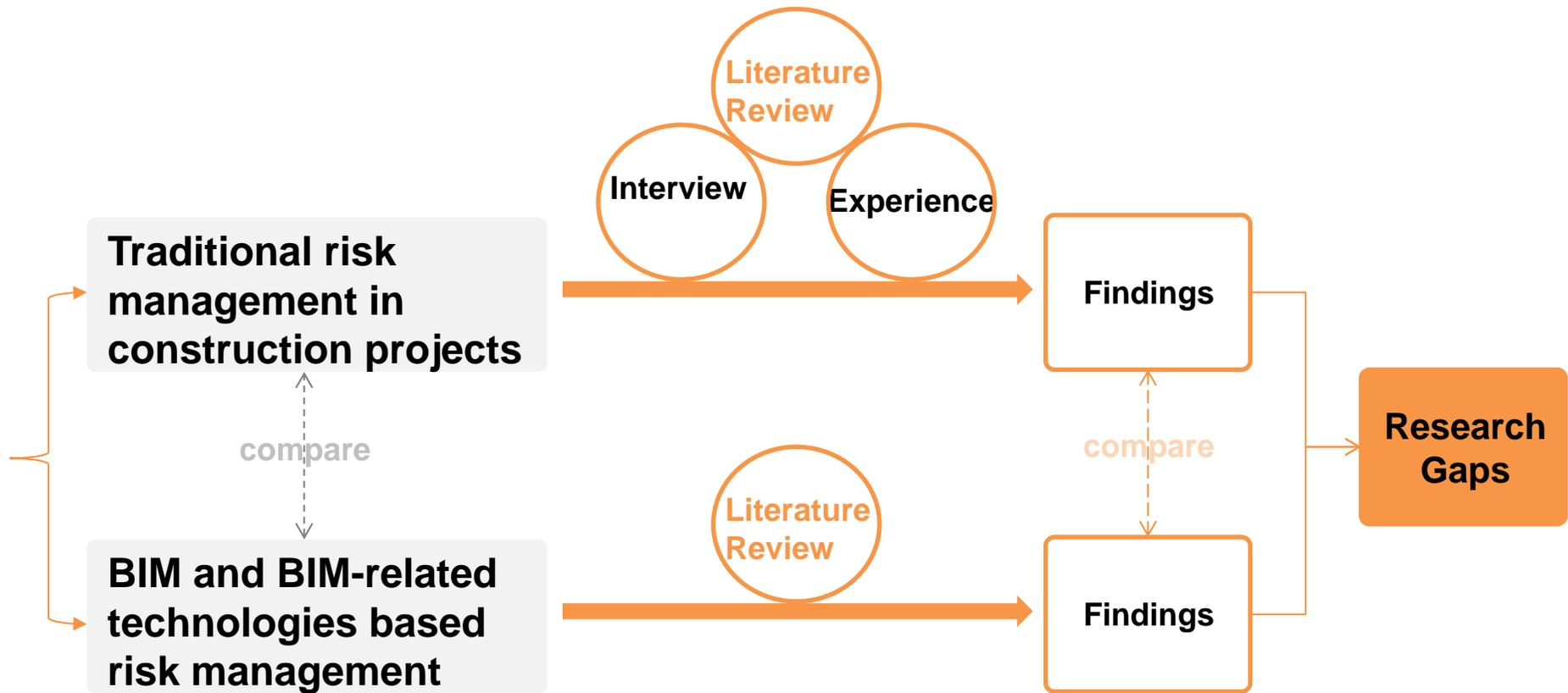
503 bridges collapsed in US 1989-2000 [1];

Over **26,000** workers died on construction sites in US 1989-2013 [2];

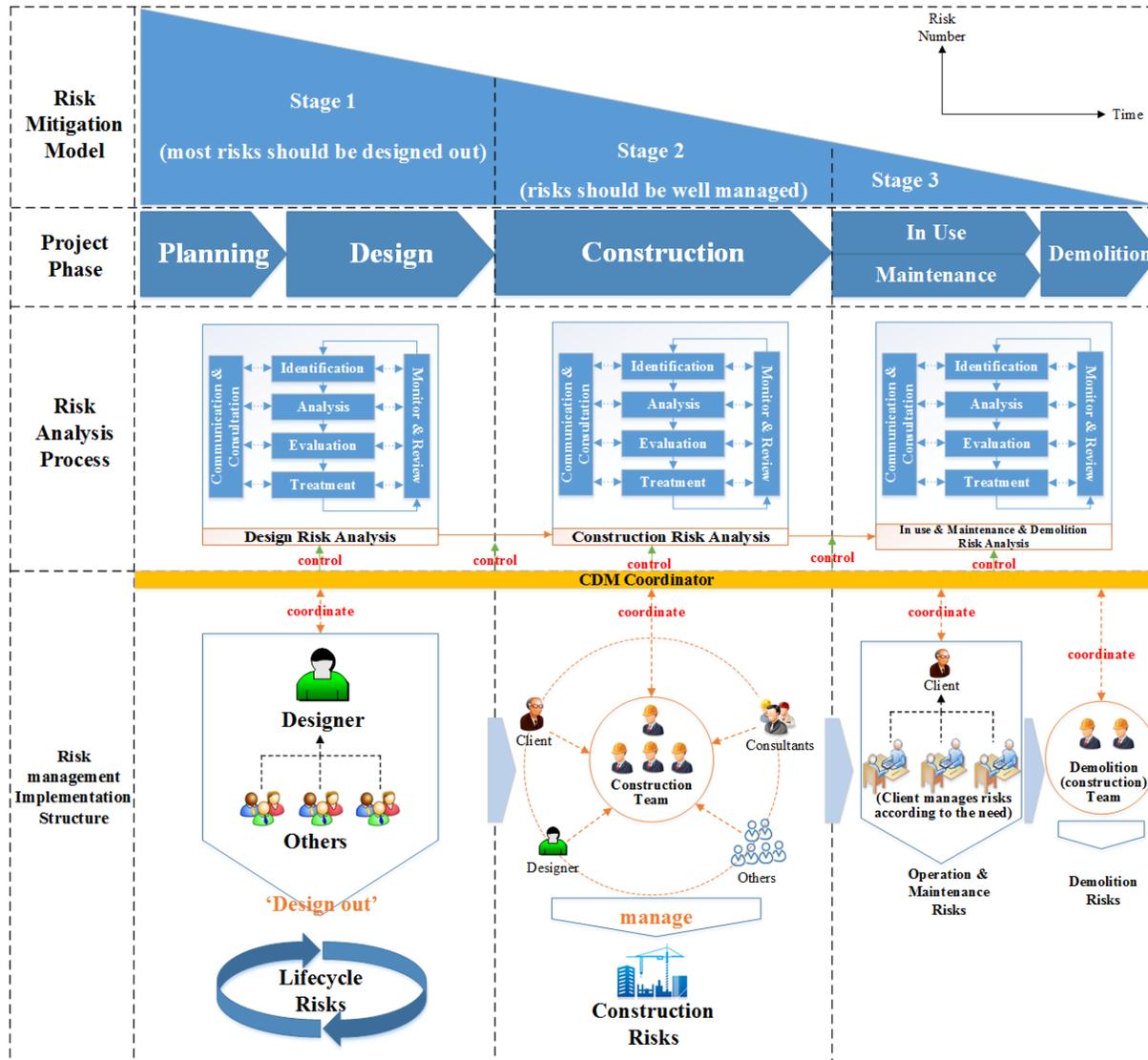
Over **60,000** on-site fatal accidents happen very year globally [3];

...

Method of identifying current gaps



General process of risk management



Concept of 'Early risk identification and prevention' required by UK CDM rules

Heavily reliant on multi-disciplinary knowledge and experience

Fragmented risk information management

Capture of 'correct' knowledge is challenging within limited time

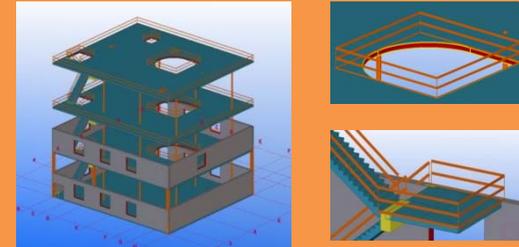
Risk communication tends to be poor, incomplete and inconsistent

BIM and BIM related digital technologies based risk management

BIM

is becoming a systematic tool for risk management in AEC projects

Automated rule checking [2]



Knowledge based system

Reactive IT-based safety systems

- 1) Database
- 2) Virtual Reality
- 3) 4D CAD
- 4) GIS



Source:[4]

Proactive IT-based safety systems

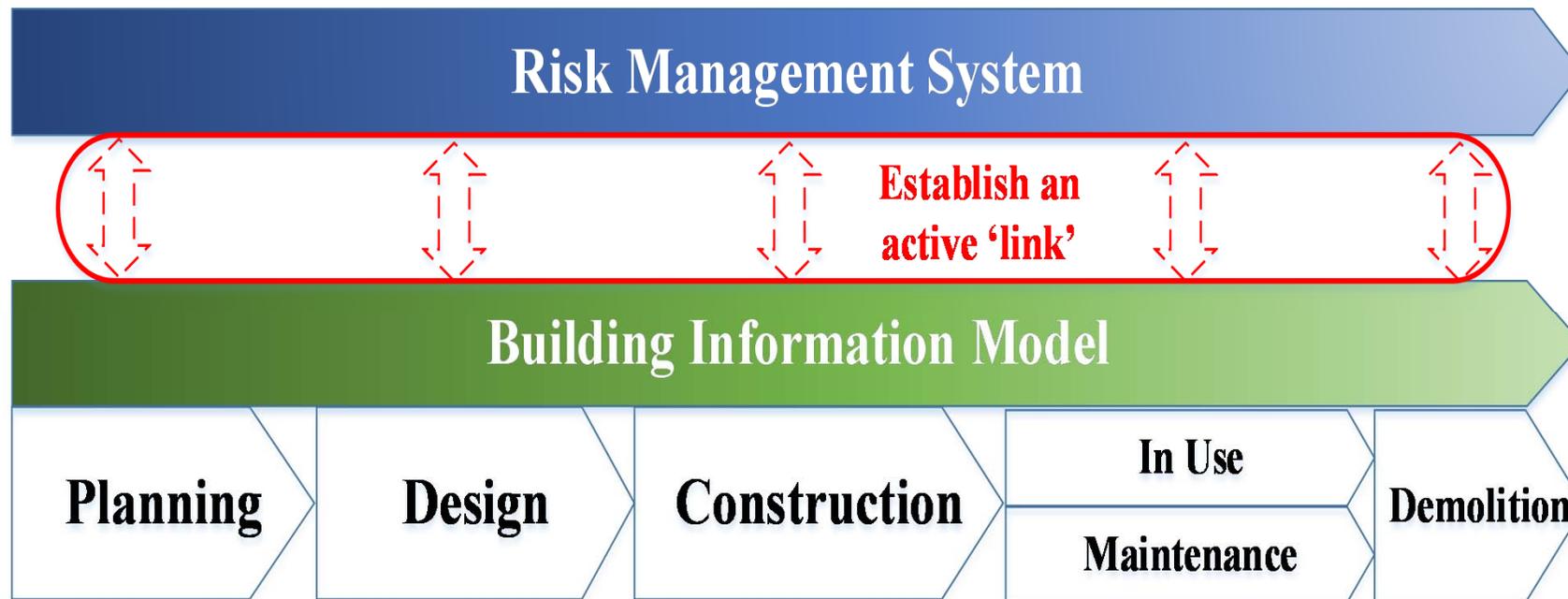
based on sensing & tracking technologies (using real-time data)



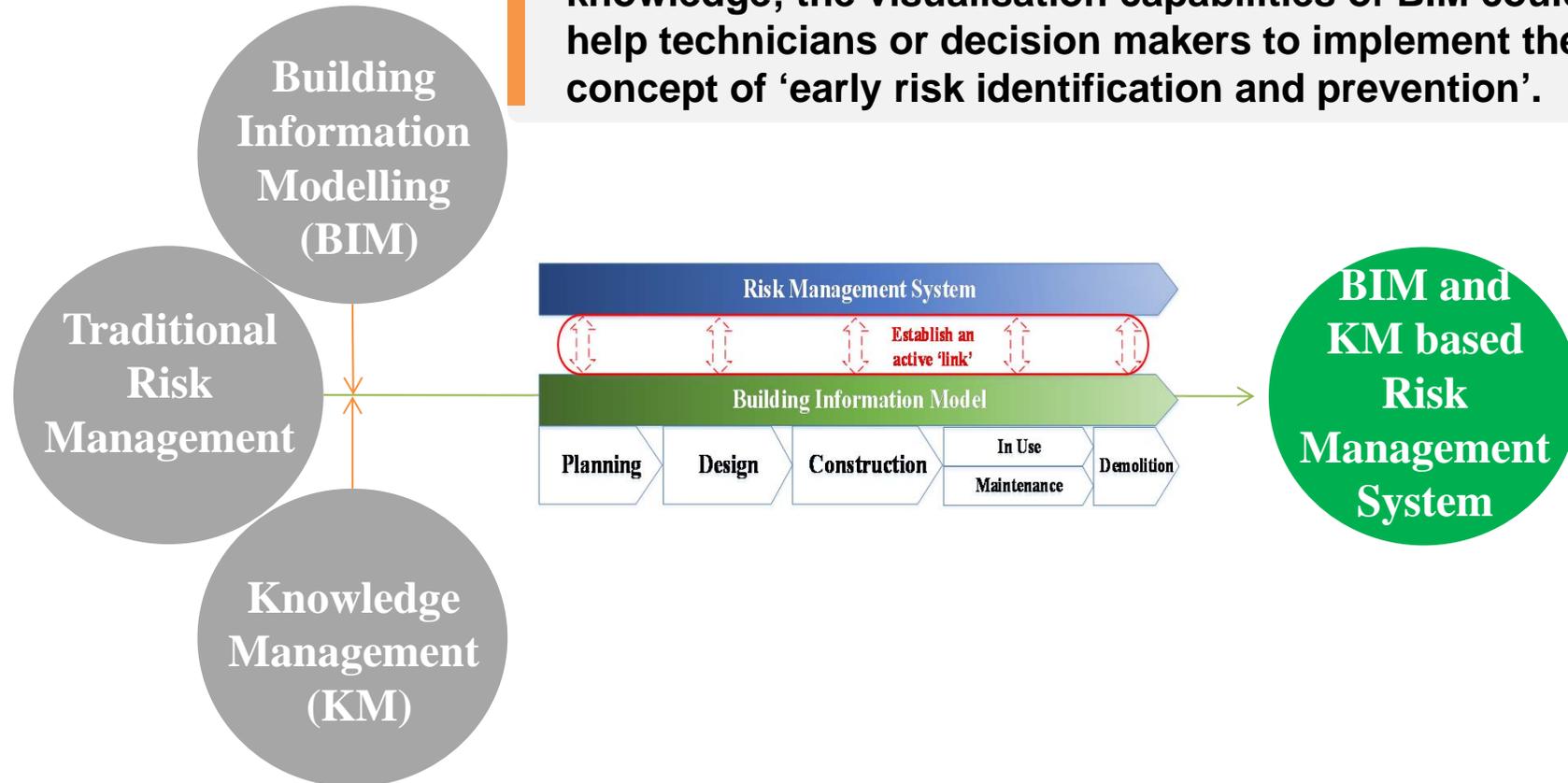
Identified Gaps

- 1) Lack of a multi-disciplinary system-thinking**
- 2) No theory to support aligning BIM with traditional risk management methods to support the development process of a project;**
- 3) Lack of a standard and colour scheme to support visualising risk in BIM**
- 4) Lack of practical testing and implementation experience**

To narrow these gaps?



BIM can be the primary data repository for shared knowledge; the visualisation capabilities of BIM could help technicians or decision makers to implement the concept of 'early risk identification and prevention'.



KM can effectively extract and manage fragmented expert based knowledge and experience, and facilitate data stored in a proper structure, communicated and reused

Research Objectives

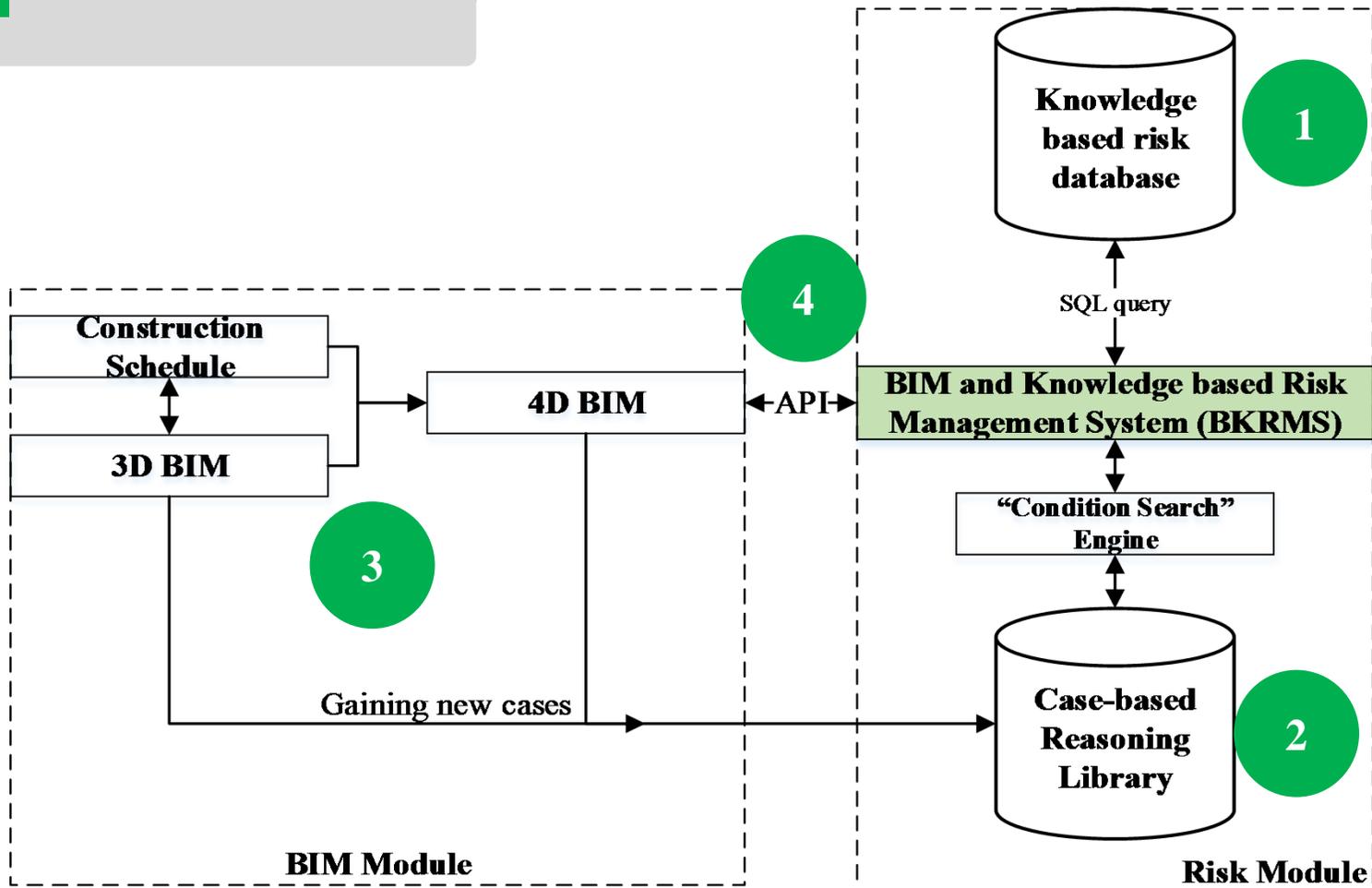
- 1) Develop a knowledge based risk model that stores risk information and cases in a proper structure;
- 2) Develop a methodology that can establish the relation between a knowledge based risk model with BIM;
- 3) Develop a tool based on existing BIM software to implement and validate the proposed methodology through a selected case study.



Research Questions

- 1) How can a Risks Model for bridge projects be formalized?
- 2) How can the 'link' between Risks Model and Building Information Model (BIM) be formalized?
- 3) How can a BIM-based tool be developed to support the proposed methodology?

Framework of BKRMS

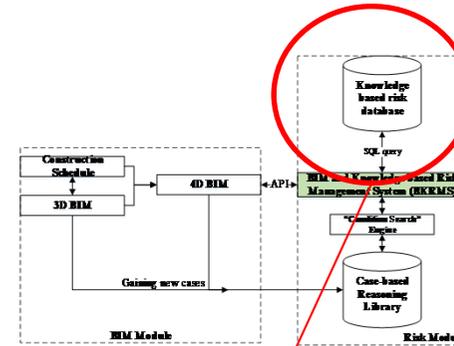
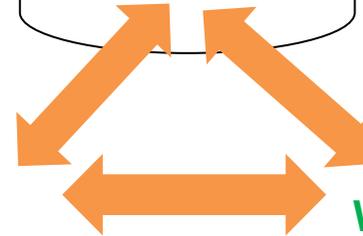


Development of risk database

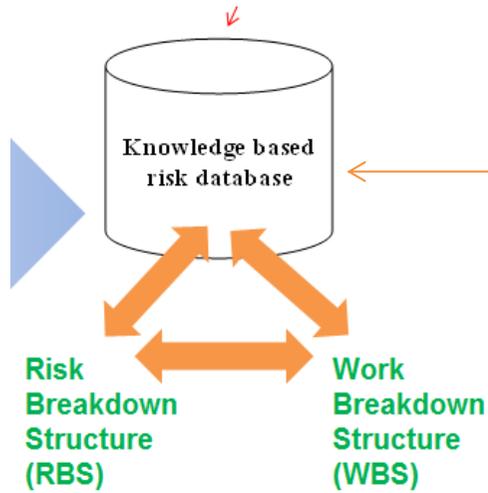


Risk Breakdown Structure (RBS)

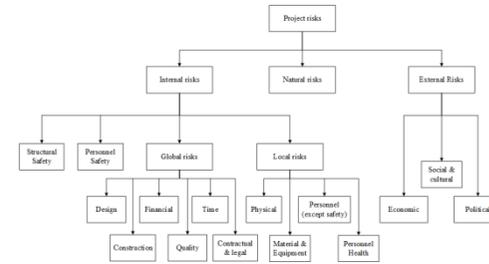
Work Breakdown Structure (WBS)



1



Risk Breakdown Structure (RBS)



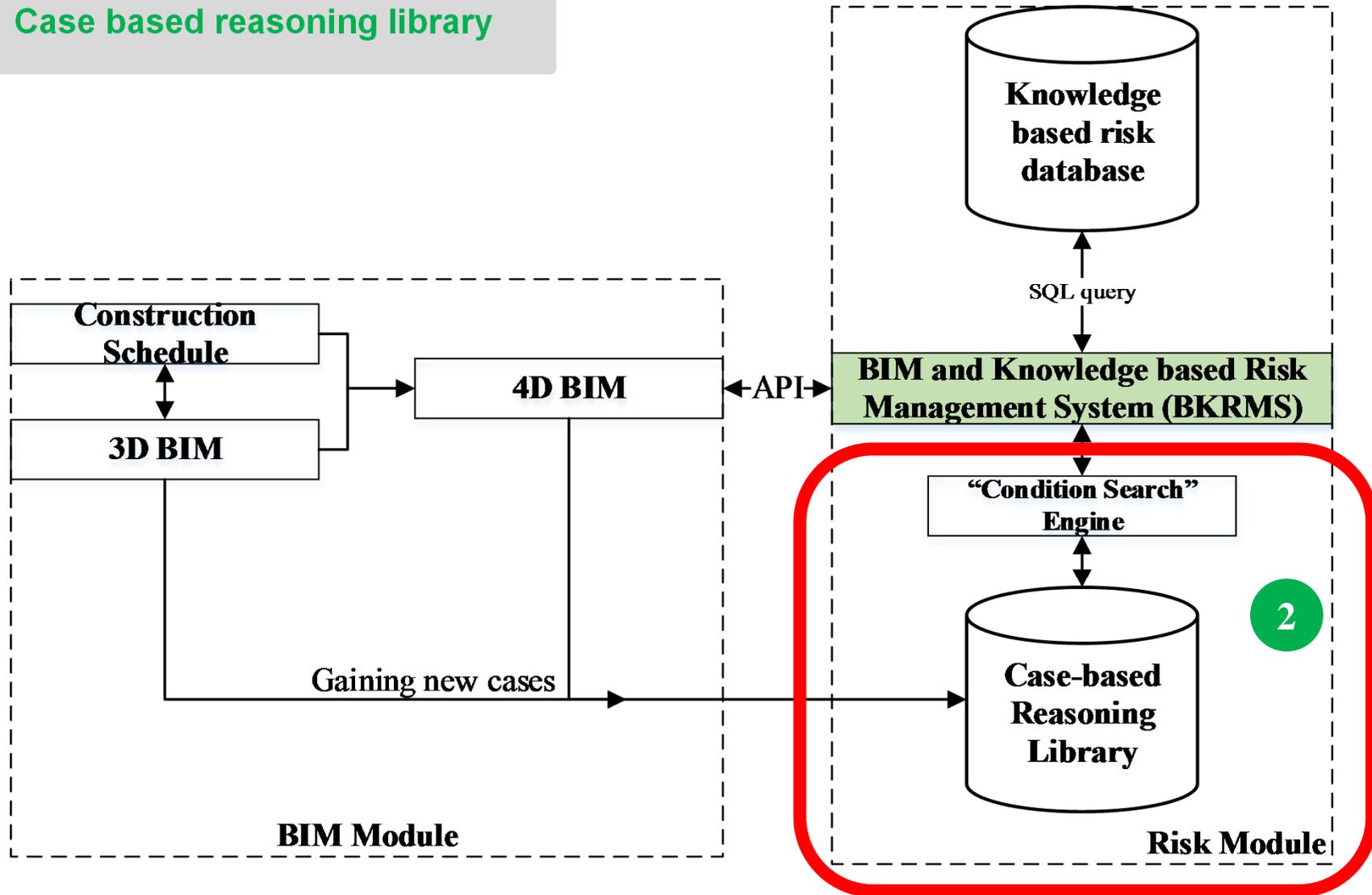
Work Breakdown Structure (WBS)



Project activities – time					

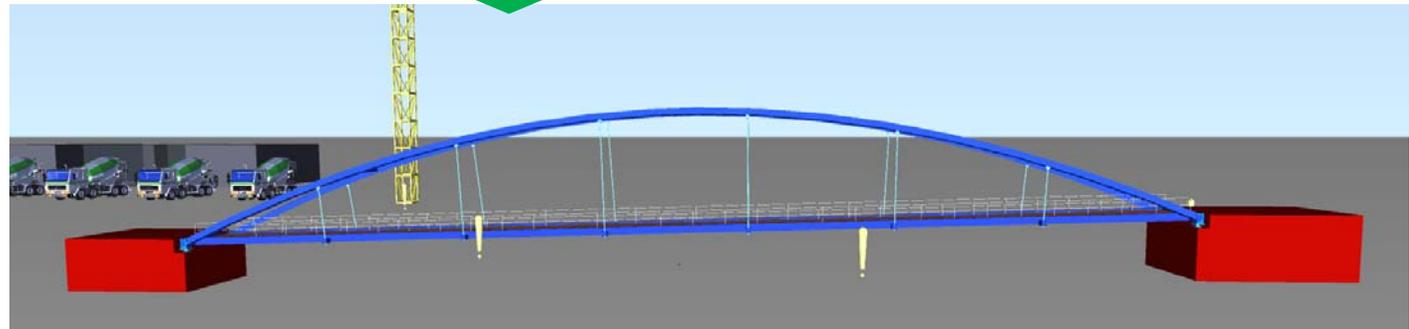
RBS-WBS Matrix

Case based reasoning library

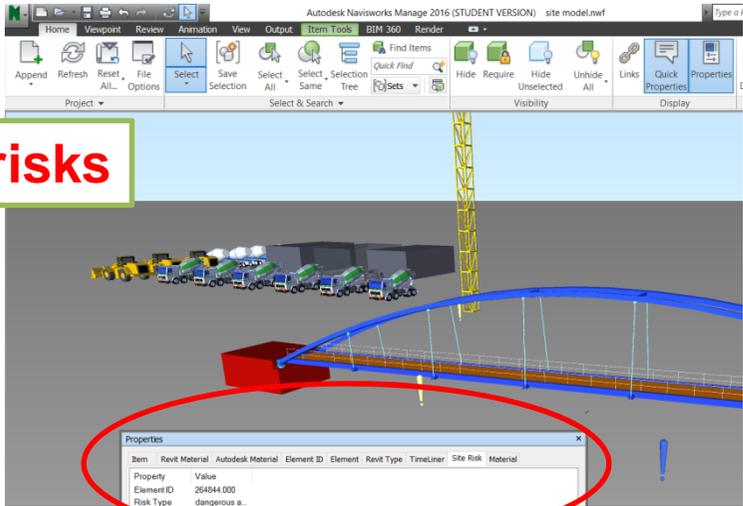


A trial case study

Dunmow foot bridge
on M60, Manchester



visualise risks

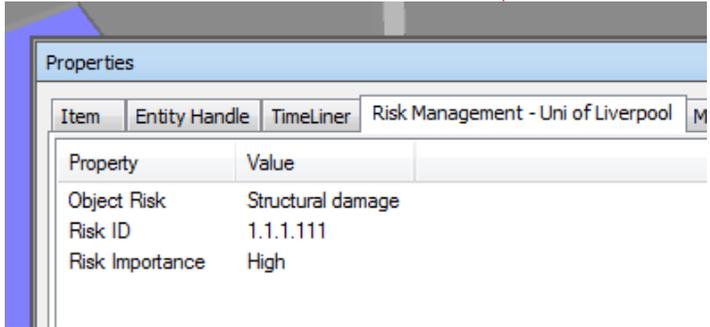


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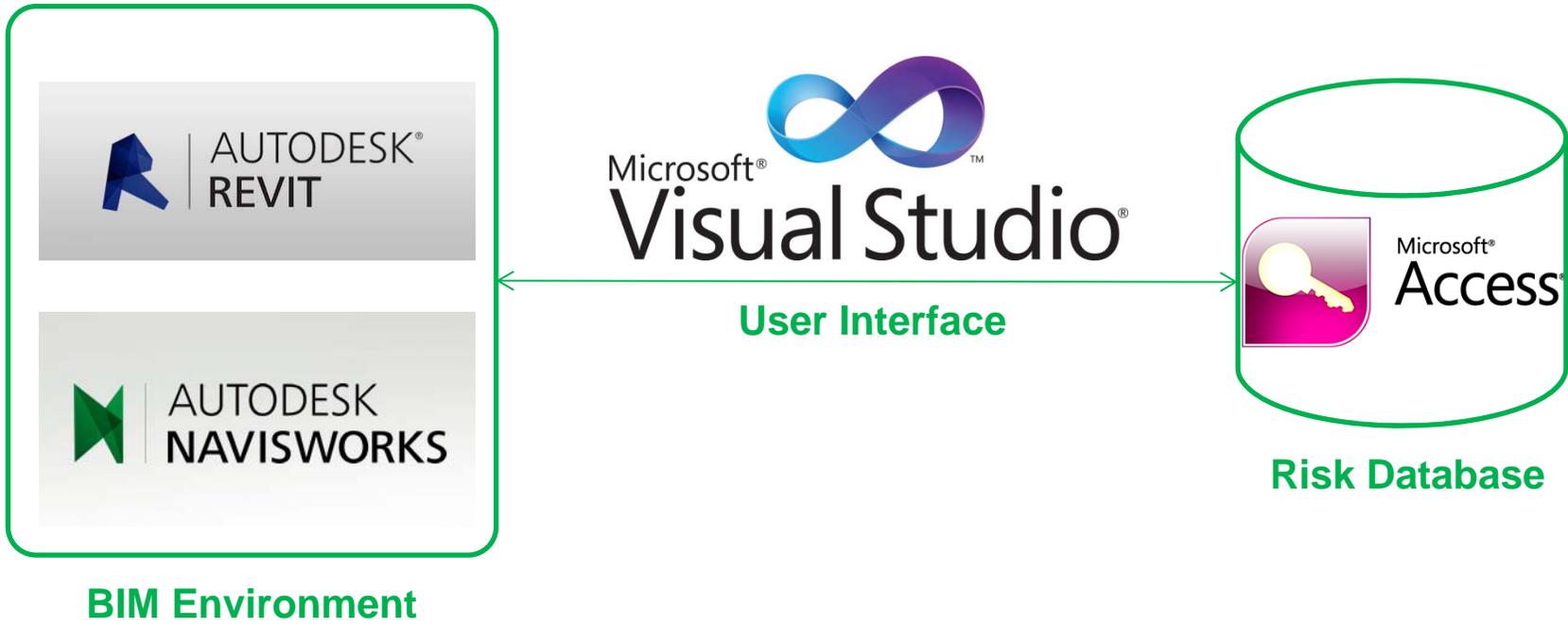


manage and track risks



4

**Tool development:
technical solution**



Future work plan

- 1) Further refine risk database, RBS, WBS and CBRL.
- 2) Establish the theory to link risks with BIM.
- 3) Develop a tool with user interface based on Revit and Navisworks.
- 4) Conduct a case study to validate the proposed method and tool.

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THANK YOU

References

- [1] Wardhana, Kumalasari, and Fabian C. Hadipriono. "Analysis of recent bridge failures in the United States." *Journal of Performance of Constructed Facilities* 17.3 (2003): 144-150.
- [2] Zhang, Sijie, et al. "Building information modeling (BIM) and safety: Automatic safety checking of construction models and schedules." *Automation in Construction* 29 (2013): 183-195.
- [3] ILO, 2005. *Fact Sheet on Safety at Work*. International Labour Organization, Geneva, Switzerland.
- [4] Guo H, Li H, Chan G, et al. Using game technologies to improve the safety of construction plant operations[J]. *Accident Analysis & Prevention*, 2012, 48: 204-213.