CBIM - GA No. 680676

# A Concurrent Cloud-based BIM Design Paradigm for Interdisciplinary Design Collaboration

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Trimble

TECHNION
Israel Institute
of Technology

CBIM - European Training Network

Cloud-based Building Information Modelling

# Progress

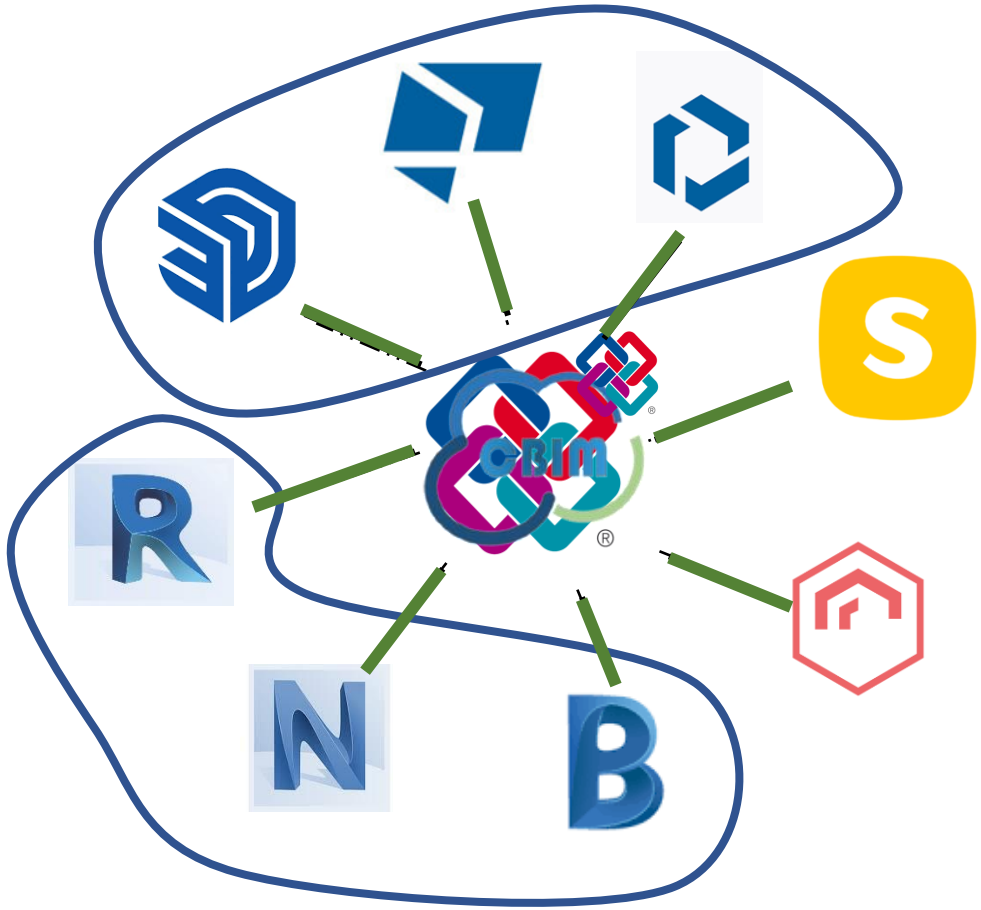


**Fig 1.** Knowledge Gaps and Opportunities

**Problem Identification**

Current design collaborative pattern, which is fragmented and disjoint, no longer satisfies the increasing industrial demand in terms of time, cost and quality.

**Knowledge Gaps**

- There is information lost or distorted among different formats
- There is not a standard digital and automated workflow
- The cognitive capability among different BIM formats is not enough for intelligent assistance across platforms

# Progress

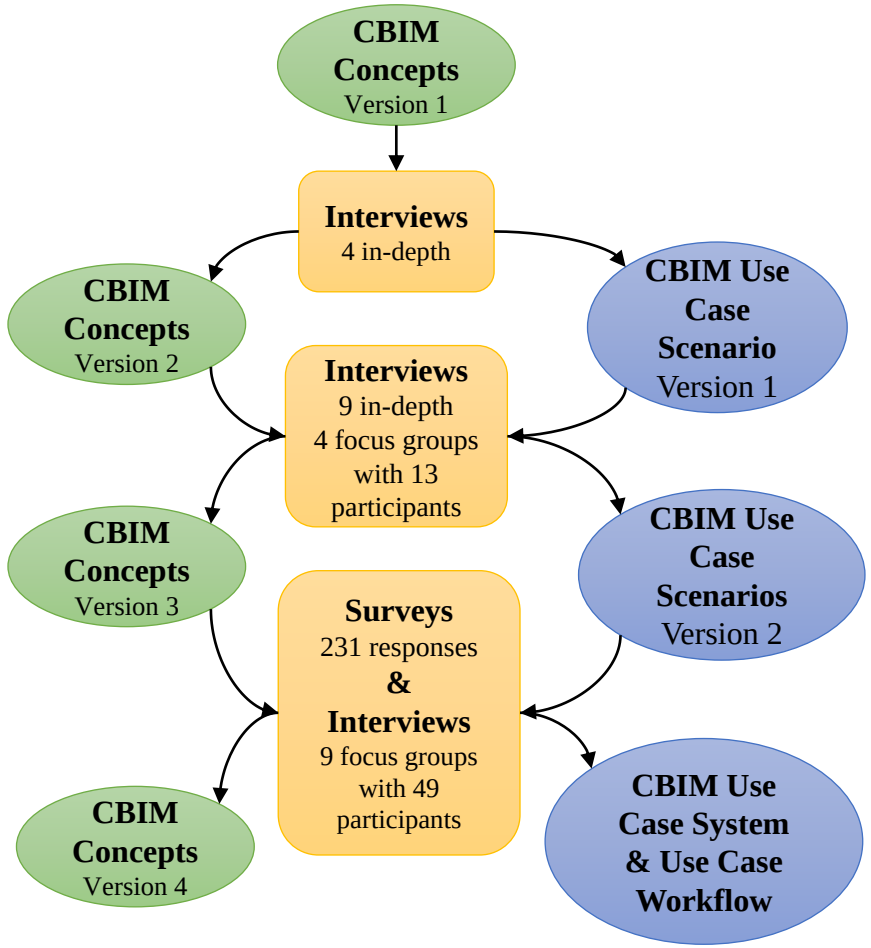



**Fig 2**. Research Flow Diagram

## Research Goal & Objectives

To explore if and how the future Cloud-based BIM paradigm might drive better collaboration for interdisciplinary design issues in the detailed design phase, this study adopted design science methodology with iteration on interviews and artefact design to fulfill the two objectives.

- To depict a future CBIM paradigm for inter-domain design collaboration
- To elicit the feedback from designers

# Progress

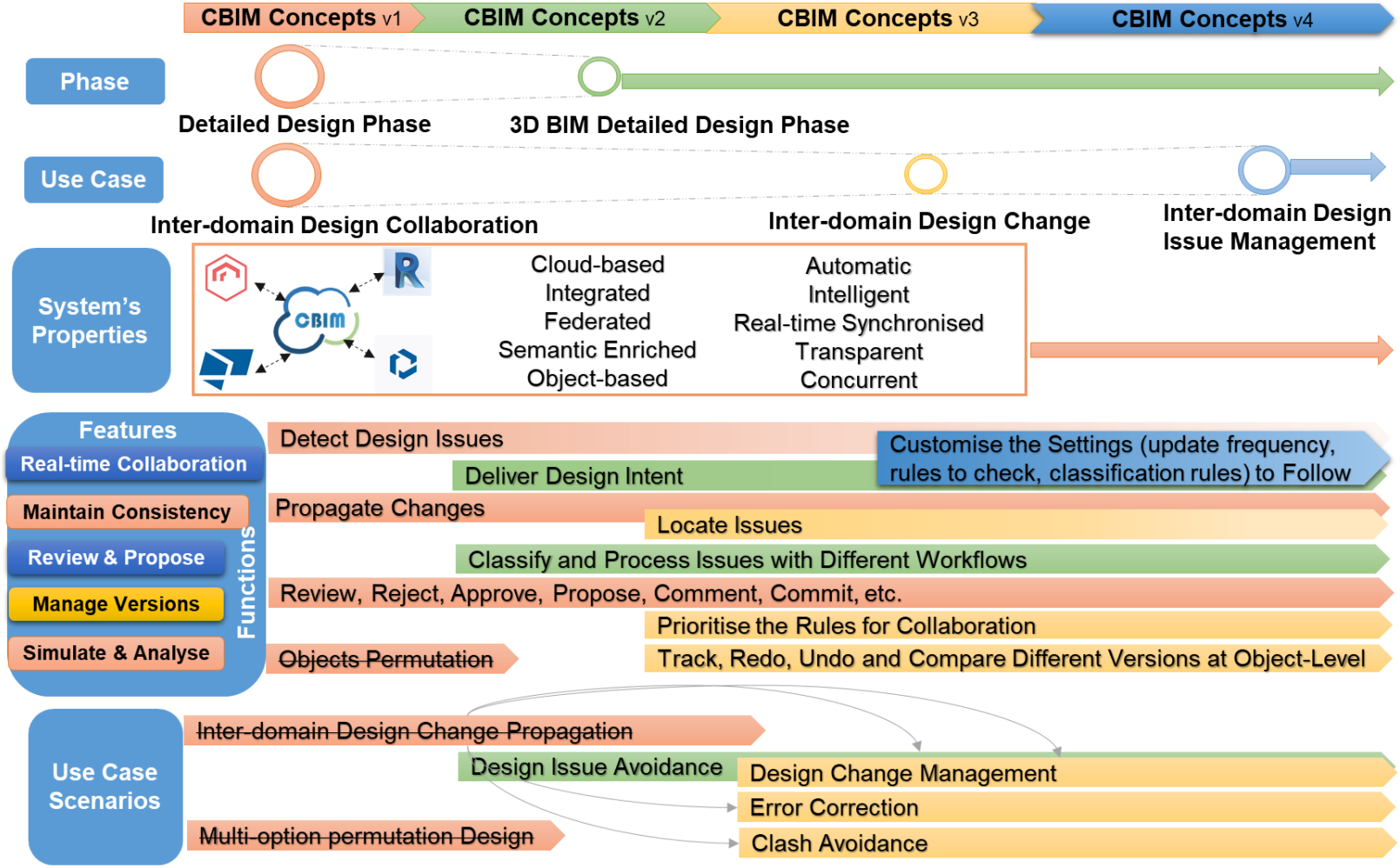



**Fig 3**. Evolution of CBIM Concepts

**Key Findings:**

In one word, users not only require more transparency, real-time synchronisation, intelligent assistance, and easier interaction directly through models, but also require the freedom and flexibility to create design, customise settings, and prioritise the tasks, and protect ownership.

# Progress

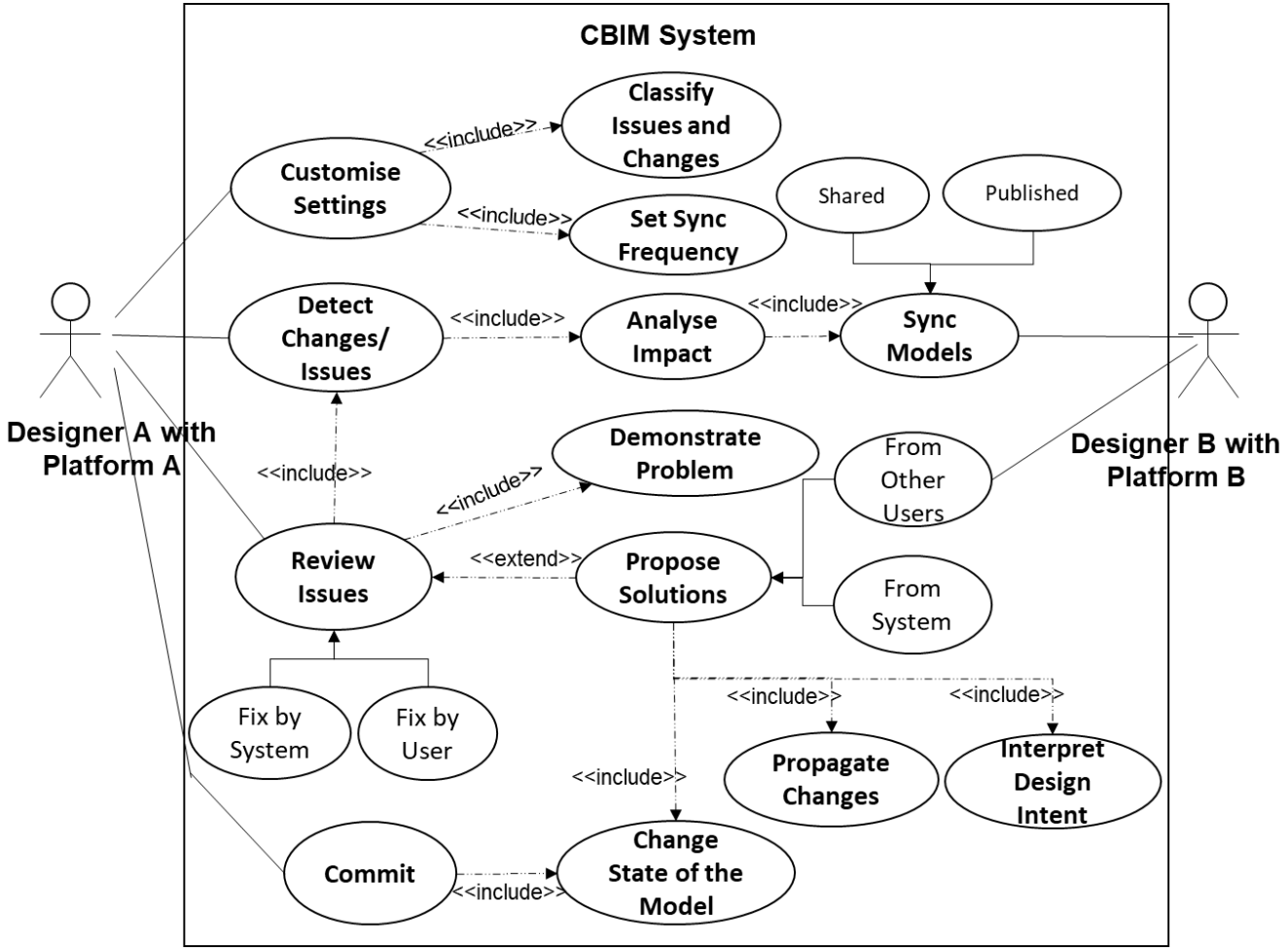



**Fig 4**. CBIM System UML Use Case Diagram

# Progress

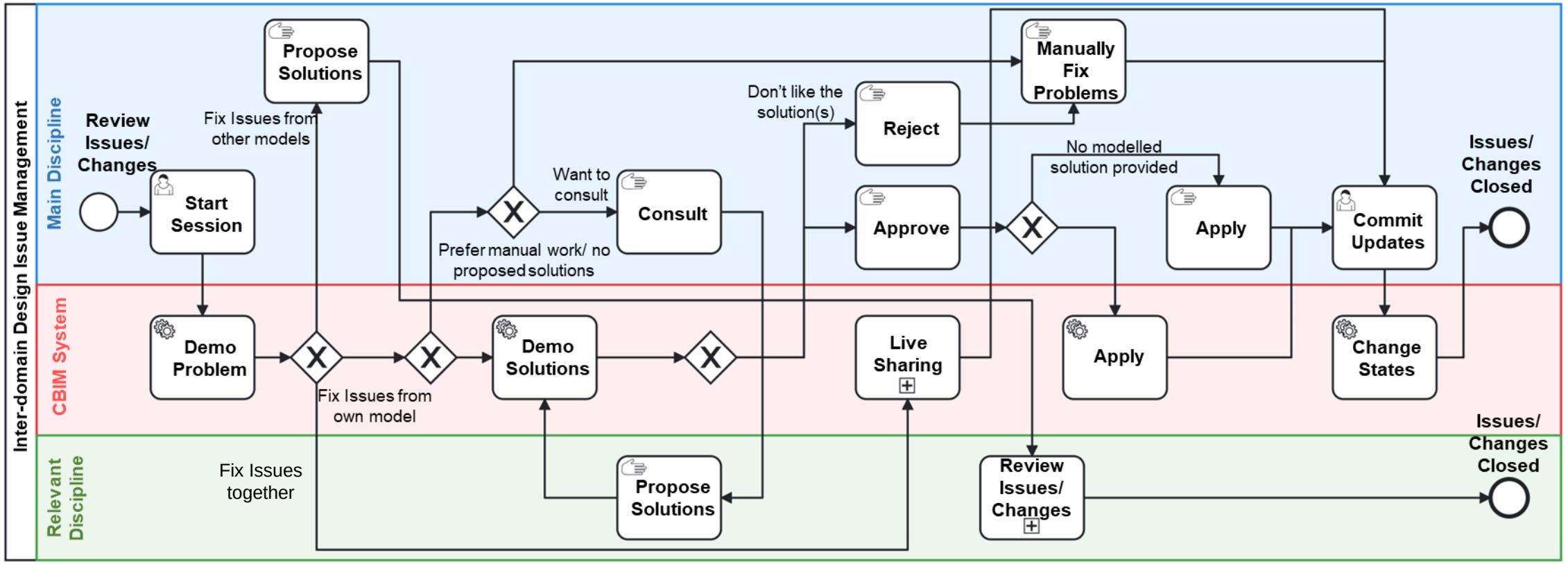
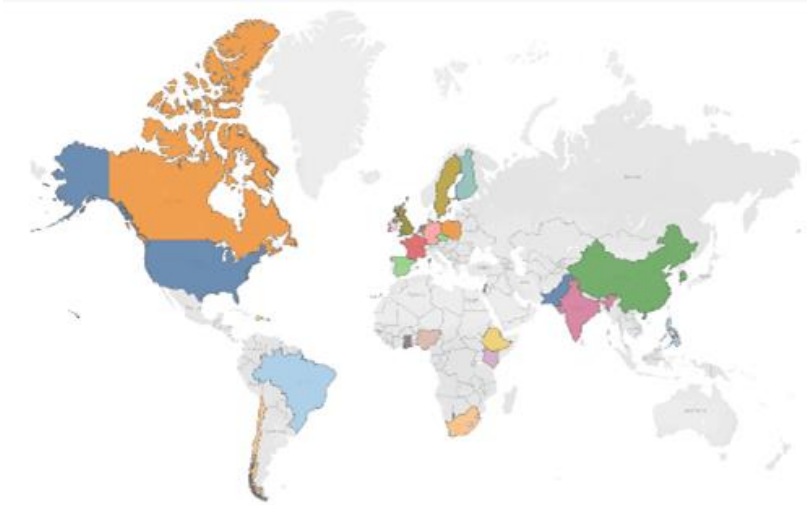
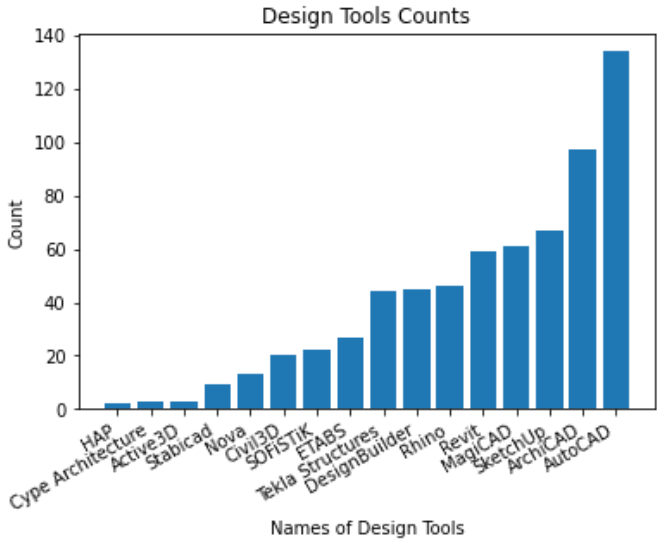
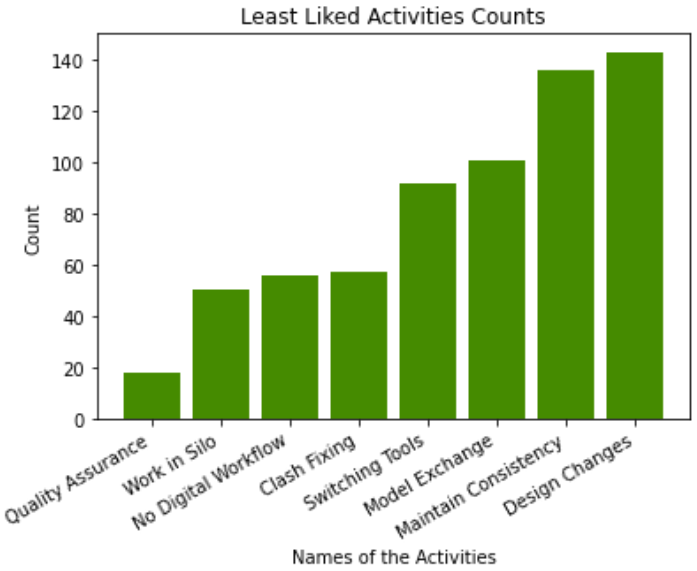


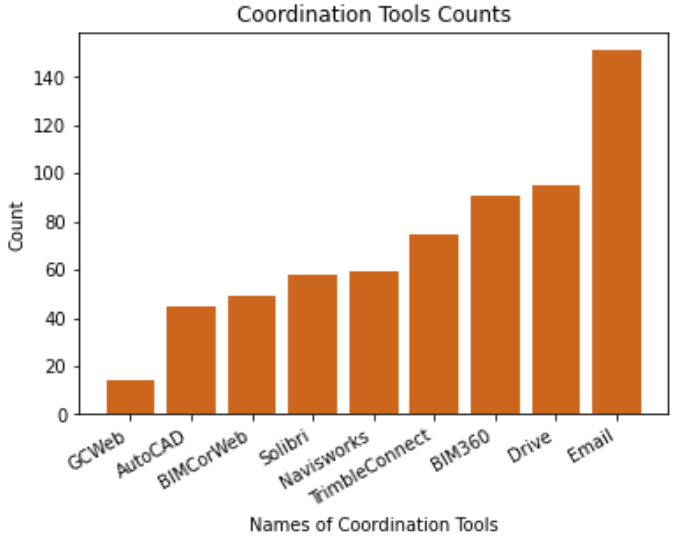

**Fig 5**. Inter-domain Issue Management BPMN Workflow

# Progress





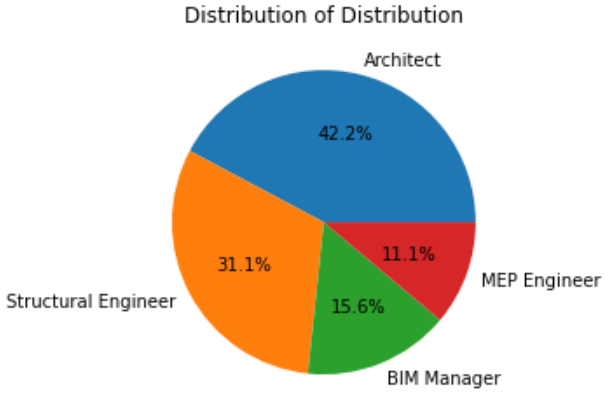



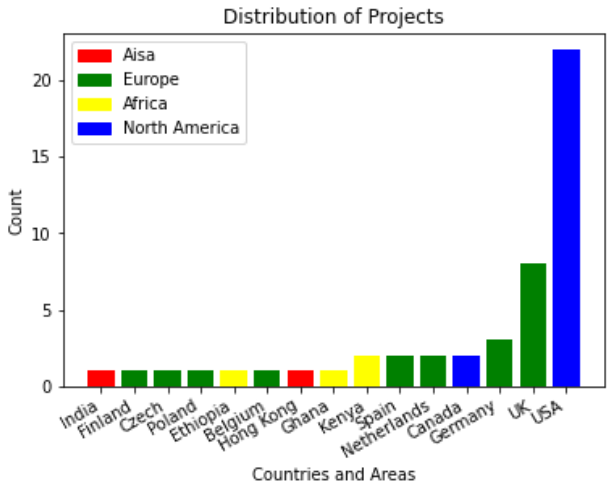



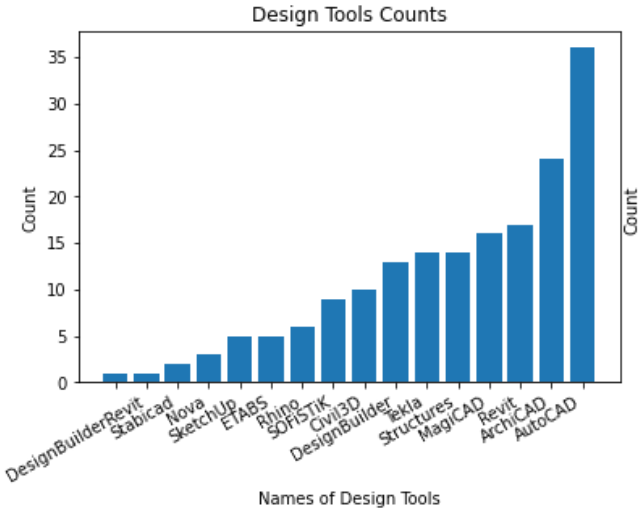

**Survey Analysis**

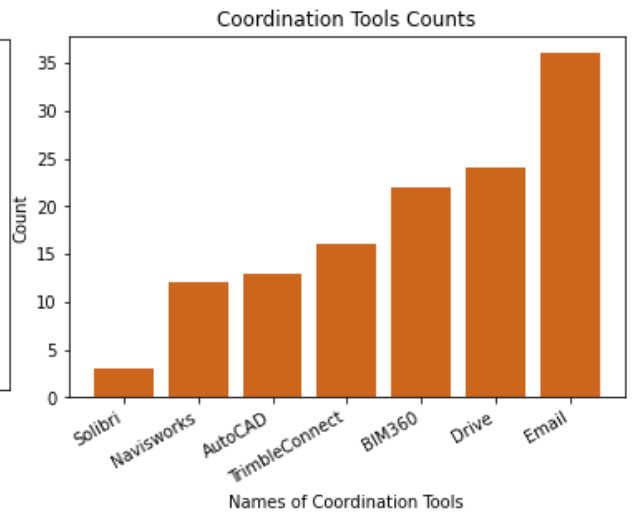
- 2D CAD still dominates in the detailed design phase
- Email and Drive are the most common tool for communication
- Design change and maintain consistency are the biggest headache in detail design collaboration

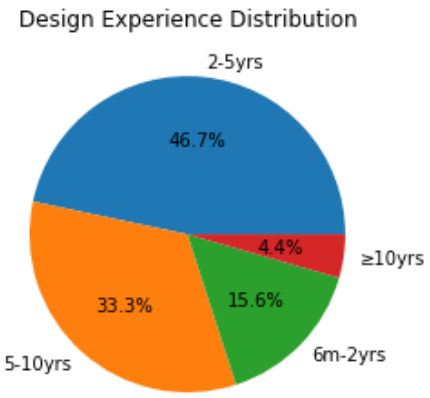
# Progress

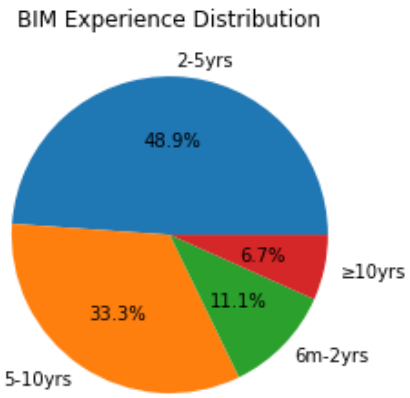

Distribution of Distribution
Architect
42.2%
11.1%
MEP Engineer
31.1%
Structural Engineer
15.6%
BIM Manager

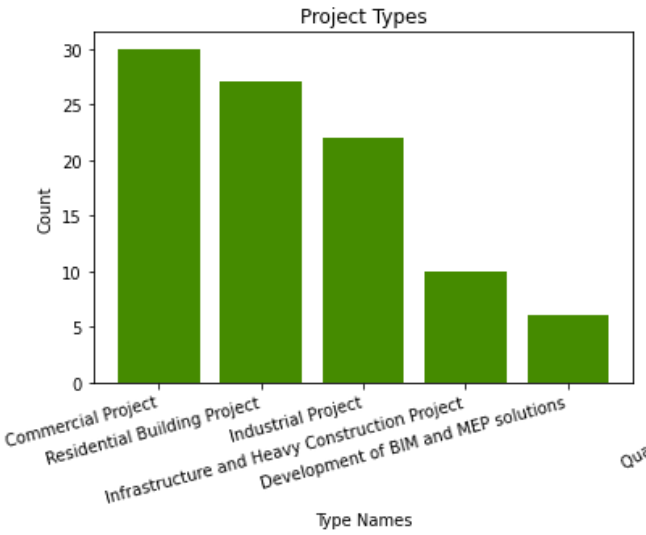

Distribution of Projects
Aisa
Europe
Africa
North America
Count
India
Finland
Czech
Poland
Ethiopia
Belgium
Hong Kong
Ghana
Kenya
Spain
Netherlands
Canada
Germany
UK
USA
Countries and Areas

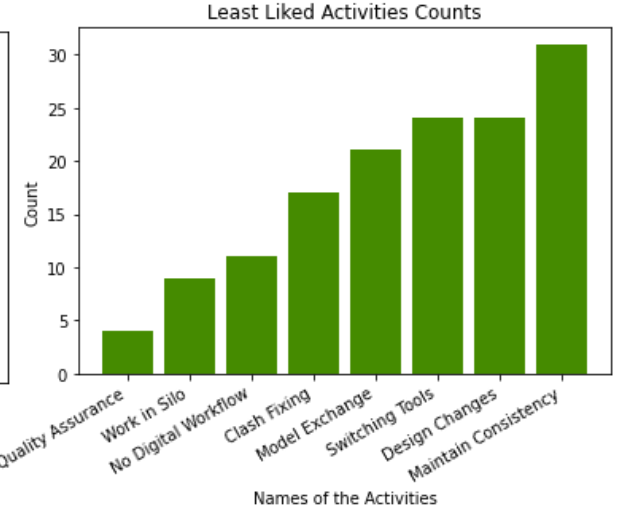

Design Tools Counts
Count
DesignBuilder
Revit
Stabicad
Nova
SketchUp
ETABS
Rhino
SOFISTiK
Civil3D
DesignBuilder
Tekla Structures
MagiCAD
Revit
ArchiCAD
AutoCAD
Names of Design Tools


Coordination Tools Counts
Count
Solibri
Navisworks
AutoCAD
TrimbleConnect
BIM360
Drive
Email
Names of Coordination Tools

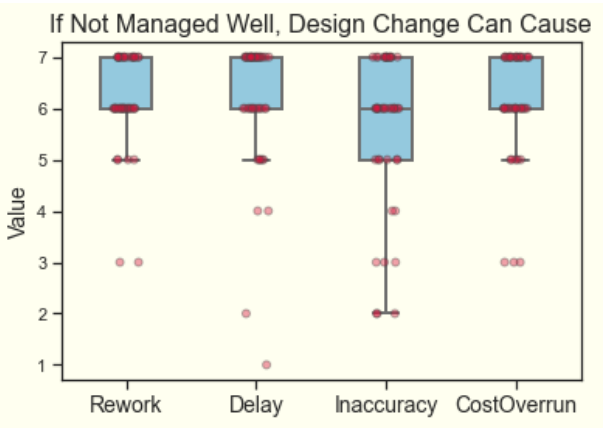

Design Experience Distribution
2-5yrs
46.7%
4.4%
≥10yrs
33.3%
15.6%
5-10yrs
6m-2yrs

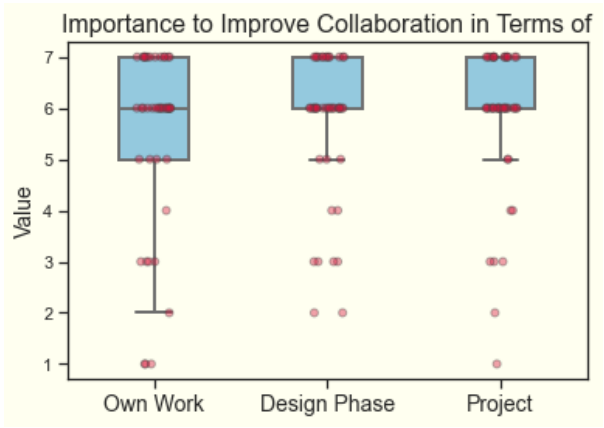

BIM Experience Distribution
2-5yrs
48.9%
6.7%
≥10yrs
33.3%
11.1%
5-10yrs
6m-2yrs

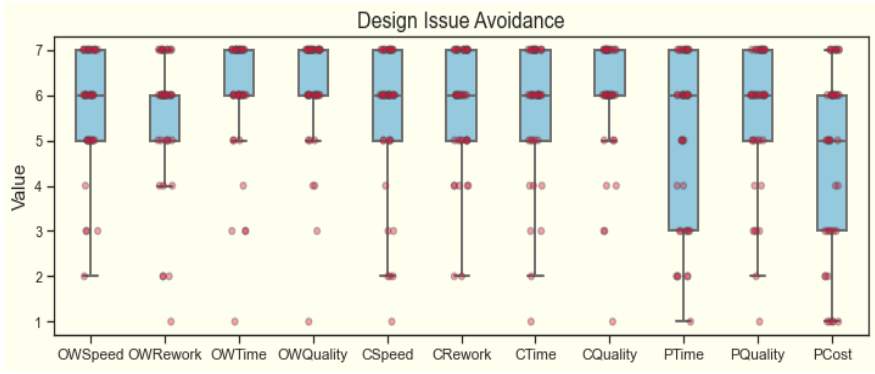

Project Types
Count
Commercial Project
Residential Building Project
Industrial Project
Infrastructure and Heavy Construction Project
Development of BIM and MEP solutions
Type Names


Least Liked Activities Counts
Count
Quality Assurance
Work in Silo
No Digital Workflow
Clash Fixing
Model Exchange
Switching Tools
Design Changes
Maintain Consistency
Names of the Activities

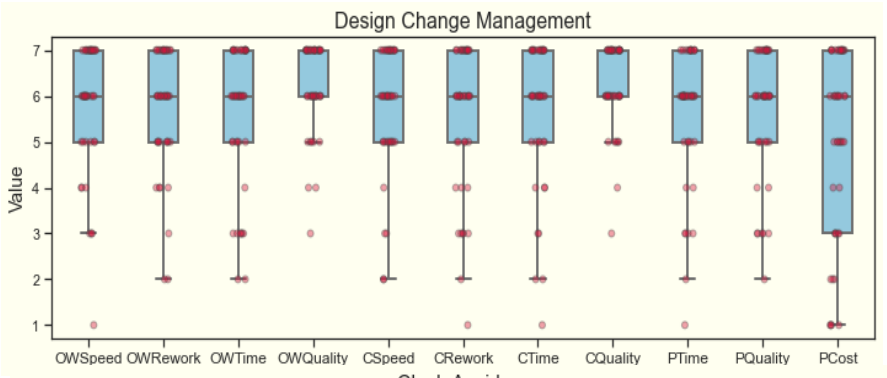
# Progress

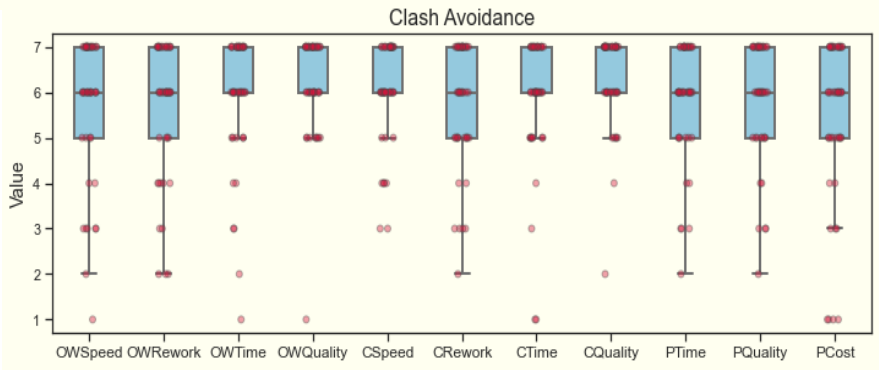


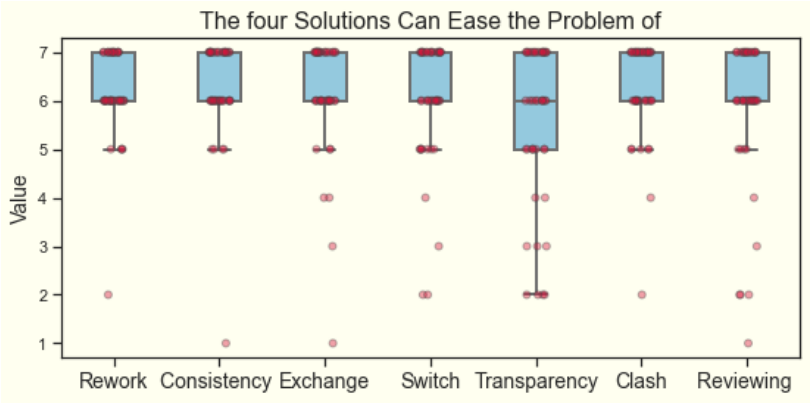








**Focus group summary**

- the biggest headache in detail design collaboration
- The proposed paradigm is well accepted (overall satisfaction achieves 82.51%) for facilitating managing the inter-domain design issues by demonstrating four scenarios and corresponding solutions to nine focus groups with 49 participants.

# Current Status & Final Steps

| Timeline | March | April | | | | May | | | | June | | | | July | Aug. | Sept. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week 4 | Week 1 | Week 2 | Week 3 | Week 4 | W1 | W2 | W3 | W4 | W1 | W2 | W3 | W4 | | | |
| **1st paper** | Refine paper with Rafael | Send to others for Review | | Publish | | | | | | | | | | | | |
| **Experiment** | Schedule and organise | Experiment | | | | | | | | | | | | | | |
| **Secondments** | Contact | | | | | Loclab | | | | | | | | Israel | | |
| **2nd paper** | | | | Write paper | | | | | | | Review | | Publish | | | |
| **Dissertation** | | | | | | | | | | | | | | Consolidate and write | | |

**Challenges**

To get right people on board for experiment on time

# Contribution & Limitations

**Contribution to knowledge:**

- Described the core functions of a Cloud-based BIM design system for inter-domain design concurrent collaboration
- Developed a UML use case diagram for CBIM system
- Created a BPMN workflow for inter-domain issue management use case
- Envisioned a set of use case scenarios and mockups
- Identified how CBIM system features affect user behavior during collaboration
- Determined necessary steps to develop CBIM for easier and gradual user acceptance
- Identified how these features impact collaborative pattern, particularly level of concurrency

**Implication**

- Interview feedback suggests CBIM has potential to facilitate concurrent design collaboration in AEC industry
- Human-centric approach to BIM system development can bring innovation to BIM design collaboration

# Contribution & Limitations

**Limitations**

- Larger sample size, representation from different countries, and even distribution levels of adoption would provide better representation
- Discrepancies between reported and actual behavior may exist without direct observation

**Future work**

- Conduct experiments to create immersive environment to observe how people interact with different factors embedded in CBIM paradigm
- Examine technology and business aspects to determine how to bring CBIM system to reality.

# Thank you!

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