28 July 2023

Welcome to

The Future of Work

Building Information Modelling

BIM Harambee .Africa

General Arrangements

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SOM SURVEY INSTRUMENTS

DEPARTMENT OF ARCHITECTURE · UNIVERSITY OF PRETORIA ·

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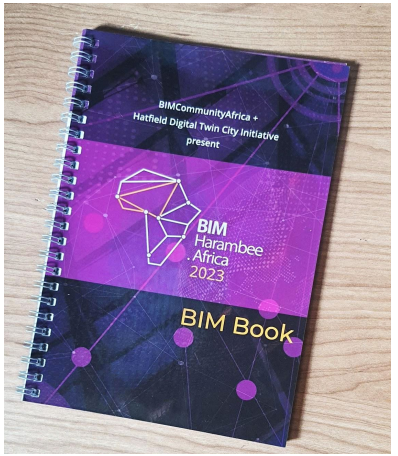
POPIA

THIS SESSION IS BEING RECORDED

General Arrangements

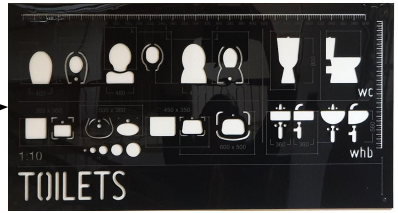
Coffee and refreshments (cash)

- **Artisans** coffee stand outside Lecture Room 3-3
- **Vida-E Cafe** in the basement/courtyard
- **5 minute walk** to Artisan and Pure Cafe restaurants on campus - ask Boukunde students for directions!



Restrooms

- **Unisex restrooms @** opposite side of lecture rooms next to architecture studios, on every floor



Emergency Exit

- **Ground** and **Basement @** north, east and west of building.

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Survey

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Friday

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Friday 28 July - My BIM Journey

AECO Educators, Lectures, & Professionals Session

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12:30	**SAPOA PropTech in South Africa** The future of the SA property market through technology: how the real estate sector is engaging technology to bring the built environment into a digital age and delivering a range of positive outcomes for stakeholders.	**Matthew Marshall** SAPOA PropTech Committee
12:45	**What is BIM? No, really?** BIM workflows, core concepts and definitions and important issues for educators.	**Suvaniya Pillay** BIM Specialist, Baker Baynes
13:00	**Boukunde Live-BIM** Outcomes from the live scan-to-BIM of Boukunde and connecting to how BIM is the future of building.	**Richard Matchett** Digital Lead, Zutari
	10 mins comfort break	
13:30	**State of the South African Digital Built Environment** Before we "smart city," we need to BIM. Current environment and possibilities BIM Mandate and ISO 19650 (with National Annex)	**Richard Matchett** **Rudd van Deventer** Director, Spaceworx
14:00	**Teaching Case Study: BIM for Circularity, University of Pretoria** Education case study from the built environment postgraduate research unit.	**Calayde Davey,** Architecture **Helene Potgieter,** HPA **Johann vd Merwe,** Structural
14:45	**What must graduates be able to do in the professional environment?** Skill sets and learnings for interdisciplinary built environment works.	**Gary Mansfield** Digital Innovation Lead, CKR
15:05	**Q & A with industry professionals**	**All speakers**

Educator Session

South African Property Association

MATTHEW MARSHALL SAPOA PropTech COMMITTEE

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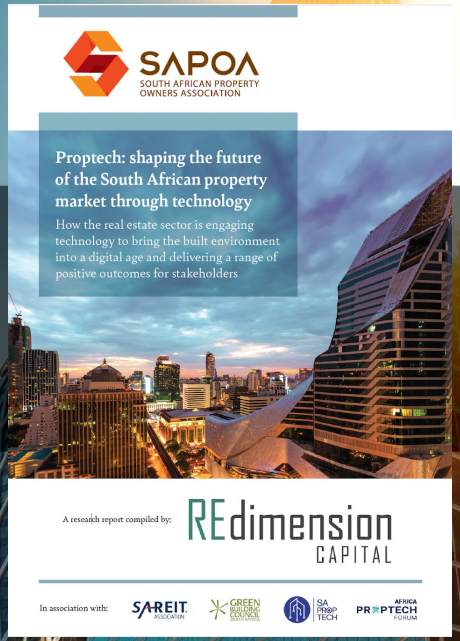
A research report compiled by

REdimension CAPITAL

SAPOA
SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION



Proptech

Shaping the future of the South African property market through technology

In association with

SAREIT ASSOCIATION
GREEN BUILDING COUNCIL SOUTH AFRICA
SA PROPTECH
AFRICA PROPTECH FORUM

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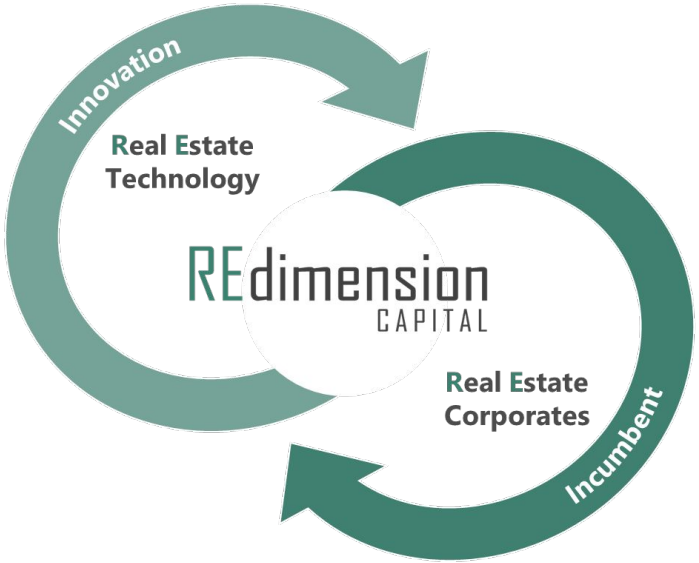
REdimension CAPITAL

An investment manager targeting investment into innovative technologies that have the power to improve the way properties are experienced, managed and developed

We are strategically aligned with forward-thinking investment partners, creating an ecosystem of mutual value, accelerating technology adoption and driving sustainable outcomes



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SAPOA
SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

SAPOA Proptech Sub-committee

Goal 1

Use technology to drive increased industry profitability; improve industry customer experiences; and reduce risk

Goal 2

Establish the South African real estate industry as one the top five most progressive and innovative in the world

Goal 3

To educate, inform and support SAPOA members in order to make better tech-related decisions and be inspired and excited about the opportunities and solutions presented by technology

Established with the support from a range of industry bodies in order to provide a cohesive proptech voice in working towards its stated goals

AFRICA PROPTECH FORUM · PROPTECH AFRICA · SA PROP TECH · SAREIT ASSOCIATION · GREEN BUILDING COUNCIL SOUTH AFRICA · SACSC South African Council of Shopping Centres · SAIV · RICS · NPPC

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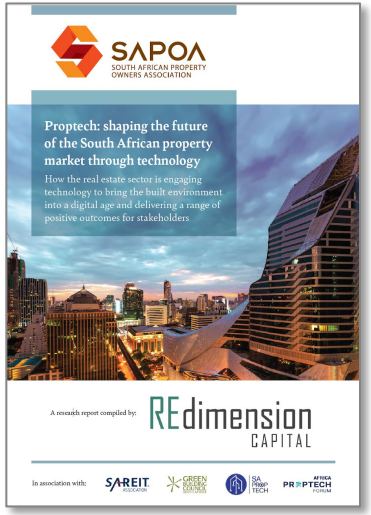
A comprehensive overview of the proptech market in South Africa

SAPOA SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

- Landlords
- REIT investors
- Industry bodies



- Service providers
- Entrepreneurs
- Tech investors

The report encompasses two years of research and engagement across a broad range of stakeholders to the South African proptech landscape

Report structure

- Property Technology Landscape and Impact on The Built Environment
- Funding and Transactional Activity
- The South African Proptech Landscape
- SAPOA Proptech Committee
- The State of Technology Adoption in The SA Real Estate Market
- Executive Interviews

REdimension CAPITAL

South African proptech landscape

SAPOA SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

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Source: REdimension Capital, 2023

REdimension CAPITAL

The state of technology adoption in the SA real estate market

SAPOA SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

A survey conducted in late 2022, instituted by the SAPOA Proptech Committee

94% of respondents expecting technology to have at least a mild impact

74% anticipate the impact to be more significant

83%
respondents said that up to 60% of their process were still manual

39%
respondents which believe it optimal to have an in-house approach to developing technologies

48%
respondents did not have, or were not aware of, a specific technology / innovation strategy

"As a highly fragmented market, it was not surprising to see respondents indicating that their biggest challenge with the proptech sector is education on the market and lack of in-house skill to support implementation."

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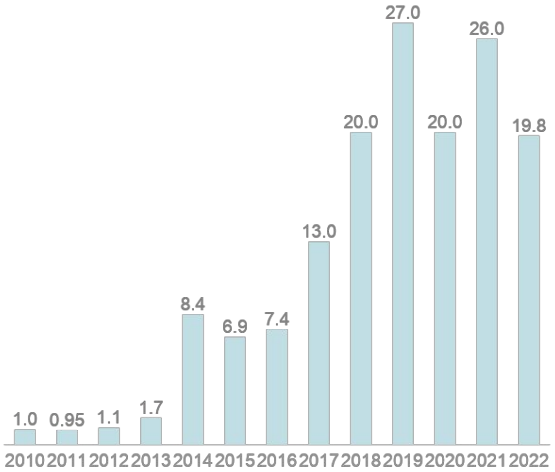
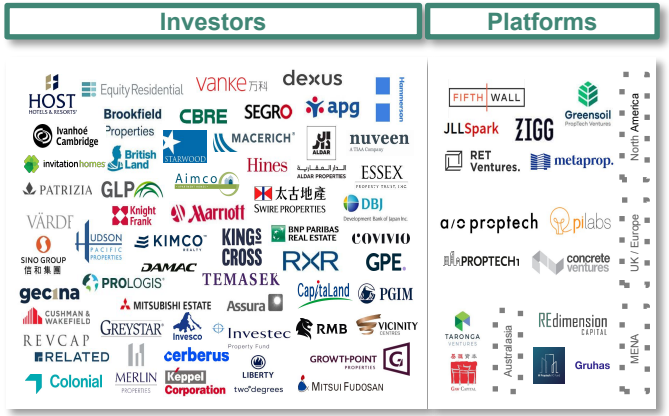
The state of technology adoption in the SA real estate market

SAPOA SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

Global funding into real estate technology



Select dedicated proptech funds and their investors



Increasing transactional activity within the South African sector including new funding rounds and founder exits

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Dedicated industry bodies

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Executive contributors

SAPOA SOUTH AFRICAN PROPERTY OWNERS ASSOCIATION

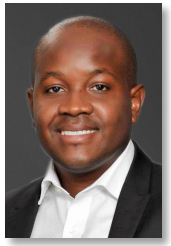
ATTACQ INVEST • DEVELOP • GROW

Jackie van Niekerk
Chief Executive Officer

GROWTHPOINT PROPERTIES

Estienne de Klerk
Chief Executive Officer (South Africa)

SESFIKILE CAPITAL
Property Investments



Kundayi Munzara
Director and Portfolio Manager

VUKILE PROPERTY FUND
REAL ESTATE. REAL GROWTH.

Laurence Rapp
Chief Executive Officer

Galetti CORPORATE REAL ESTATE

John Jack
Chief Executive Officer

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Thank you

REdimension CAPITAL

www.sapoa.org.za/proptech-report/

Educator Session

What does BIM mean for the future of work in my discipline?

MATTHEW MARSHALL SAPOA PropTech COMMITTEE

BIM IN ARCHITECTURE

Core Concepts, Workflows and Issues for Educators

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CORE CONCEPTS

What are some of the core concepts of BIM?

- Collaboration
- Information Management
- Visualisation
- Accuracy
- Efficiency
- Sustainability

- Affect BIM concepts have on project teams.

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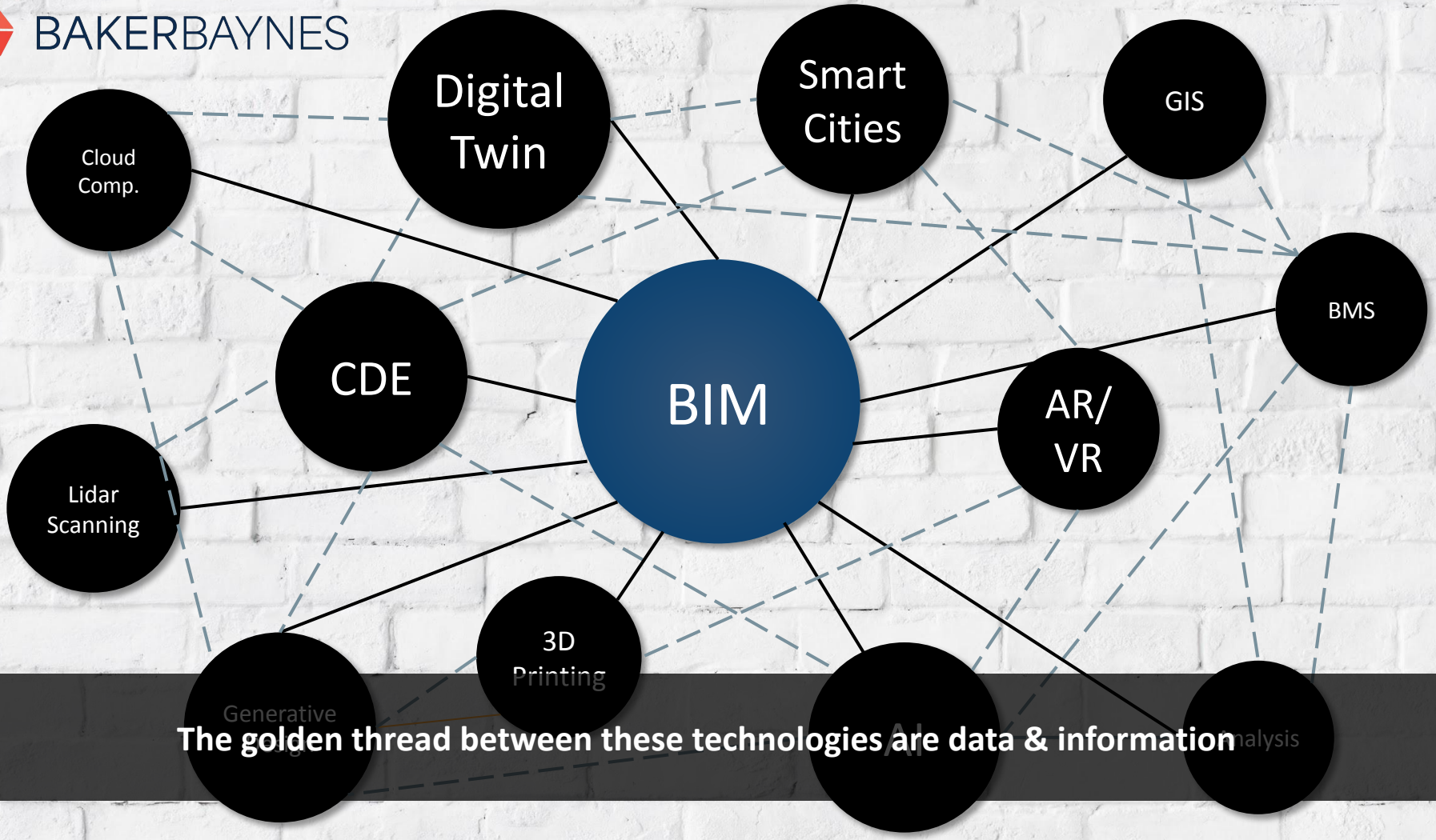

The golden thread between these technologies are data & information

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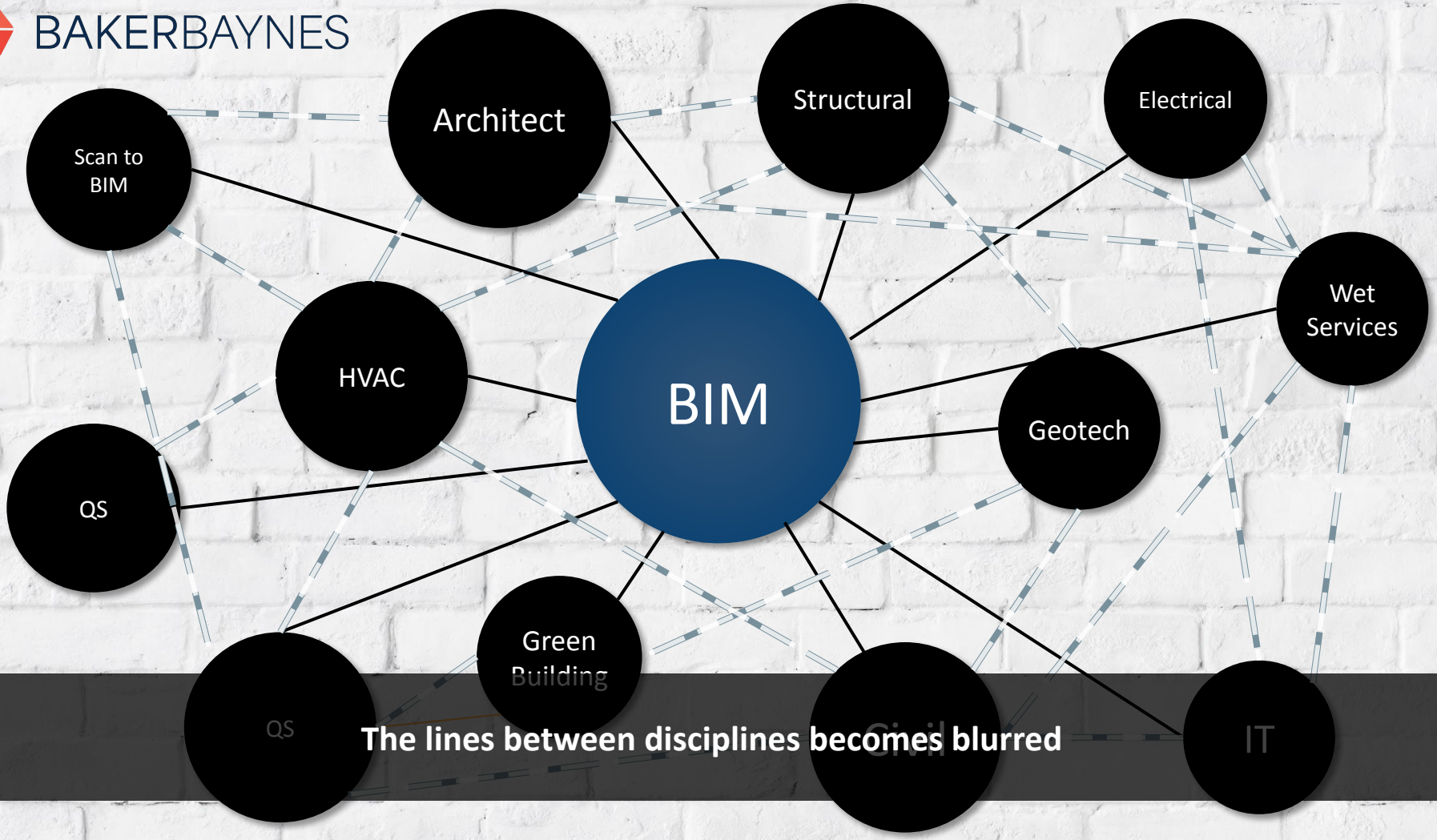

The lines between disciplines becomes blurred

OPPORTUNITIES & WORKFLOWS

- What workflows or processes have arisen in architecture because of BIM?
- New opportunities and career paths
- Workflows within projects

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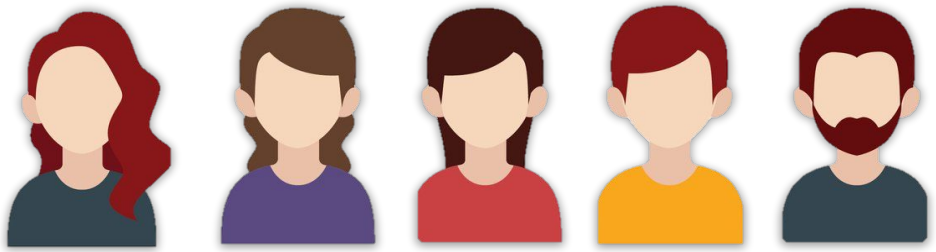
WORKFLOWS – NEW BIM Roles



- BIM Technician/modeler (operational level)
- BIM Engineer (operational level)
- BIM Coordinator (tactical level)
- BIM Manager (strategic level)
- Digital Lead (strategic level)

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What does this mean for Educators?

- How does BIM fit into a curriculum?
  - Undergrad vs Postgrad
  - Inter-disciplinary vs Intra-disciplinary collaboration
- Potential Setbacks
- Objectives for BIM Readiness

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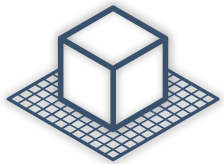
HOW does BIM fit into a Curriculum?

- Undergrad vs Postgrad
- Inter-disciplinary vs Intra-disciplinary collaboration







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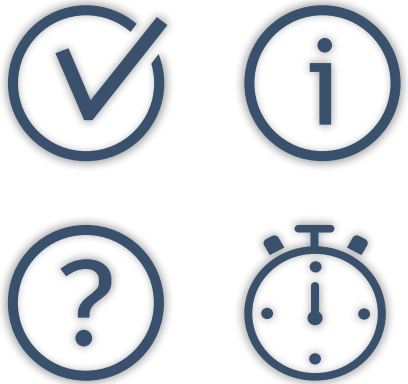
POTENTIAL SETBACKS

- Students and professionals may be hesitant to fully collaborate with other disciplines
- Large student bodies in one discipline
- Multi-disciplinary organization
- Cost of BIM adoption
- Timeline



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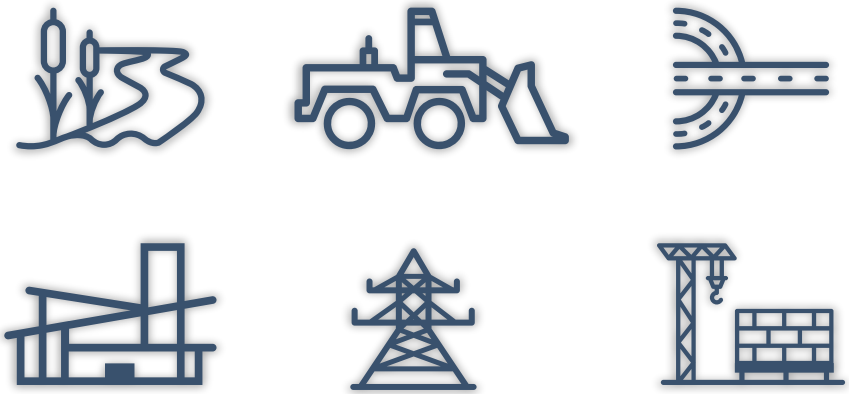
Objectives for Students and Professionals BIM Readiness

- Theory
- Technology
- Collaboration
- Professional Engagement
- Application



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Summary

- BIM Competency will become a requirement for disciplines in the Built environment
- New Digital Workflows related to BIM are emerging constantly
- Professionals need to keep up
- Student need to be prepared
- We can all benefit

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BIM Workflows

Boukunde BIM

Outcomes from Thursday

BIMCommunityAfrica + RICHARD MATCHETT, ZUTARI

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.Africa

CONGRATULATIONS

MODENA
Architecture | Engineering | Construction | Infrastructure

- **Thank you** to all the students who participated in our scavenger hunt
- You will receive more information regarding how to access your **free training** in the next 10 days
- **Winners** of one of the 50 power banks have been notified by email

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BIM Harambee Africa

The State of the South African Digital Built Environment

Current environment and possibilities

RICHARD MATCHETT DIGITAL LEAD ZUTARI

The State of the South African Digital Built Environment

Current environment and possibilities

RICHARD MATCHETT DIGITAL LEAD ZUTARI

How does the emergence of BIM and Digital Project Delivery influence the Future of Work?

** in the AECO space


"CLEARLY, THE THING
THAT'S TRANSFORMING IS
NOT THE TECHNOLOGY —
IT'S THE TECHNOLOGY THAT
IS TRANSFORMING YOU."
- JEANNE W. ROSS OF MIT SLOAN'S CENTER
FOR INFORMATION SYSTEMS RESEARCH -

https://insights.regenesys.net/

1.0 — **1780 – Mechanisation**
Industrial production based on machines powered by water and steam

2.0 — **1870 – Electrification**
Mass-production using assembly lines

3.0 — **1970 – Automation**
Automation using electronics and computers

3.5 — **1980 – Globalisation**
Offshoring of production to low-cost economies

4.0 — **Today – Digitalisation** (Digitalisation)
Introduction of connected devices, data analytics and artificial intelligence technologies to automate processes further

5.0 — **Future – Personalisation**
The fifth industrial revolution, or Industry 5.0, will be focused on the co-operation between man and machine, as human intelligence works in harmony with cognitive computing. By putting humans back into industrial production with collaborative robots, workers will be upskilled to provide value-added tasks in production, leading to mass customisation and personalisation for customers

Raising the BIM tide

https://7wdata.be/

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Pre-1990's – Math, science and drawings

1990's - 2008'ish... CAD – automation of the drawing board

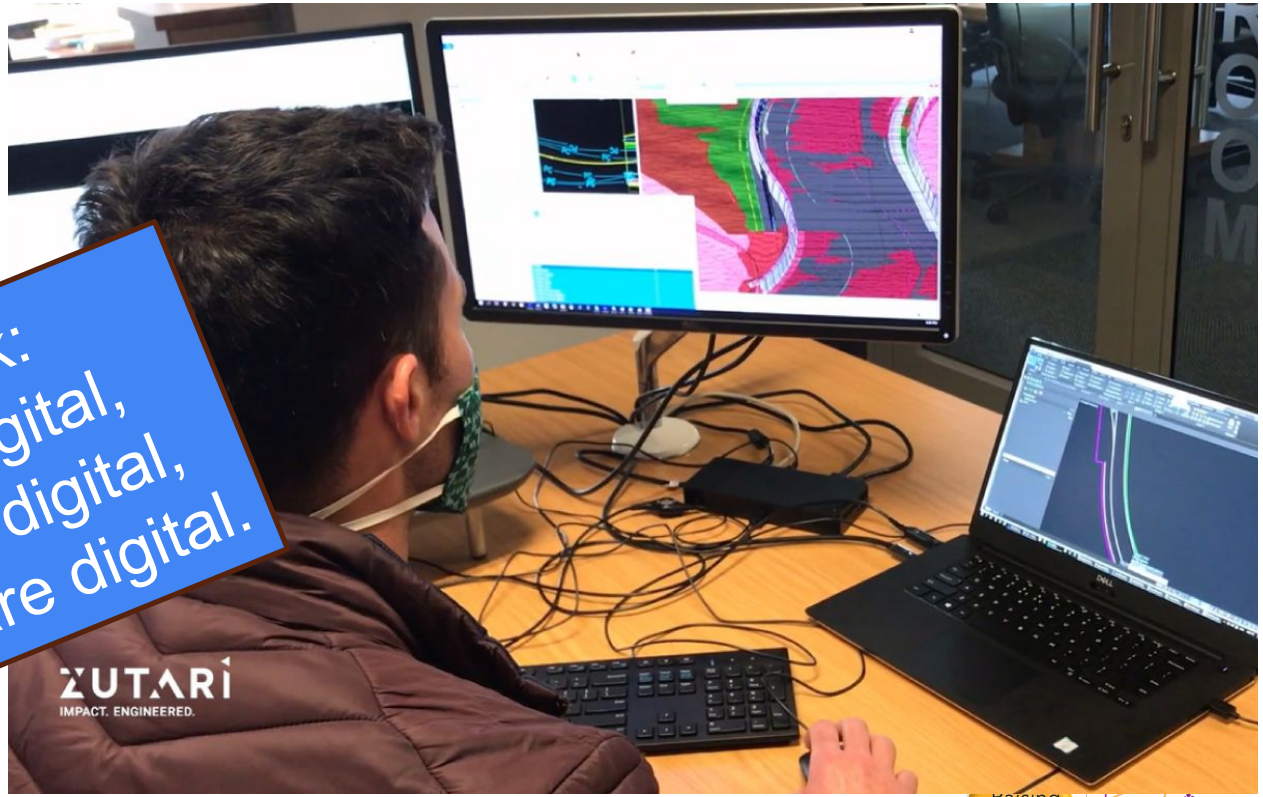
Essentially the same thing, just not on paper with pens, rulers and stencils!

Computers made drafting and tracing easier and more efficient, but didn't change the basic principle of creating ***DRAWINGS***

Now – where industry is moving: Digital Project Delivery

The proactive adoption of emerging technologies, and the development of our people to use these technologies effectively and reliably.

Beyond drawings, into the future of data driven operations



Future of Work:
Our tools are digital,
our outputs are digital,
the processes are digital.

WISDOM

KNOWLEDGE

INFO

DATA

Know-how, experience, insight, understanding and contextualised knowledge

Contextualised, categorised, calculated and condensed data

Facts and figures which relay something specific, but which are not organised

~~WISDOM~~ *Intelligence/Smartness*

Derive & Attain

KNOWLEDGE

Interpret

INFO

Process / synthesise

DATA

Collect

***Optimise** performance*

What information do we need for decisions?
How can I optimise my operations?
What if…? How could we…? Should we…?

***Provide** value*

What do you know? How do you collaborate?
Sharing ideas, collaborating, avoidance of doubt.
How is your facility performing?

***Create** information*

Analyze the data, create meaning, produce new information, design.
What facility assets do you have? What does it consist of? What condition is it?

***Measure** the physical world*

What is there?

Raising the BIM tide

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The Value of Digital Engineering for Operations

Intelligence/Smartness

WISDOM

KNOWLEDGE

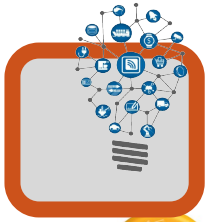
IN

Future of Work:
Execute projects with a lifespan focus

ISO 19650

Business Processes and Decision Making

Product
Policy
Financial
Legal
HR / People



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BIM Harambee Africa

What is a “Smart City”?

- IBM defines a smart city as “one that makes optimal use of all the interconnected information available today to *better understand and control its operations* and *optimise the use of limited resources*.”
    - Governance – visibility, transparency of processes
    - Service delivery – metrics of delivery, condition of facilities
    - Performance – utilities (water, power, telecoms, waste, sewer, drainage)
    - Mobility – traffic management, public transport, parking management

    …

    - Assets – location, condition, age, types

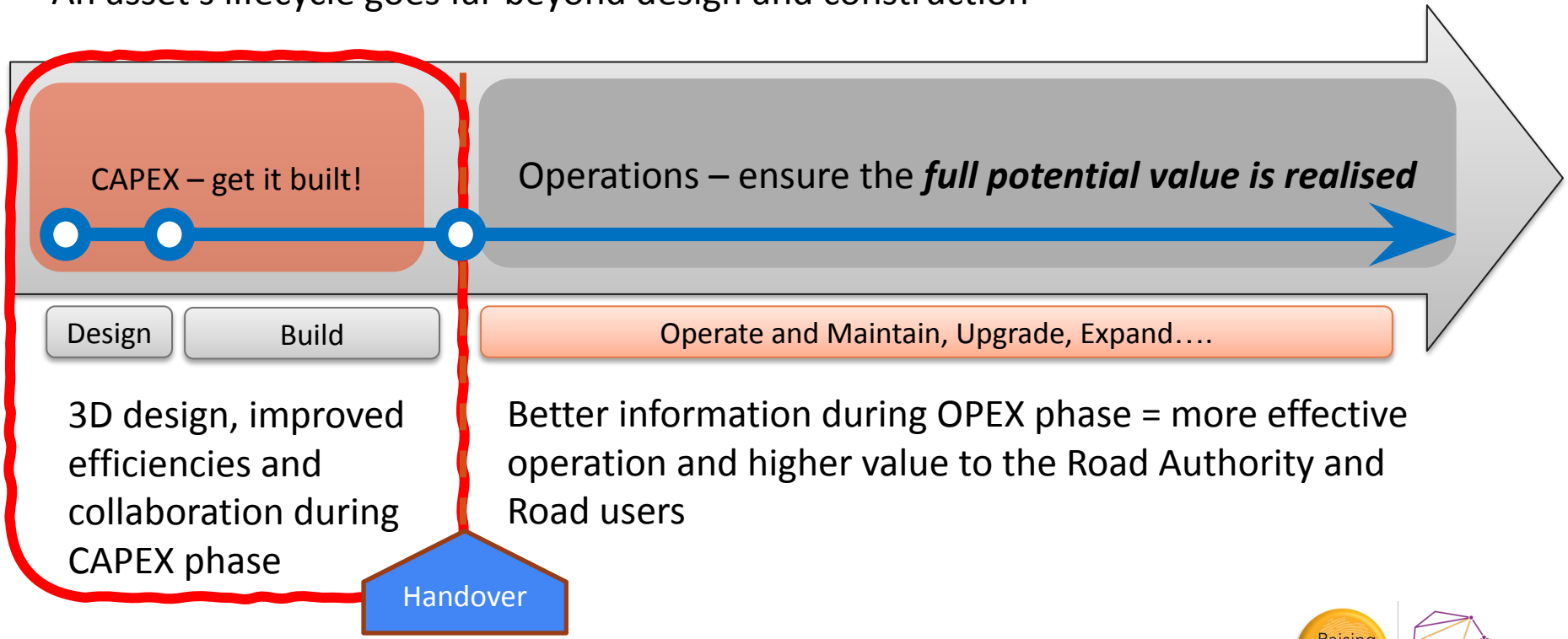
Here’s the gap

Where are the assets? – (not 100% sure…)

Where is the information about the assets? – (“missing” or outdated)

Whole of Life Value – Better Information Management

An asset's lifecycle goes far beyond design and construction



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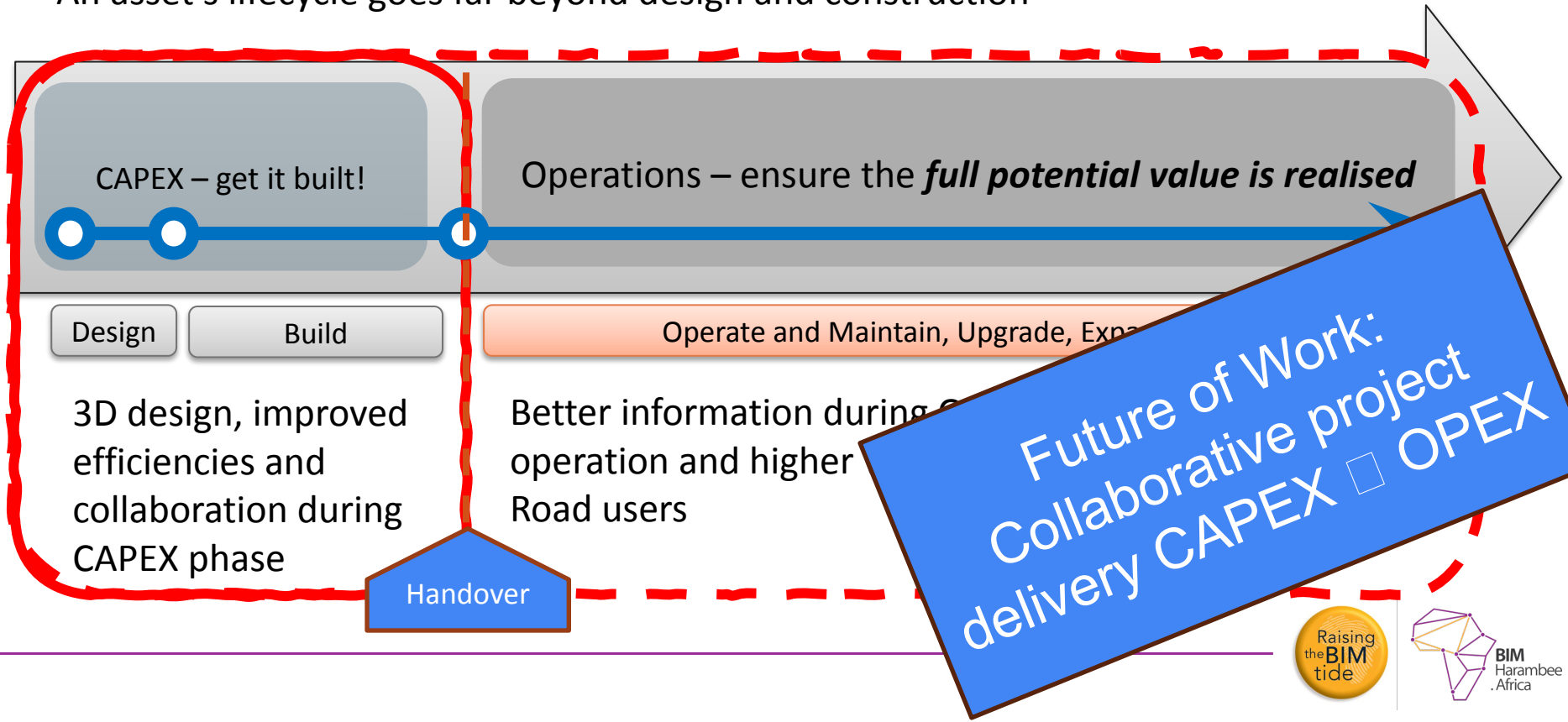
Whole of Life Value – Better Information Management

An asset's lifecycle goes far beyond design and construction



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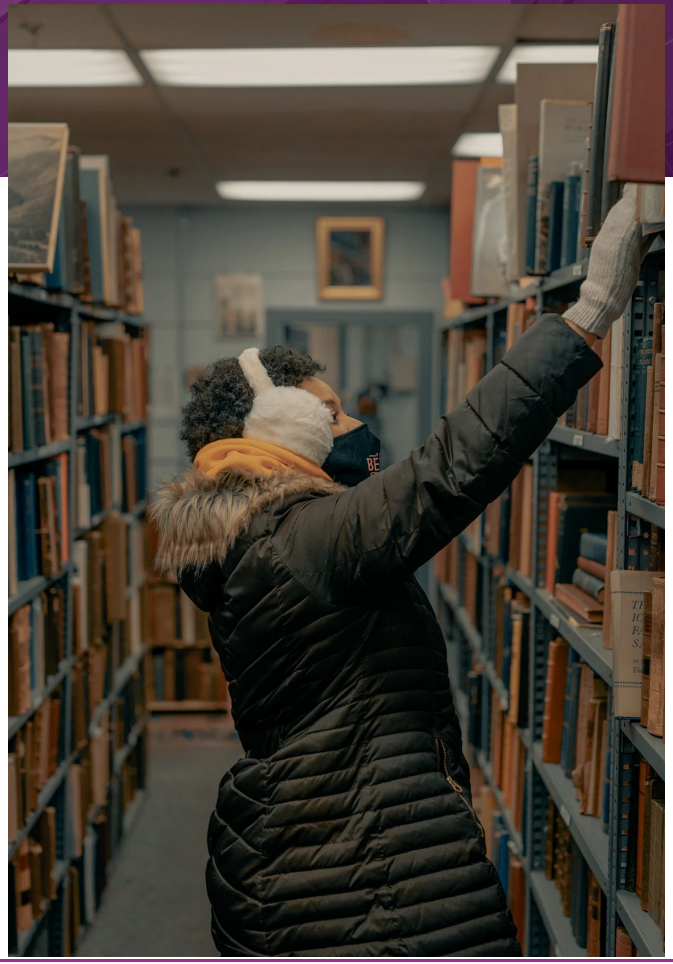
The familiar reality ….



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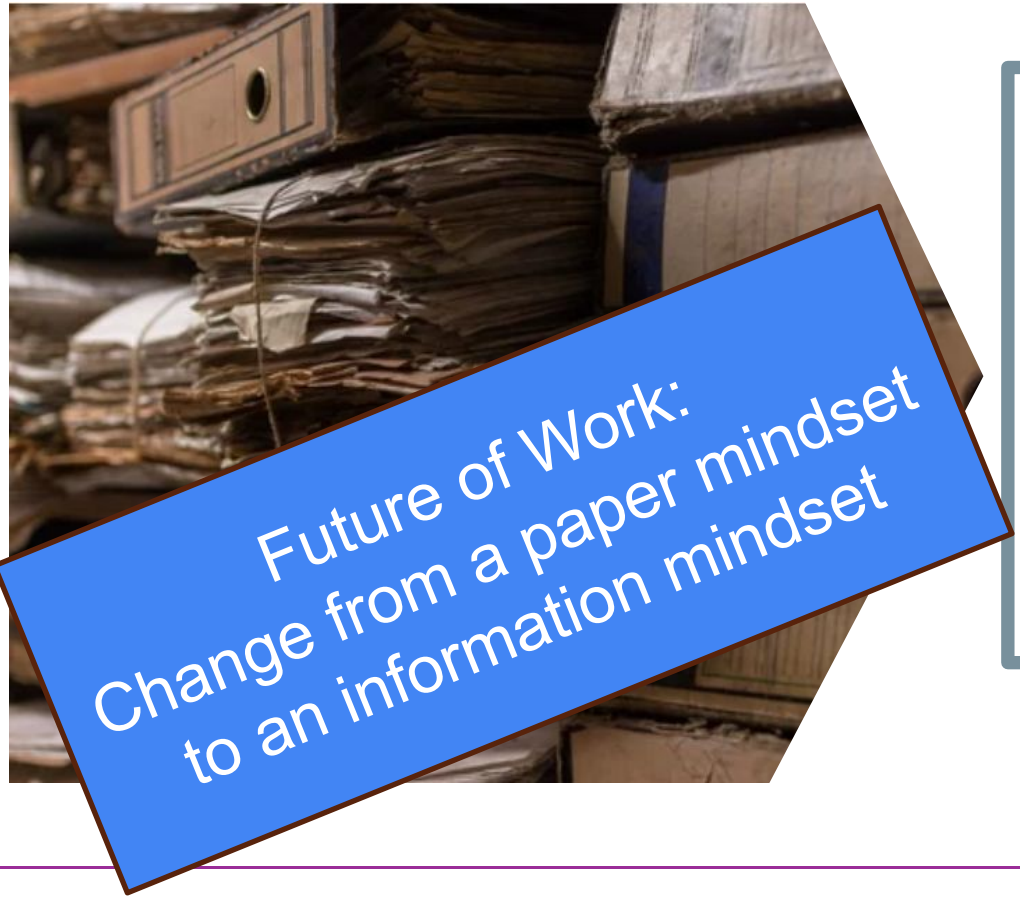

Future of Work:
Change from a paper mindset to an information mindset

- OEM Operators Manual
- 3D Component view and parts list
- Configuration and Installation Record
- Commissioning record and Warrantees
- Trouble Shooting Guide
- Keyplan of installations
- Maintenance Schedule

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Design Approach

Better Information Management

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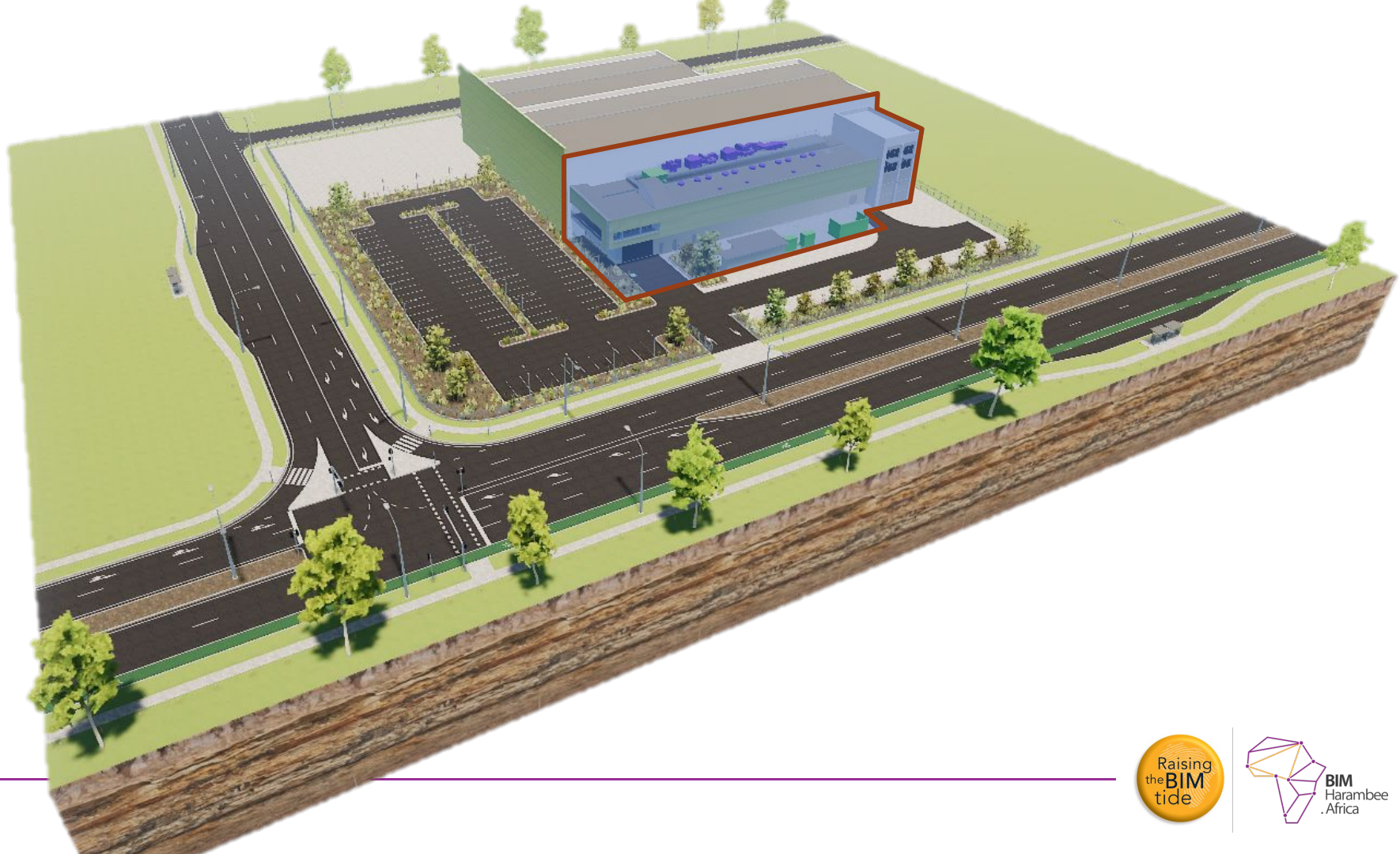

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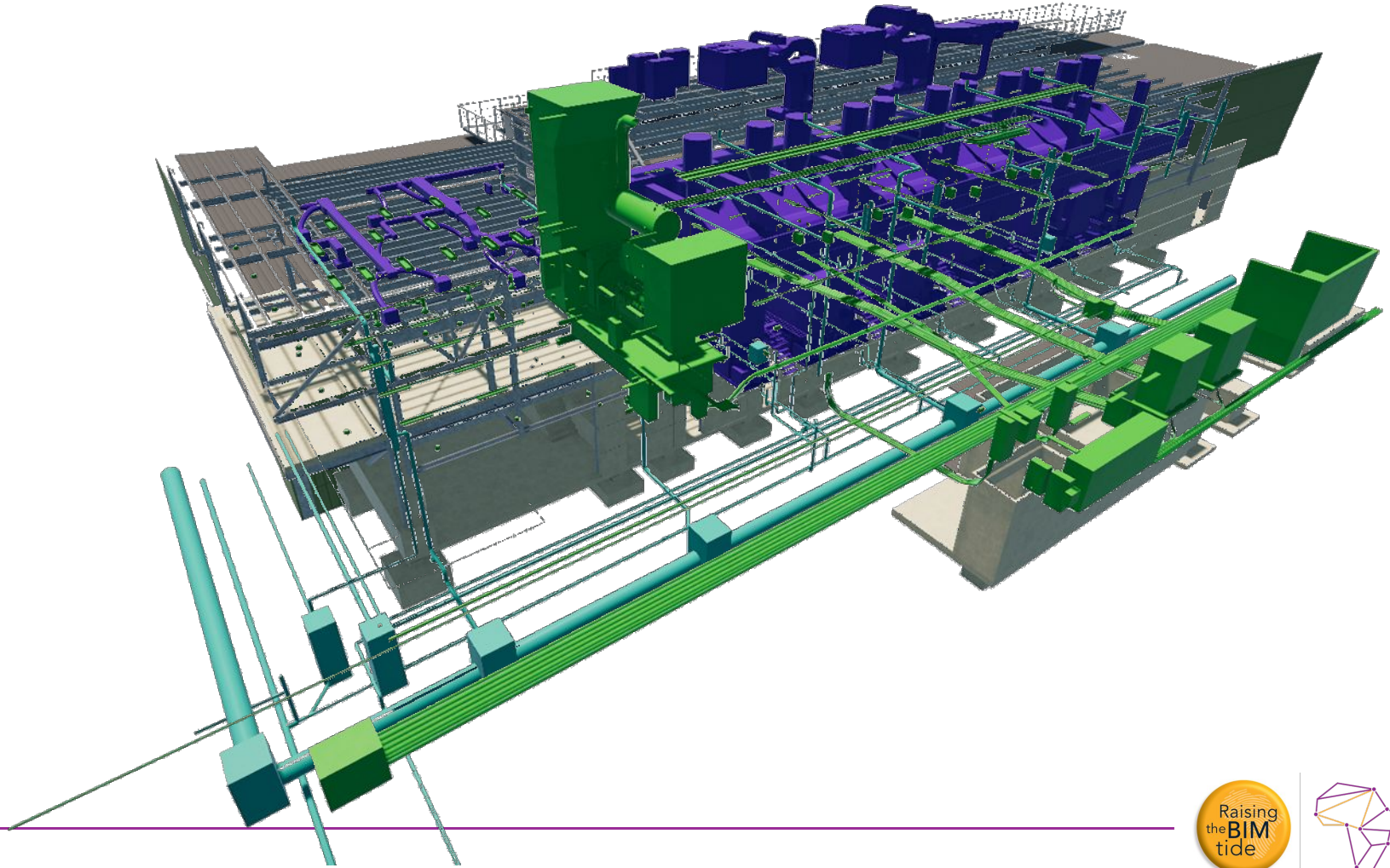

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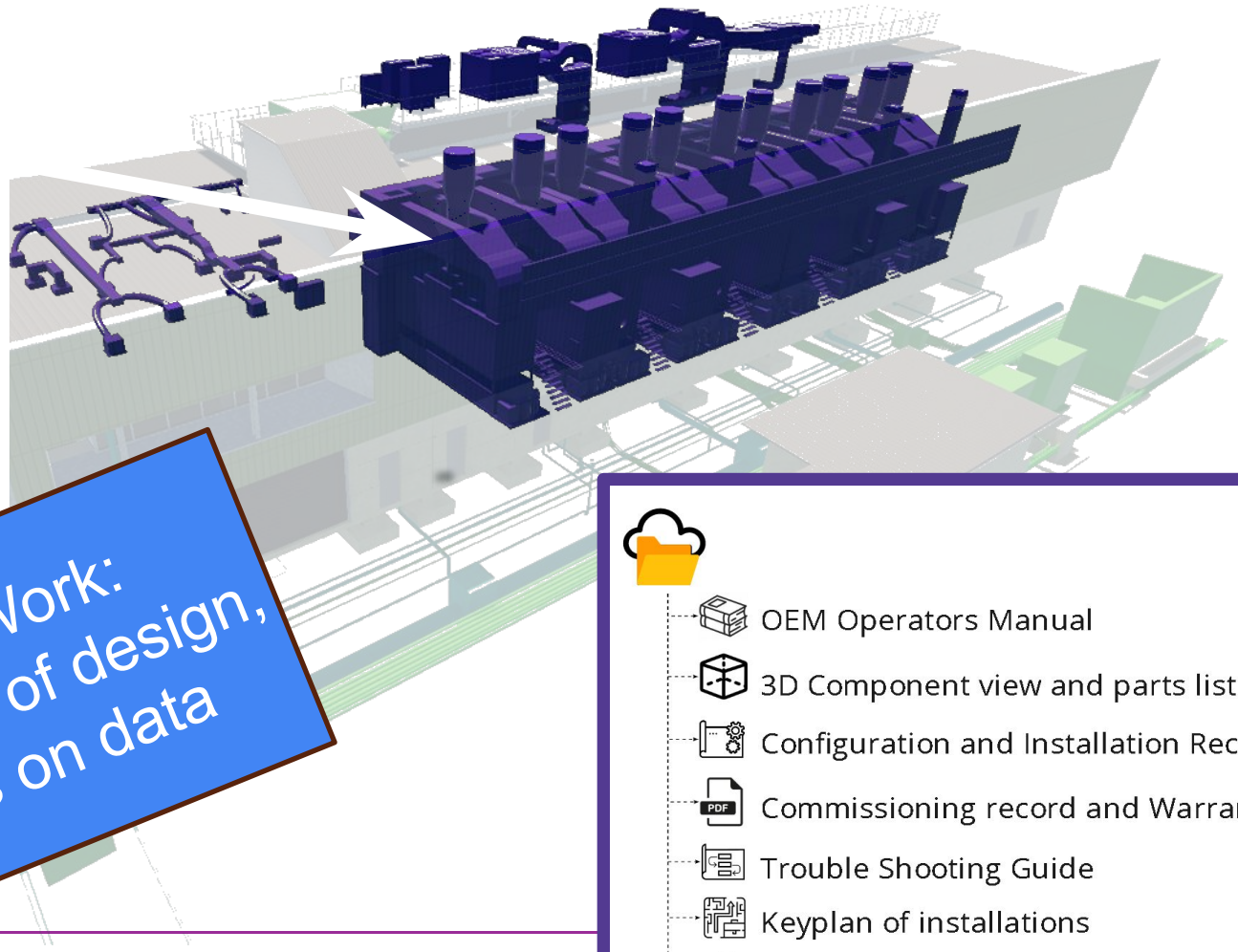


Category Name = Mechanical Equipment

Family Name = Aur_A_AHU_Packaged Ventilator Type 2

Type Name = Standard

System Classification = Exhaust Air,Supply Air,Return Air

System Name = Mechanical Exhaust Air 288,Mechanical Supply Air 437,Mechanical Return Air 349

Phase Created = New Construction

OmniClass Number = 23.75.35.14.14

level = LOWER GROUND

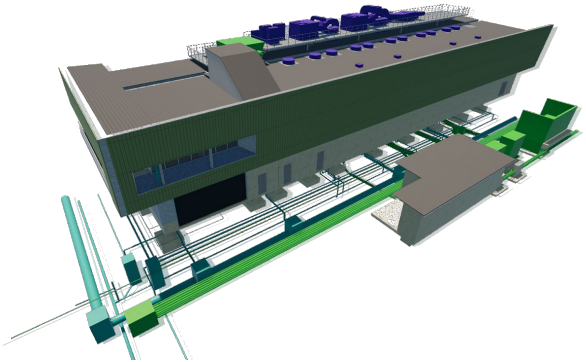
Type Mark = IEC

Future of Work: New methods of design, new focus on data

- OEM Operators Manual
- 3D Component view and parts list
- Configuration and Installation Record
- Commissioning record and Warrantees
- Trouble Shooting Guide
- Keyplan of installations
- Maintenance Schedule

3D Modeling vs BIM

Key Characteristics



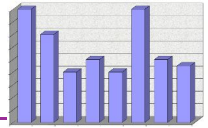
3D design collaboration
Clash management
Interdisciplinary coordination

Link Static Documentation and Metadata to Model — 3D BIM

Link the project schedule — 4D BIM

Link the cost estimate and cashflow — 5D BIM

Link sustainability data and ratings — 6D BIM



Link performance data — 7D BIM

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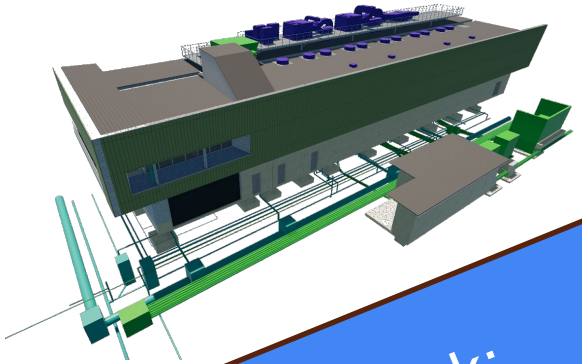
3D Modeling vs BIM

Key Benefits



Future of Work:
New approach to design and construction

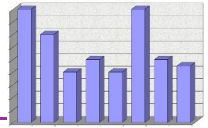
coordination

Data enriched model, handover docs — 3D BIM

Time simulations of construction, coordination — 4D BIM

Cashflow visualisation, earned value demonstration — 5D BIM

Calculation of Green Star Ratings — 6D BIM



Asset performance management — 7D BIM

Raising the BIM tide

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CAPEX stage to OPEX Stage

The changing players

Lifecycle Optimisation

Owner, Consultants

Facilities Management

FM Contractor

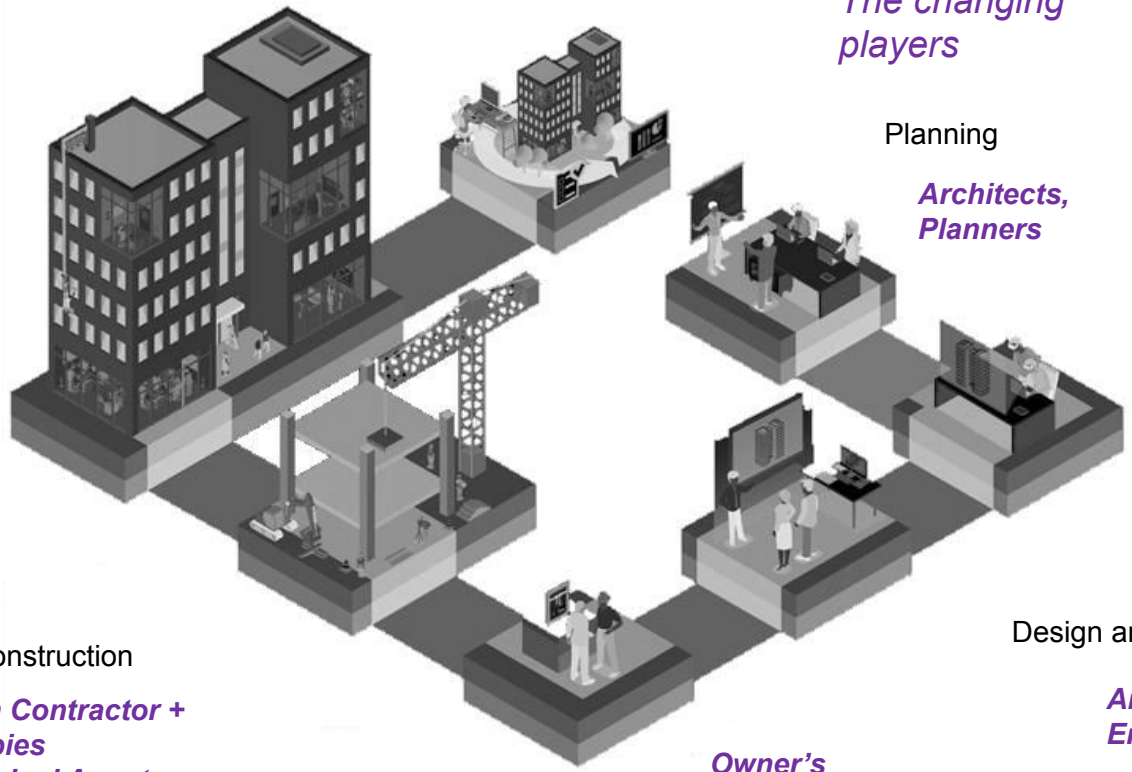
Occupation and Operations

Owner, Operator Tenants

TRANSITION

Commissioning

Main Contractor + subbies
Principal Agent
Engineering Consultant



Planning

Architects, Planners

Conceptual Design

Architects, Engineers

Design and Engineering

Architects, Engineers

Owner's Procurement Professional Team

Procurement

Construction

Main Contractor + subbies
Principal Agent
Engineering Consultant

Image adapted from www.tekla.com

Raising the BIM tide

BIM Harambee Africa

Facilities Management

FM receives unfamiliar documentation
FM takes over unfamiliar facility
Operations commence
Staff Training, operational readiness

Asset Management

Portfolio Management
Data driven decisions
Management of changes
[where is the info?]
Expansion, modification,
Repurpose, demolish

Lifecycle Optimisation

Green Star Ratings
Regulatory requirements
Financial benefit of optimisation

Standardise
Specify
Manage

Supervise, witness, accept

Shop Drawings vs Design intent
Required changes, queries, amen
Final equipment, material and finis
Detailed installation by trades,
Utilities buried, covered by landscap
areas
Services covered by cladding and ceili

Constructio
n

TRANSITION

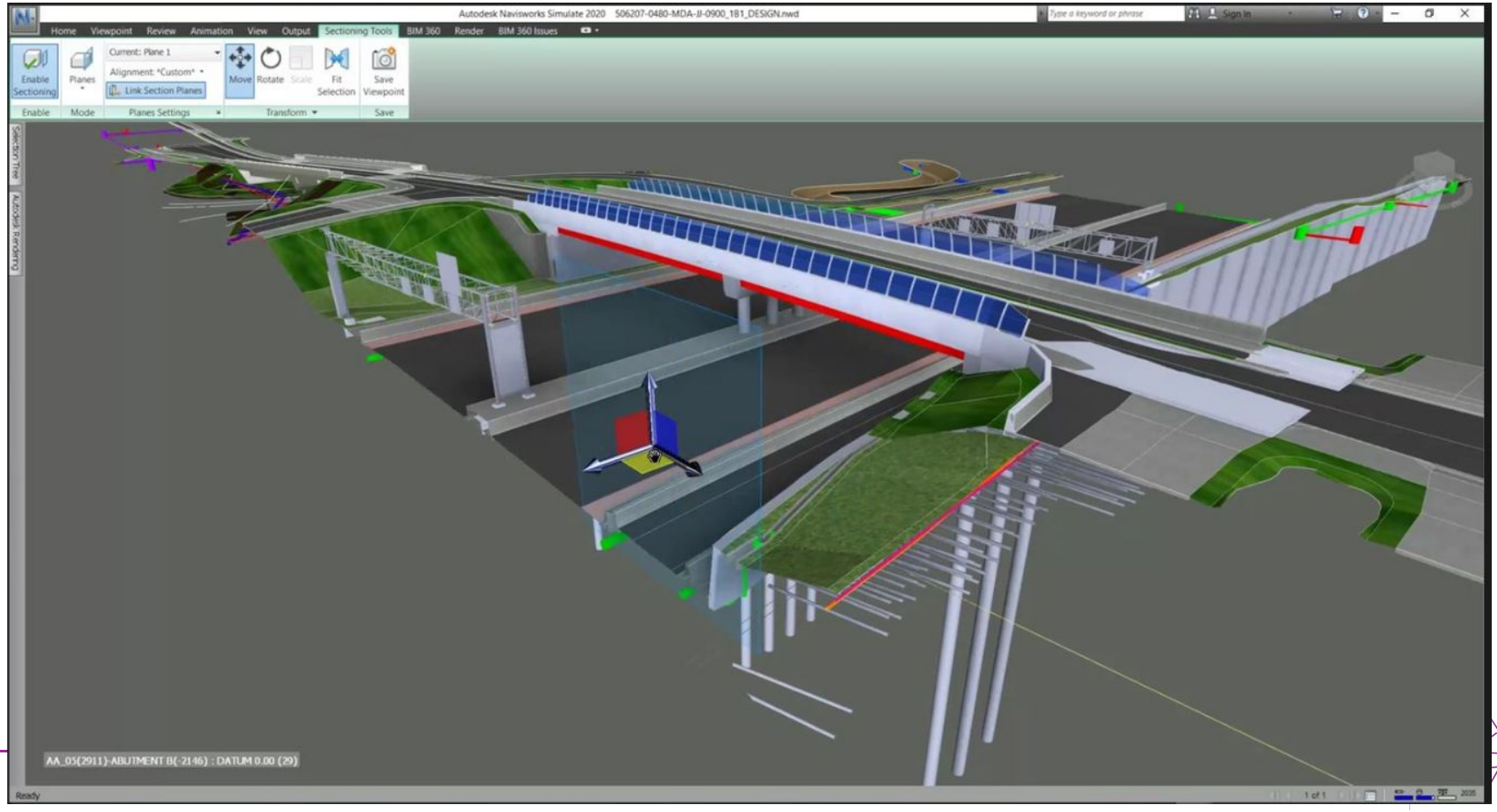
Hand-over
Documentation

As-Built Records
2D Layouts
Survey data and drawings
Taking over certificates
P&ID of Plant and
equipment
OEM Manuals &
Warrantees

Commissionin
g

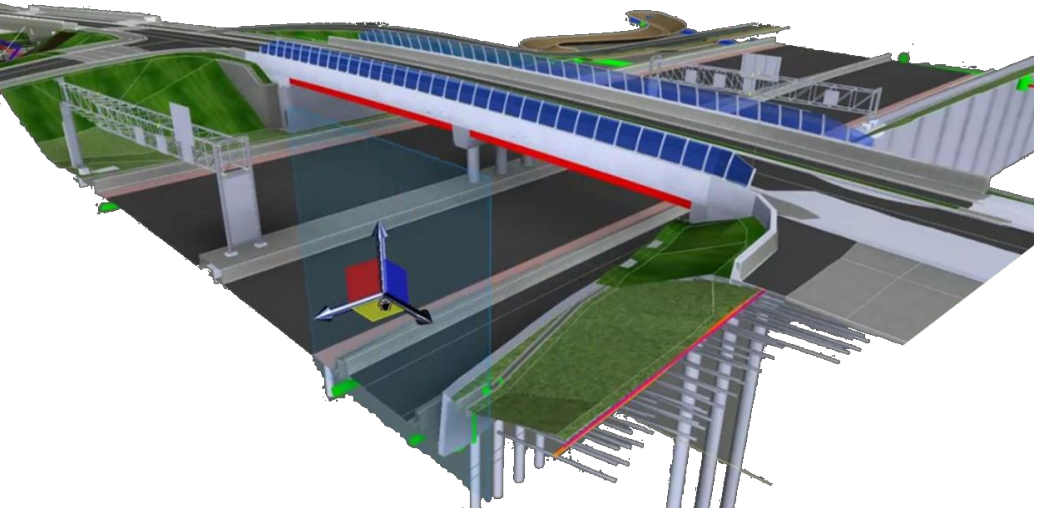
.Africa

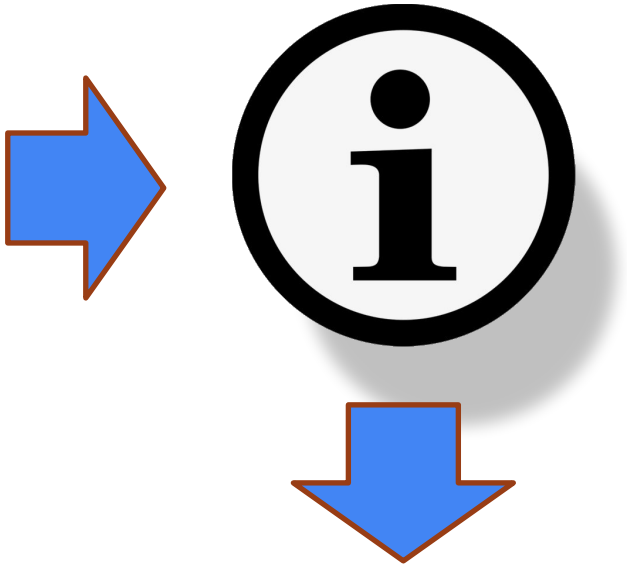
Not just buildings!!!



BIM Harambee .Africa

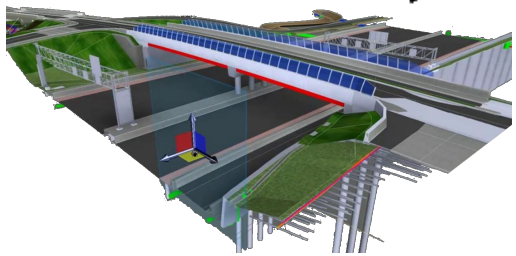
All design info is potential asset info



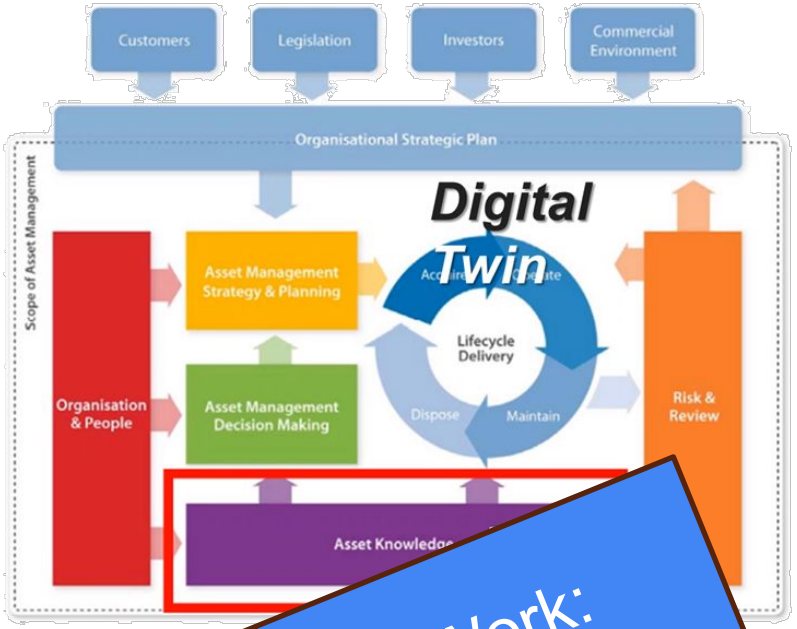


Asset Information

Asset Management depends on good BIM



Asset Information



Future of Work: New focus in asset information planning

Raising the BIM tide

BIM Harambee Africa

Change Management

Information Standards

Cost models

Organisation KPIs

Sustainability goals

Predictive Maintenance

Project requirements

Energy Performance Certification

Maintenance schedules

Project planning

What information do you need??

Asset Registers

ESG reporting

Engineering specifications

Facilities management

Knowledge Management

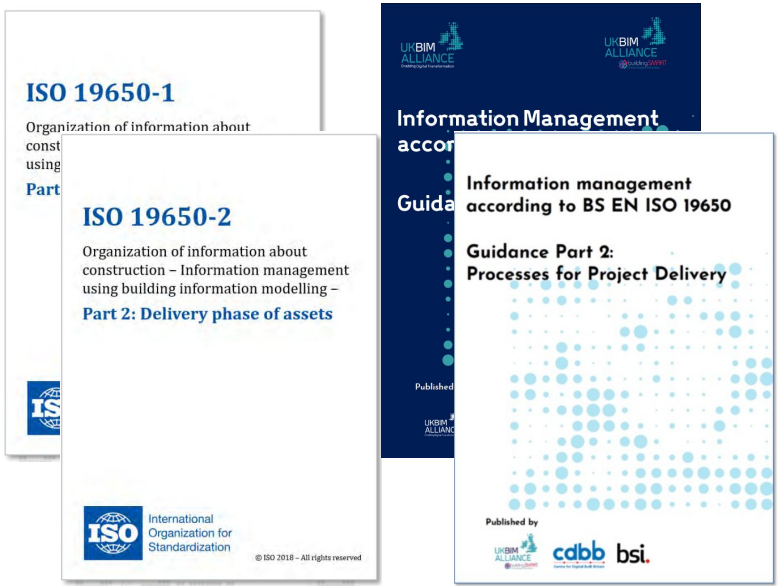
Enterprise management

Raising the BIM tide

BIM Harambee Africa

ISO 19650 in a nutshell

ISO19650 - Standard and Guidance Digital / BIM information management



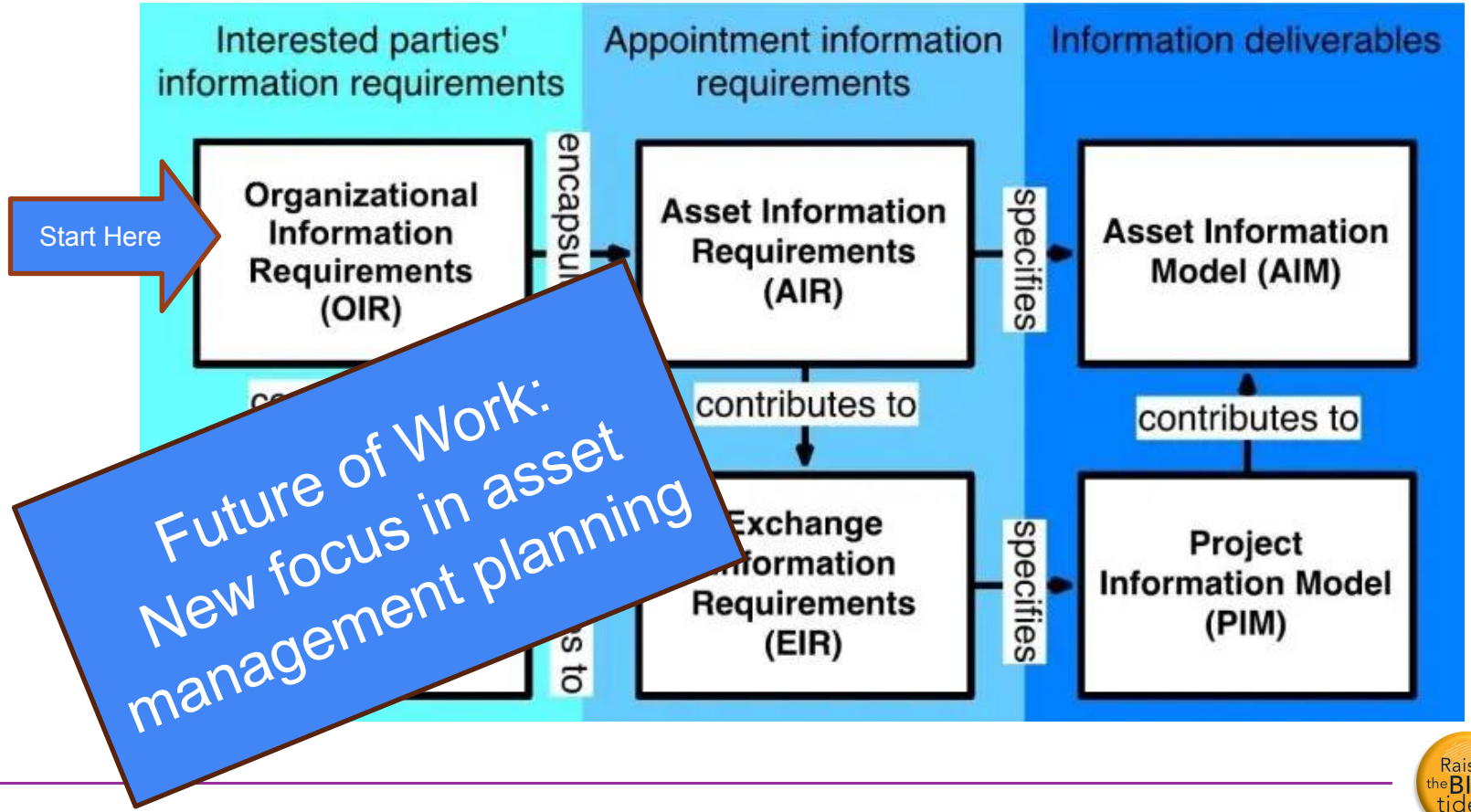
- Define agreed information objectives (owner, operator, employer)
- Integrate the information objectives into the planning and procurement stages
- Plan and execute the project and create the digital deliverables and construct the physical assets simultaneously
- Commission and handover BOTH the physical and the virtual assets.

Based on the BS1192 series

Raising the BIM tide

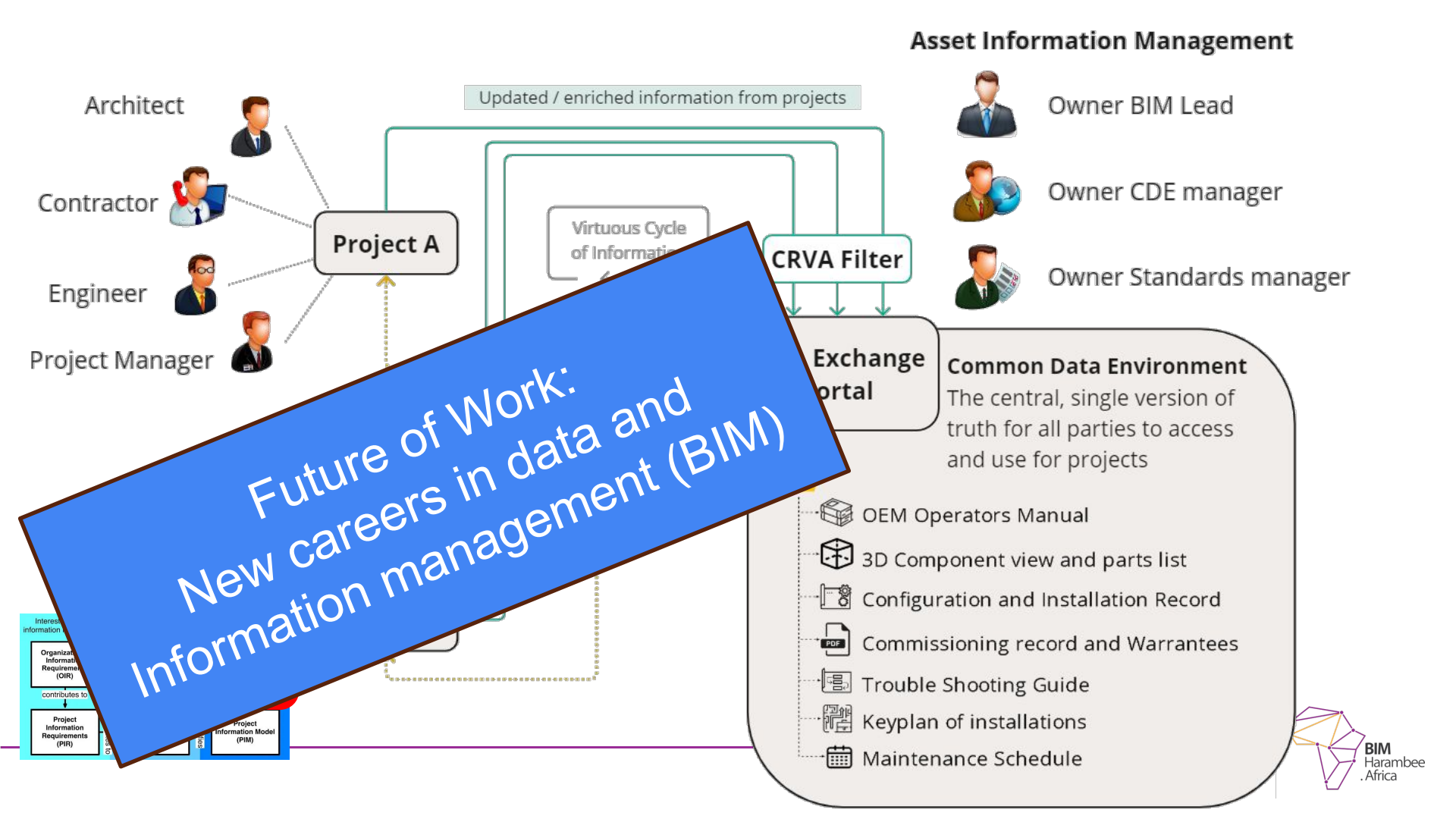
BIM Harambee Africa

A structured approach to defining Information Requirements



Raising the BIM tide

BIM Harambee Africa


Asset Information Management
Architect
Contractor
Engineer
Project Manager
Updated / enriched information from projects
Project A
Virtuous Cycle of Informati
CRVA Filter
Owner BIM Lead
Owner CDE manager
Owner Standards manager
Exchange
ortal
Common Data Environment
The central, single version of truth for all parties to access and use for projects
OEM Operators Manual
3D Component view and parts list
Configuration and Installation Record
Commissioning record and Warrantees
Trouble Shooting Guide
Keyplan of installations
Maintenance Schedule
Future of Work:
New careers in data and
Information management (BIM)
BIM
Harambee
.Africa

Better Information Management

Lifecycle Optimisation

Facilities Management

FM

Contractor

The changing players

Occupation and Operations

Owner,
Operator
Tenants

Planning

Architects,
Planners

TRANSITION

Commissioning

Main Contractor +
subbies
Principal Agent
Engineering Consultant

Construction

Main Contractor +
subbies
Principal Agent
Engineering Consultant

Procure

QS

Future of Work:
Better Information Management
from start to finish.

Image adapted from www.tekla.com

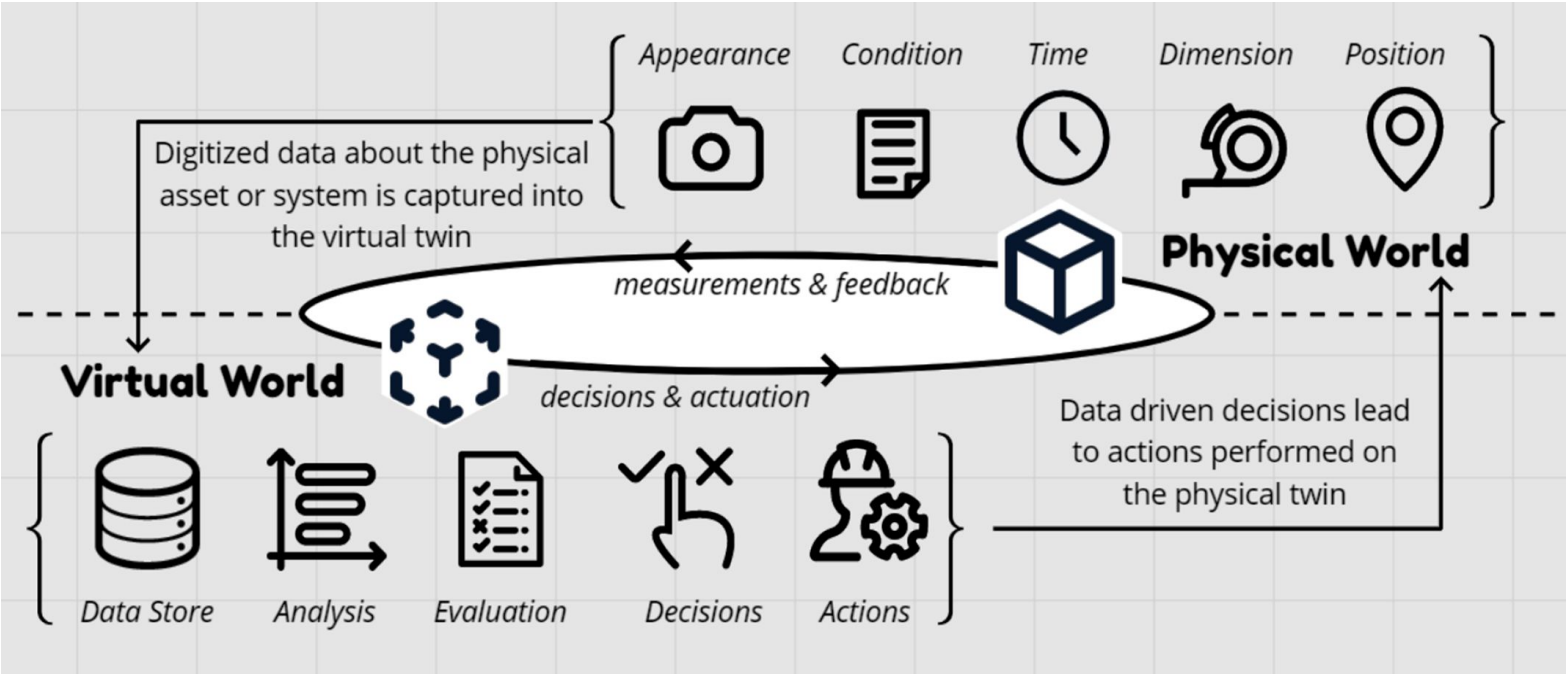
Raising the BIM tide

BIM Harambee Africa

What is a “Digital Twin”?

- A cyber-physical system
- A decision support simulation
- A autonomous, self governing asset

….



How would Digital Twins generate direct value to
Real Estate, Infrastructure, Asset, Operations + Business Management

Human — Service Request

- Water main break
- Signal malfunction
- Pothole or Graffiti
- Street light out
- Machine broken
- HVAC broken

Human — Inspections

- Asset identified
- Asset attributes reviewed
- Prior work reviewed
- Schedule and issue crews
- Dispatch

Human — Work Orders

- Fix the thing
- Record information, dates, supervisor, work performed,
- Manage resource utilization, labor, material, equipment

Human — Reports

- Cumulative reports: where, when, how much?
- Lifecycle: where and when can we expect this to happen again or in the future?
- Planning: follow-up inspections and related works
- Archive reports to find histories

React —> Review —> Revisit

Dept Architecture, EBIT,
University of Pretoria

How would Digital Twins generate direct value to
Real Estate, Infrastructure, Asset, Operations + Business Management

Data-Driven — Service Requests

- Add sensors + smart instruments vs human observations
- relatively cheap & retrofitting easy
- Monitor in real time vs after-the-fact
- allows for instant knowledge as opposed to late learning

Data-Driven — Inspections

- Accurate locations already known
- Reduce surveyance time, effort and costs
- Learn before dispatching
- Know what/who to take with
- No double trips, errors, rework
- Instant updates to the system

Human — Work Order

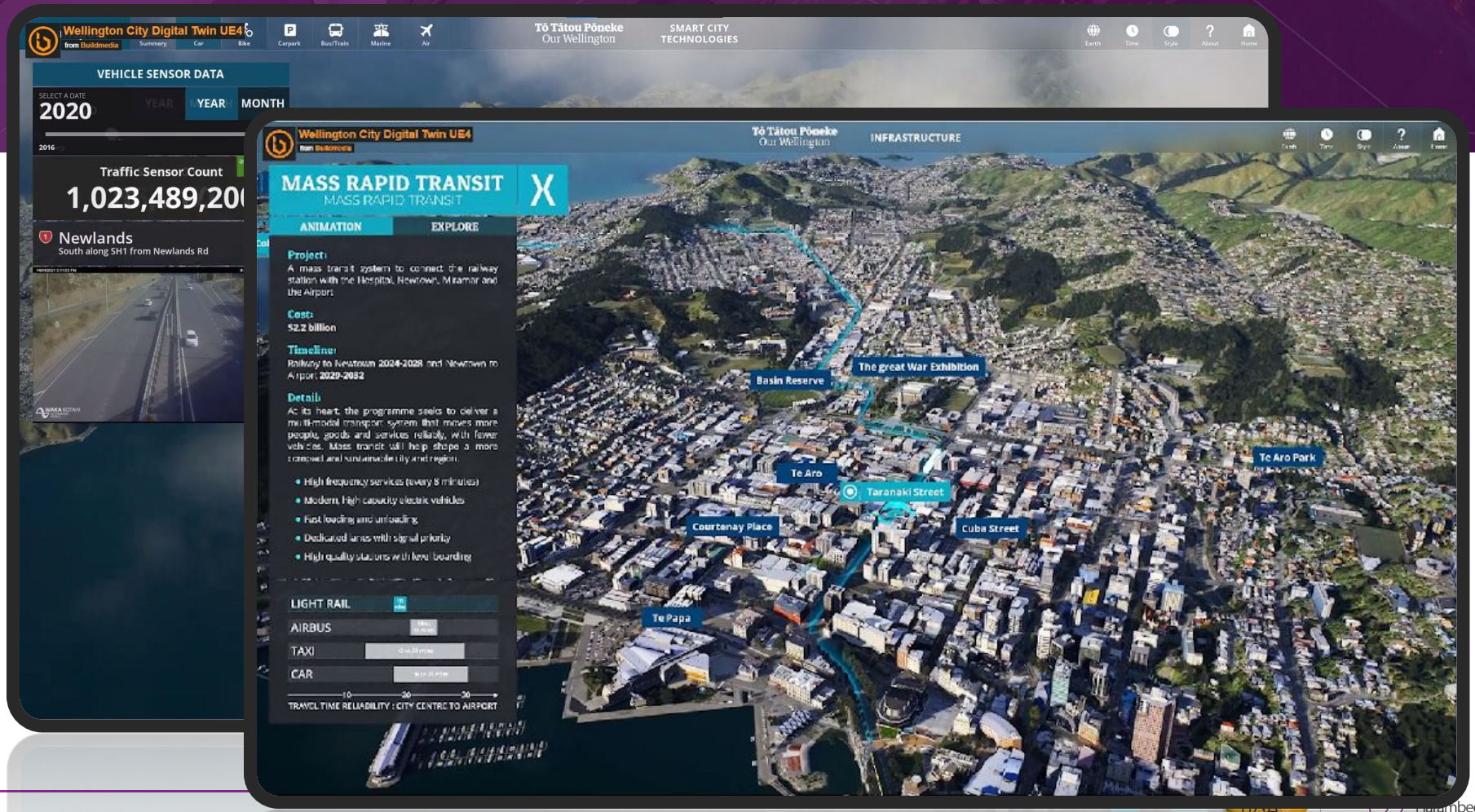
- Fix the thing
- Record live information, dates, supervisor, work performed,
- Manage live resource utilization, labor, material, equipment
- Instant updates to the system

Data-Driven — Reports

- No human effort required.
- Instant reporting and histories

Predict —> ~~React~~ —> Prevent —> Review —> ~~Revisit~~

Dept Architecture, EBIT,
University of Pretoria


Wellington City Digital Twin UE4
from Buildmedia
Summary
Car
Bike
Carpark
Bus/Train
Marine
Air
Tō Tātou Pōneke
Our Wellington
SMART CITY
TECHNOLOGIES
Earth
Time
Style
About
Home
VEHICLE SENSOR DATA
SELECT A DATE
2020
YEAR
MONTH
2016
Traffic Sensor Count
1,023,489,20(
Newlands
South along SH1 from Newlands Rd
Wellington City Digital Twin UE4
from Buildmedia
Tō Tātou Pōneke
Our Wellington
INFRASTRUCTURE
MASS RAPID TRANSIT
MASS RAPID TRANSIT
ANIMATION
EXPLORE
Project:
A mass transit system to connect the railway station with the Hospital, Newtown, Miramar and the Airport
Cost:
$2.2 billion
Timeline:
Railway to Newtown 2024-2028 and Newtown to Airport 2029-2032
Details:
At its heart, the programme seeks to deliver a multi-modal transport system that moves more people, goods and services reliably, with fewer vehicles. Mass transit will help shape a more connected and sustainable city and region.
High frequency services (every 5 minutes)
Modern, high capacity electric vehicles
Fast loading and unloading
Dedicated lanes with signal priority
High quality stations with level boarding
LIGHT RAIL
AIRBUS
TAXI
CAR
TRAVEL TIME RELIABILITY : CITY CENTRE TO AIRPORT
Basin Reserve
The great War Exhibition
Te Aro
Taranaki Street
Te Aro Park
Courtenay Place
Cuba Street
Te Papa

Math, Science and Design are not essentially different

but…

The “why” and the “way” we deliver projects, is.

The State of the South African Digital Built Environment

BIM Mandate & ISO 19650

(with National Annex)

BIM Harambee .Africa

RUDD VAN DEVENTER DIRECTOR SPACEWORX

Why is SANS/ISO 19650 so important?

- Think of SANS/ISO 19650 as a process and methodology for executing a BIM project
- The Methodology has a direct impact on practice and what is done in professionals offices when preparing and sharing documentation

ISO 19650-1 Concepts

- The Documentation needs to be structured and formatted to enable easy exchange between Parties
- The Parties need terms of reference to manage the exchange of information
- The Information needs to be categorised in the same way across different disciplines and locations
- On Site the contractor needs accurate, up to date construction information that he can use or issue to his subcontractors

ISO 19650-2 Delivery phase

- On completion of the Project the client/employer needs accurate information on his new assets, equipment and their maintenance requirement

ISO 19650-3 Operational Phase

Where are we with SANS/ISO 19650 adoption?

- **The Facilities Management Community** took the lead and sponsored the adoption of ISO 19650 through SABS Technical Committee 267, Facilities Management.
- SANS 19650-1 was gazetted on the 16th of September 2022.
  This covers the **Concepts and Principles** of **Building Information Management**
- SANS 19650-2 was gazetted on the 5th June 2023.
  This covers using Building Information Management in the **Delivery Phase** of the assets.
- The public comment period for SANS 19650-3 closed on the 25th of May 2023.
  This covers the **Operational Phase** of the assets.
- Adoption of the rest of the suite of ISO 19650 Standard will be taken on once the three principal sections are bedded down

Where does the National Annex fit in?

- The international ISO 19650 standards do not exist in a vacuum
- It was accepted by the ISO that every country needs to fit the standard to their own needs and requirements, while implementing conventional practice in the industry
- Each country has their own terminology, methodologies and contracts that they use and are familiar with
- The National Annex is this collection of these local conventions and is part of SANS/ISO 19650-2 *Building Information Management in the Delivery Phase of the assets*
- Avoiding unhelpful litigation

What else is necessary?

- BIM as an advanced construction technology is making headway in the production of construction documentation
- Wider adoption by other consultants and clients is needed to get to the next level of the adoption curve
- We need to move from the AEC Industry to the AECO Industry or *Architecture, Engineering, Construction and Operate Industry*
- All the Industry Stakeholders, with their differing interests and focus need to become involved in the process through the draughting of National Annex

What is the CIDB up to?

- The cidb is looking to prepare a *Building Information Management Framework* for state work. This protocol will be in alignment with the SANS 19650 standard
- The cidb has the required *Legislative Mandate from the Government* to be able to enable the SANS/ISO 19650 for Government contracts through regulation
- Using existing regulations, projects, identified by their size and/or importance will be required to use BIM
- cidb '*Best Practice: Construction Works Requirements for Digital 2D/3D Collaboration'* will be the vehicle

BIM Framework

- The cidb is going to set up an Industry Focus Group to assist with the development of a **BIM Framework**
- The initial requirements will be for contracts Grade 7 and above – R 20 mil and above
- The cidb will be working in line with the recommendations set out by the International Organisation for Standardisation (ISO)
- The recommendations will either be part of, or form the **National Annex**
- The cidb will be working on an open, non-proprietary format for the exchange of information

What does each BIM practitioner need to do to have a successful BIM Project?

- Understand that BIM started as ***Building Information Modelling*** and needs to become ***Building Information Management***
- Care about how they **structure their data** for the others in the Design Team and ensure that it can be utilised by the Construction Team and later handed over to the Operations Team
- Move to an **open-source data format** like IFC for the exchange of information
- Adopt the conventions that will be part of the National Annex by familiarising themselves with the UK BIM Framework

What can you do today?

- It looks like South Africa will closely follow the UK in the adoption of the SANS/ISO 19650
- There are a lot of Guidance Documents put out by the UK BIM Framework that will assist you in understanding the concept and principles
- Another UK source is the NBS (National Building Specification) with its wide range of documents including:
- Uniclass 2015 set of tables to classify all activities, processes, systems, spaces, elements, etc. in 14 separate interlinked tables

BIM Harambee .Africa

Educator Session

Teaching Case Study

HBIM for Circularity

CALAYDE DAVEY — ARCHITECTURE
JOHANN VD MERWE — STRUCTURAL ENGINEERING
HELENE POTGIETER — HPA ARCHITECTS

Why care about the materials in buildings?

WORLD GREEN BUILDING COUNCIL

39%

of greenhouse gas emissions

UN environment
United Nations Environment Programme

40

billion tons / year

http://www.mineralinfo.org

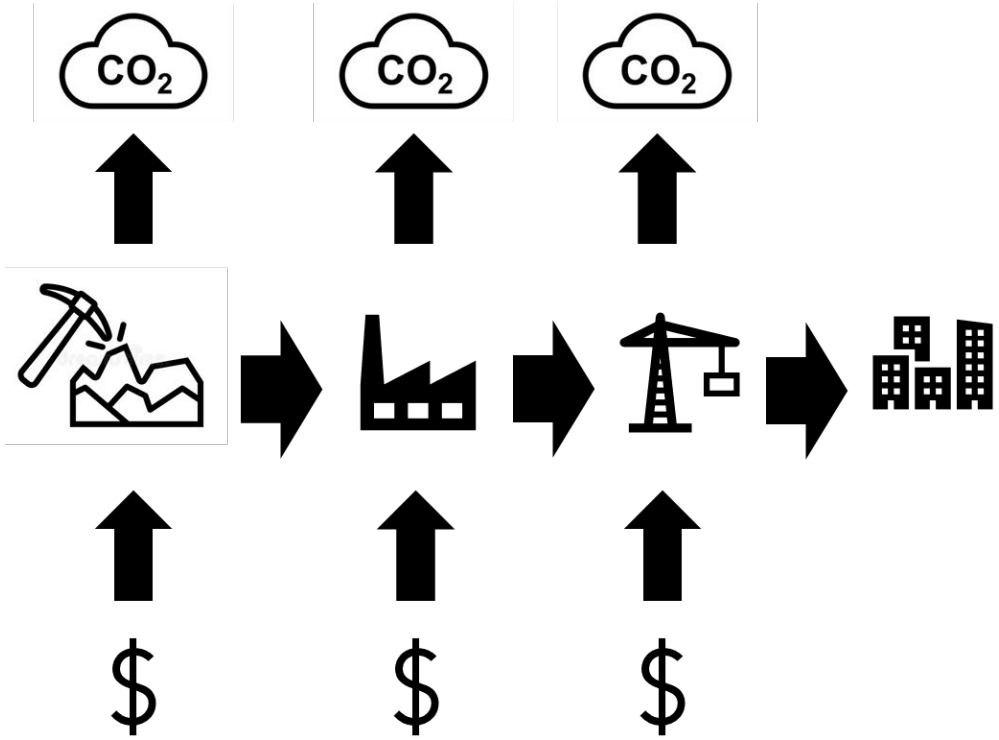
Godfrey (2018)

20%

of waste on landfill sites

40%

of global waste production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CO_2
CO_2
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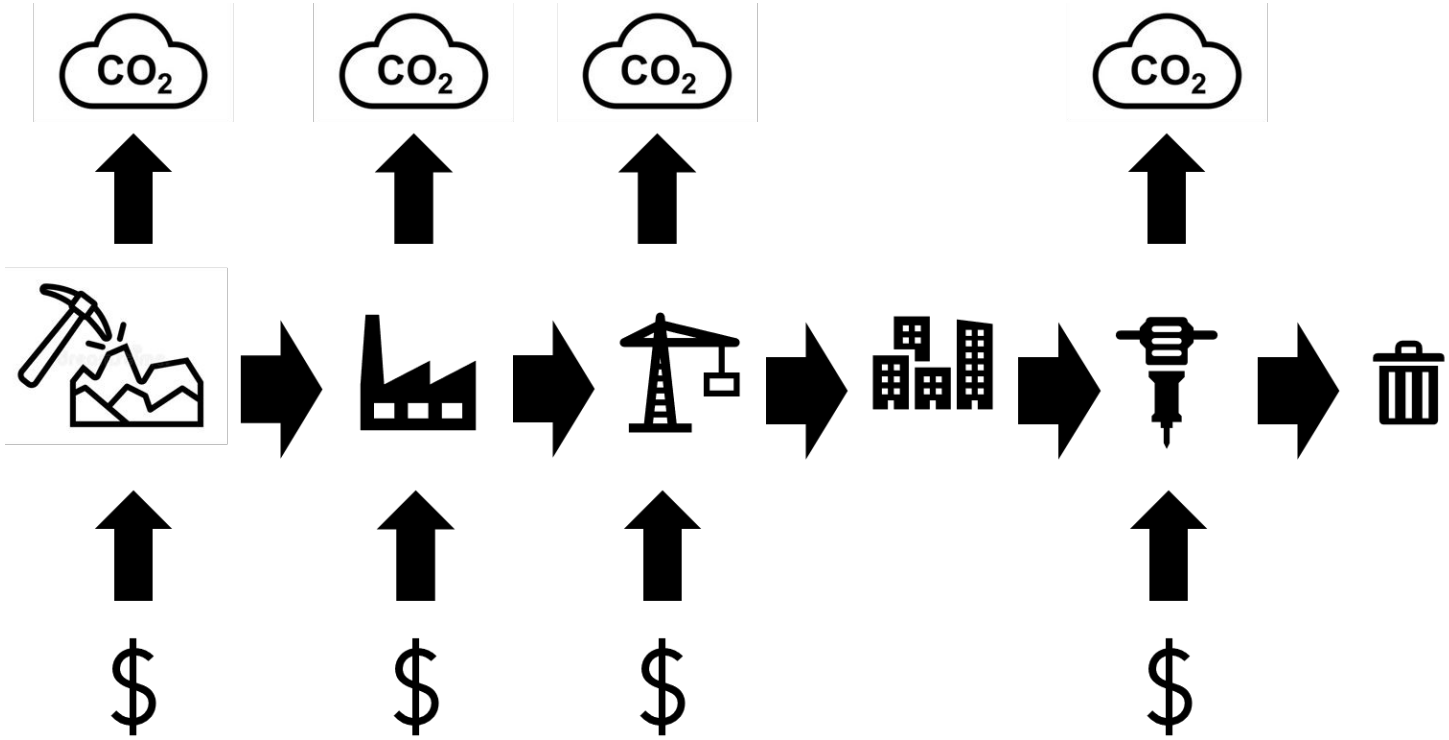
$
$


CO_2
CO_2
CO_2
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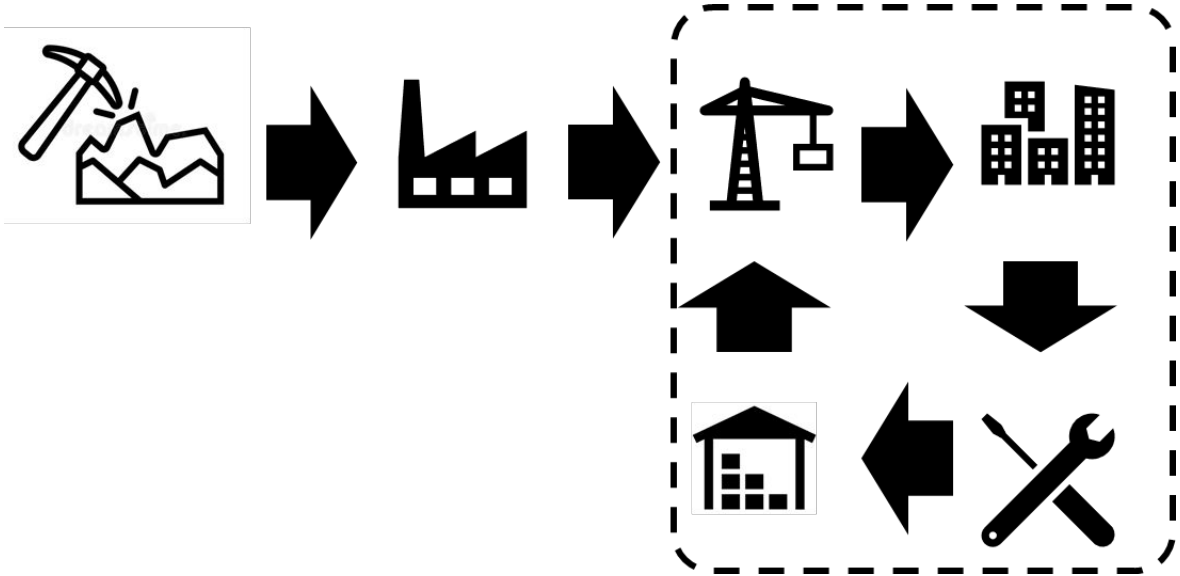
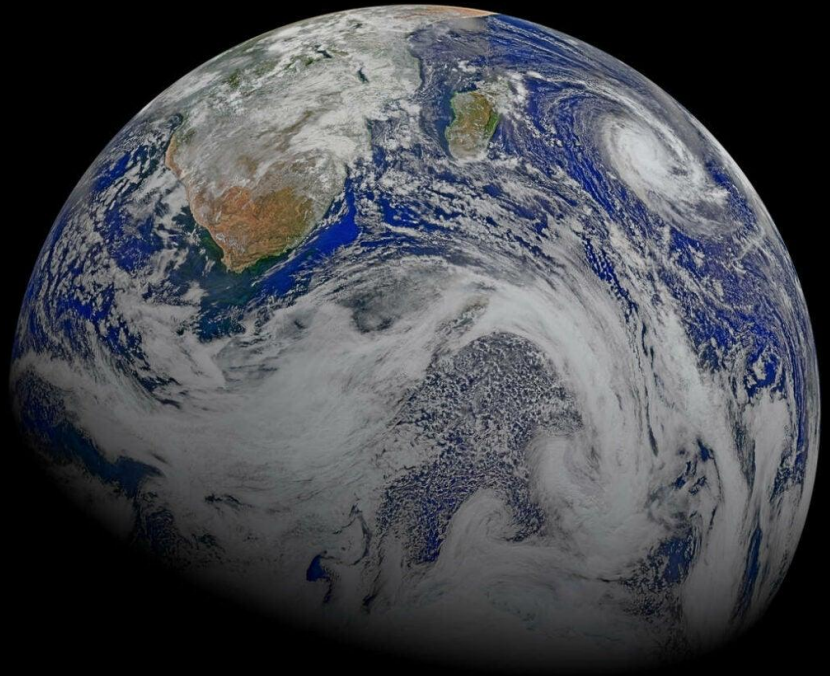


Why care about the heritage of buildings?

Why Building Conservation?

Demolition waste (USA) = 7,200 square kilometres of habitat lost & taken up with landfills
(size of Cyprus & 40% of Kruger National Park)

Planet earth is a finite resource



"EARTHRISE" *was taken aboard Apollo 8 on 24 Dec 1968 (55 years ago versus age of planet earth 4,53 billion years)*
The first image captured by humans from space that highlighted Earth's fragility -
juxtaposed against the vast blackness of space

Life cycle thinking – sustainable building development

2021 Pritzker Prize awarded to French architects
Anne Lacaton & Jean-Philippe Vassal who embraced a vow to 'never demolish'

Transformation of Social Housing Block - Paris 17°, Tour Bois le Prêtre

UIA (International Union of Architects) World Congress of Architects Copenhagen July 2023

The 10 Copenhagen Lessons:

2. **Dignity and agency for all people are fundamental in architecture, there is no beauty in exclusion**
3. **People at risk of being left behind must be accommodated first when we construct, plan, and develop the built environment.**
4. **Existing built structures must always be reused first.**
5. **No new development must erase green fields.**
6. **Natural ecosystems and food production must be sustained regardless of the built context.**
7. **No virgin mineral material must be used in construction when reuse is possible.**
8. **No waste must be produced or left behind in construction.**
9. **When sourcing materials for construction, local, renewable materials come first.**
10. **In everything we build, carbon capture must exceed carbon footprint.**
11. **When developing, planning, and constructing the built environment, every activity must positively impact water ecosystems and clean water supply.**

Why is transdisciplinary learning important in the 21st century built environment?

20st Century

Individual Realities


Social
Physical
Digital
Work in Complexity
Common Ground
Share Reality
Team work
Complex Problem-solving
Cross-skilling
Effective
21st Century Society
shared realities
Adaptable
21st Century Society
human talent

21st Century

african built environment

Economics | Jobs

South Africa Is Tackling Its Second-Biggest Growth Problem

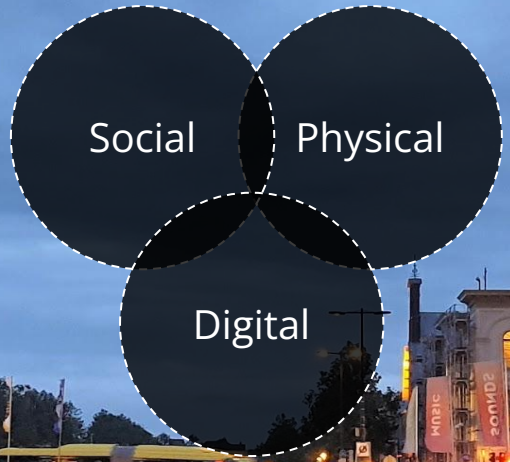
- Legal changes to ease skilled immigration are in process
- Only 25,298 skilled work visas awarded between 2014 and 2021

By Antony Sguazzin +Follow
5 July 2023 at 07:00 GMT+2

South Africa has begun taking steps to resolve what the presidency believes is the biggest impediment to growth after persistent blackouts: An acute shortage of skills.

A raft of changes to simplify the rules governing the snarled up and byzantine work permit regime were submitted to the state legal adviser last week and are expected to be passed into law in coming months, said Saul Musker, director of strategy and delivery support in the South African Presidency.

We can't
work together
if we don't
learn together



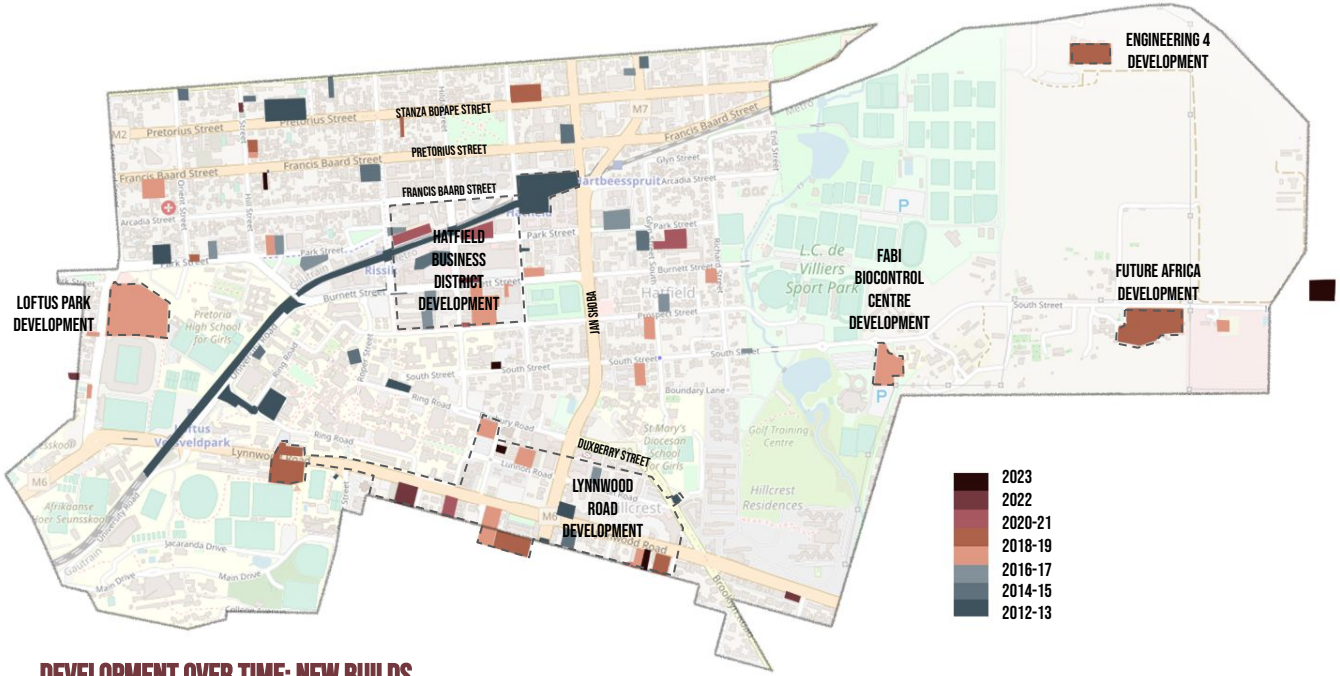
We can't
innovate together
if we don't
share reality together

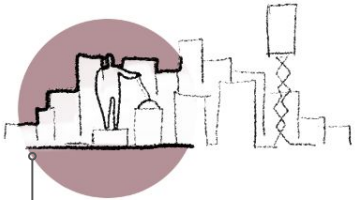
shared reality

How do we work together so we can learn together?

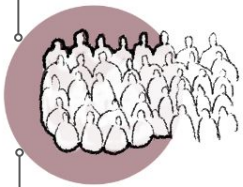
+

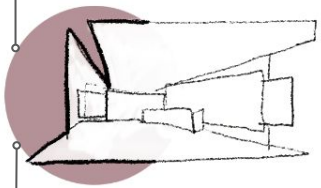
How do we do this socially, physically, and digitally?





CONSTRUCTION GROWING AT A HIGH RATE

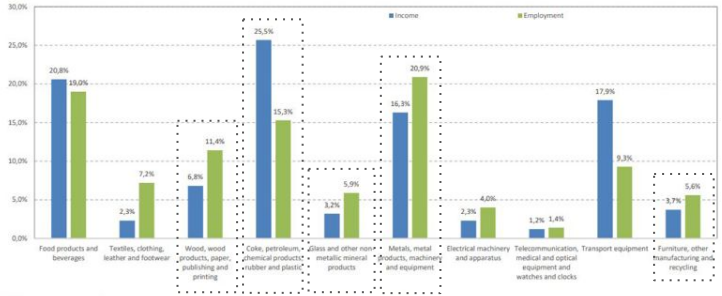


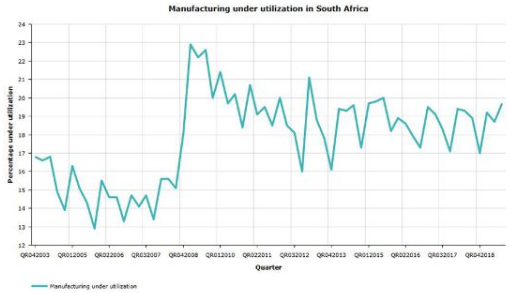


HIGH AMOUNT OF UNDERUTILIZED BUILDINGS

LOW INCOME FOR BUILDING USE AND BUILDER

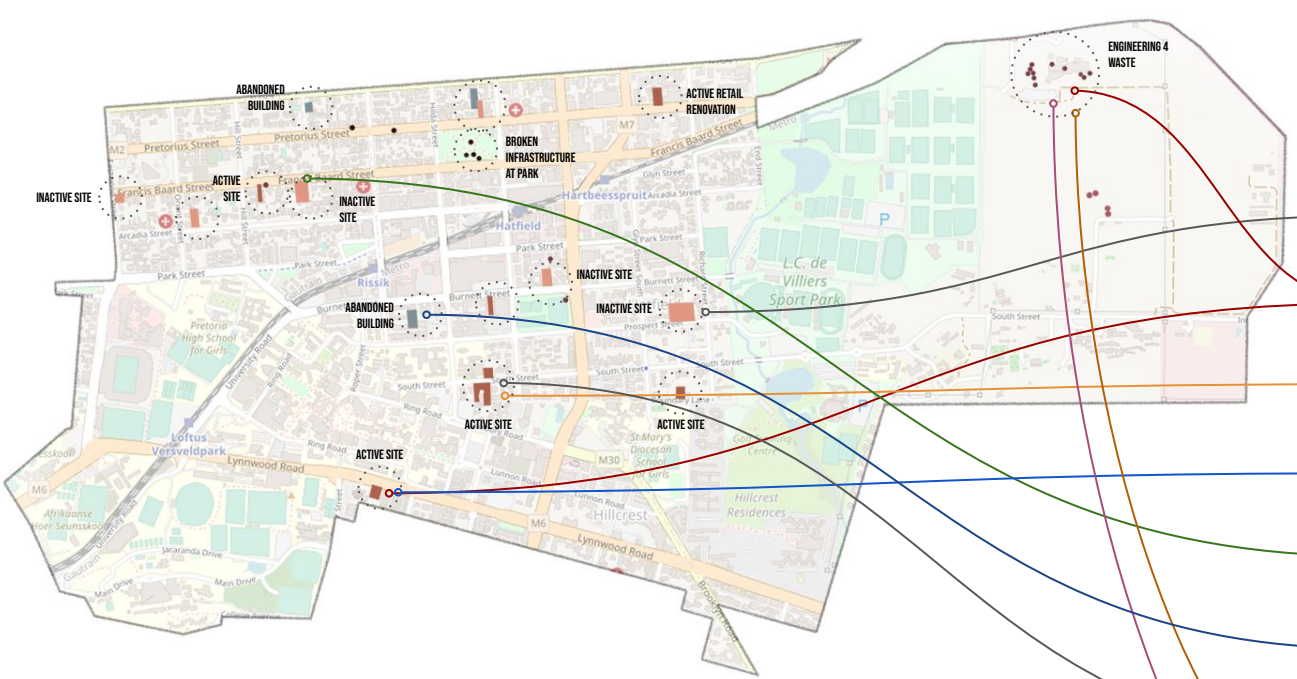
DEVELOPMENT OVER TIME: NEW BUILDS



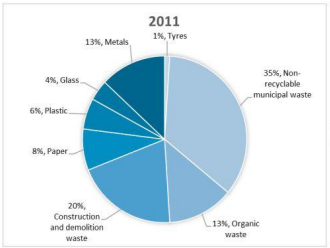


LOW INCOME FOR HIGH AMOUNTS OF EMPLOYMENT ——— HIGH INFRASTRUCTURE UNDERUTILIZED

CSIR, 2012
SIBISI, 2023
TAYLOR, 2023



BROKEN INFRASTRUCTURE
INPUT MATERIAL PILE
OUTPUT MATERIAL PILE
ACTIVE SITE
INACTIVE SITE
ABANDONED BUILDINGS



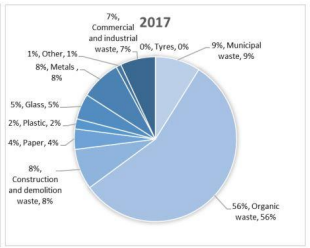
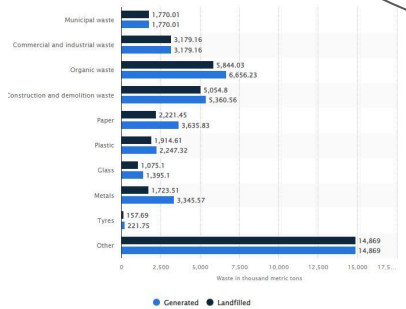


Figure 22: Comparison between 2011 and 2017 baseline report of general waste in South Africa (Source: APWC, compiled from DEA 2011 & DEA 2018)




129.9M³ CONCRETE CORES, RAILWAY SLEEPERS, RUBBLE,


50.9M³ BRICK, BRICK PAVERS, BRICK RUBBLE,


40.3M³ PALLETS, DOORS, WINDOWS, VARIETY OF PLANKS, TIMBER TRUSSES,


53.1M³ INFILL, BUILDING SAND & SOIL


2.4M³ VARIETY OF DIAMETER UPVC PIPE, PVC PLASTIC PIPES, PLASTIC WASTE


23.4M³ ROOF SHEETING, ROUND BAR, SQUARE TUBING, ALUMINIUM WINDOW FRAMES, STEEL FRAME

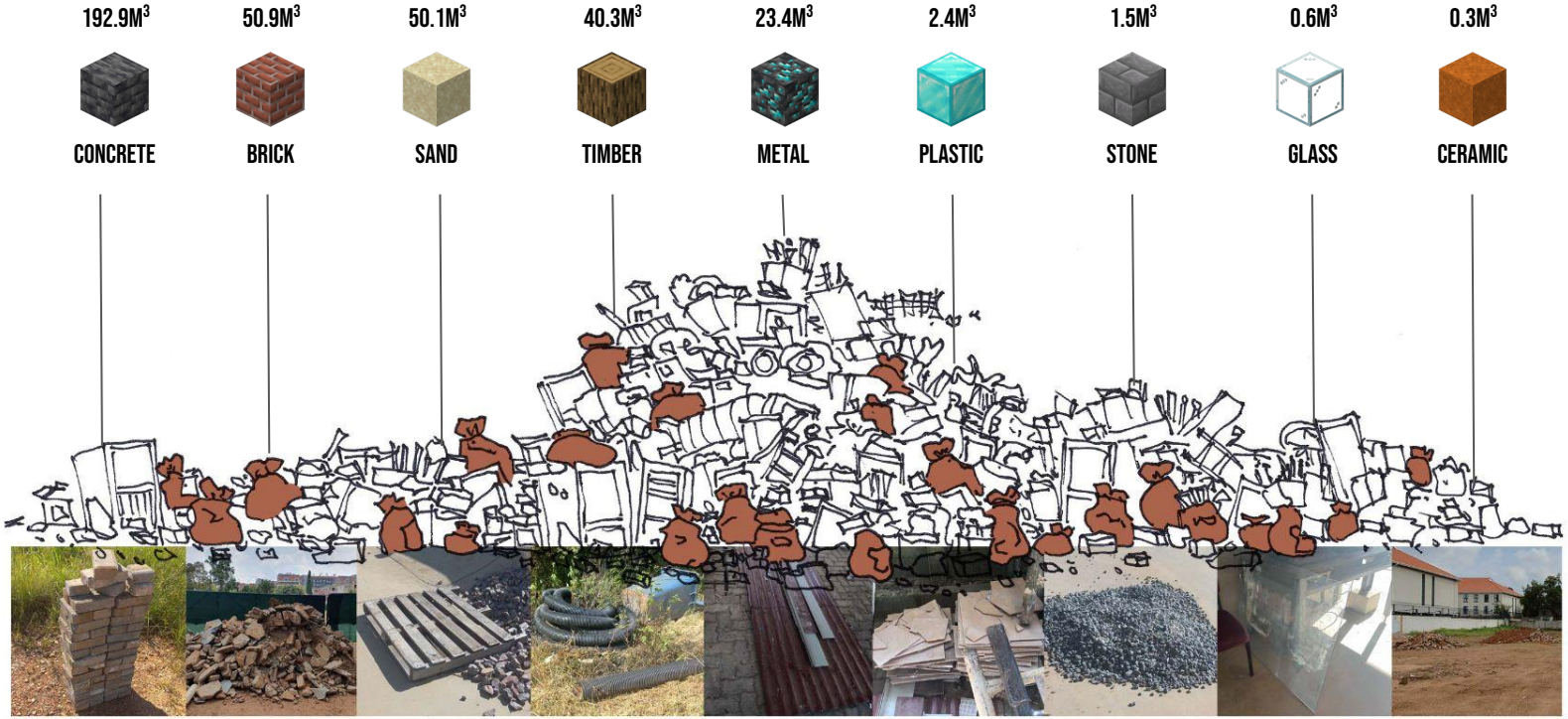

0.3M³ FLOOR TILES, TOILETS, HAND WASH BASINS, ROOF TILES,


1.5M³ VARIETY OF DIAMETERS OF STONE AGGREGATE


0.6M³ WHOLE SHEETS & BROKEN PIECES

SURVEY DATA

APWC, 2020
SIBISI, 2023
TAYLOR, 2023



"WASTE, EXCLUDING HAZARDOUS WASTE, PRODUCED DURING THE CONSTRUCTION, ALTERATION, REPAIR OR DEMOLITION OF ANY STRUCTURE, AND INCLUDES RUBBLE, EARTH, ROCK AND WOOD DISPLACED DURING THAT CONSTRUCTION, ALTERATION, REPAIR OR DEMOLITION."
(DEPARTMENT OF ENVIRONMENTAL AFFAIRS, 2012)

Reframe Real-World Problems

Heritage & Circularity Opportunities

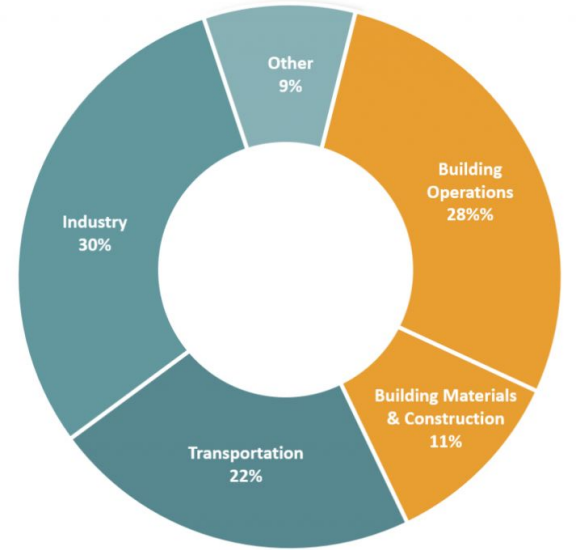
TAYLOR, 2023
GOVENDER, 2023
MINECRAFT, 2023


Wait a minute,
BIM and Digital Twins are simply the vehicles to create a
Circular Built Environment

Before we Tech,
we need Culture.

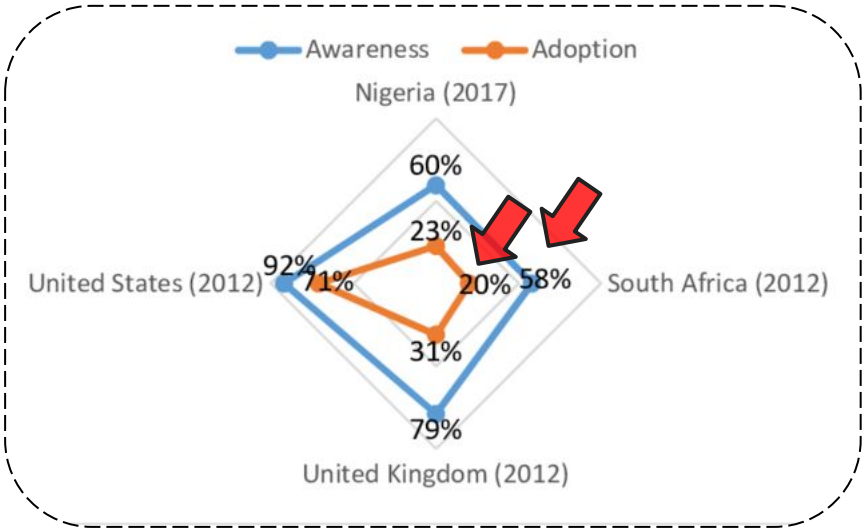
How are we actually going to do this... for realsies?

Unsustainability of the built environment



(United Nations Environment Programme, 2022)

Uptake of digitalization (BIM) in Africa



(Hamma-adama et al, 2018: p 5)

!

We know... we are very bad

?

State of Built Environment Digital Work Culture in Africa

Why we start with

Culture before we start with **Technology**

What culture should we change?

The culture of division
Untouchable experts in siloes

→ **All BE projects are transdisciplinary.**
We *must* work together, no matter where we are from.

The culture of disrespect
I don't need to know or care about your efforts or needs.

→ **We create too much nonsense**.
Most of the built environment *work* effort is simply *wasted* effort.

The culture of ignorance
My Work *vs* Your Work

→ **Our work is one holistic ecosystem**
Our Work - a holistic perspective of value.

The culture of inward focused, short-term pursuits
Task / completion focussed outcomes

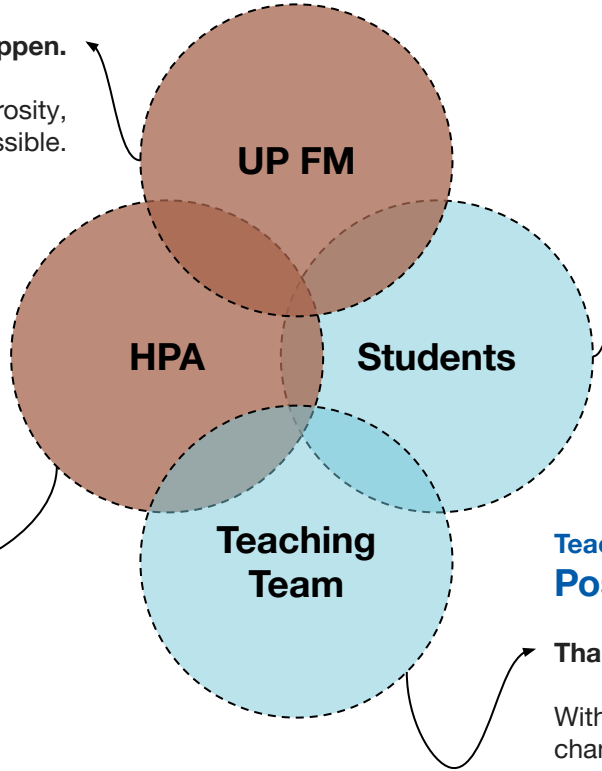
→ **Built environment projects lasts for centuries**
Service-focus for others and for the future

Owners Perspective

UP Facilities Management

Thank you for allowing this to happen.

Without owner generosity,
cross-sectional value-production is not possible.



Learner Perspective

EBIT Students

Thank you for open mindedness.

Without your creativity and enthusiasm, the development of new skills and learning can't happen.

Consultant Perspective

HPA Architects

Thank you for allowing this to happen.

Without consultant generosity,
transdisciplinary learning cannot happen.

Teacher Perspective

Postgraduate Faculty

Thank you for leadership

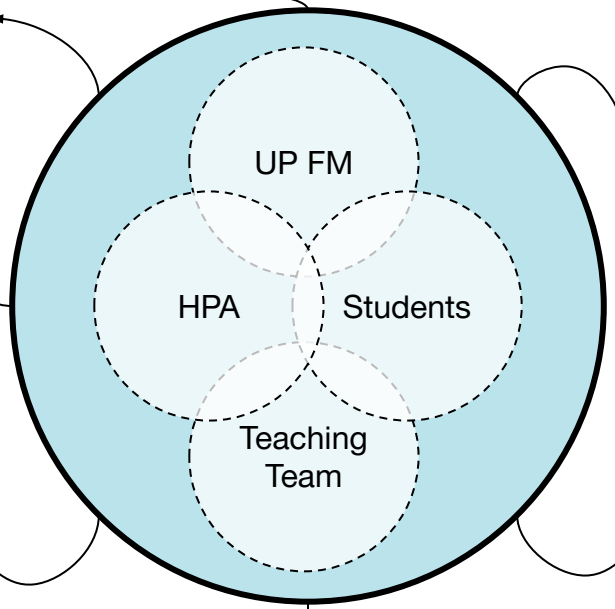
Without your active collaboration in the open, change can't happen

We commit to
work openly, work collaboratively, work with varieties of perspectives and professions

We seek
long-term impacts using BIM

We develop new skills by
cross-skilling from each other

We create
a safe-to-fail environment



We grow by
learning through action

We cultivate
a experimentation mindset

We demonstrate
leadership through behaviour

Professional Team in training

i.e.“students”

My Work *vs* **Our Work**
i.e. transdisciplinary learning

Project objectives

PROJECT OBJECTIVES: (a) Proof of economic sense
(b) HBIM for de/re construction – potential case study

(a) Proof of economic sense:

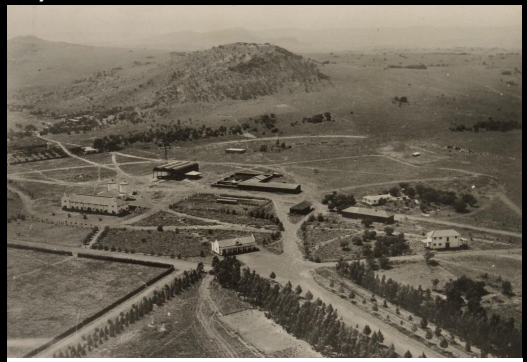
Undisputed proof to clients - up to 40% saving incurred through 'restoration, repair & refurbish' versus 'demolish & new build'.

1. **Madeleine Hotel (Pretorius Street) – ambiance in this wing mean that patrons prefer to stay here**

2. **University of Pretoria Vergeet-My-Nie Residence – insert 16 additional bedroom in existing loft space at 50% of development cost for new-build**

(b) HBIM for de/re construction

1. **UP Innovation Africa @UP (Hillcrest Experimental Farm): Convert Greenhouse 1 to Guard House (as an example)**

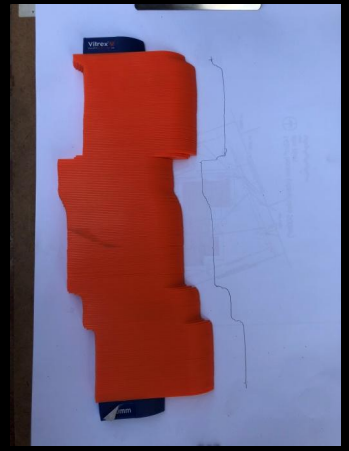


Experimental Farm - Aerial view NW c.1923

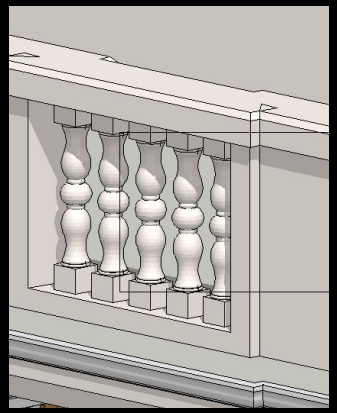
Experimental Farm - Horse Stables & Dairy c.1923

PROJECT OBJECTIVES: Appropriate Technologies & Limitations

Appropriate TOOLS & Technologies - HPA scanned historic buildings since 2009;
Limitations of point cloud scans when converted to CAD lack the accuracy required
IPAD pro LIDAR scanner / POLYCAM was used , combined with the integration of physical & digital tools to achieve the level of accuracy required:

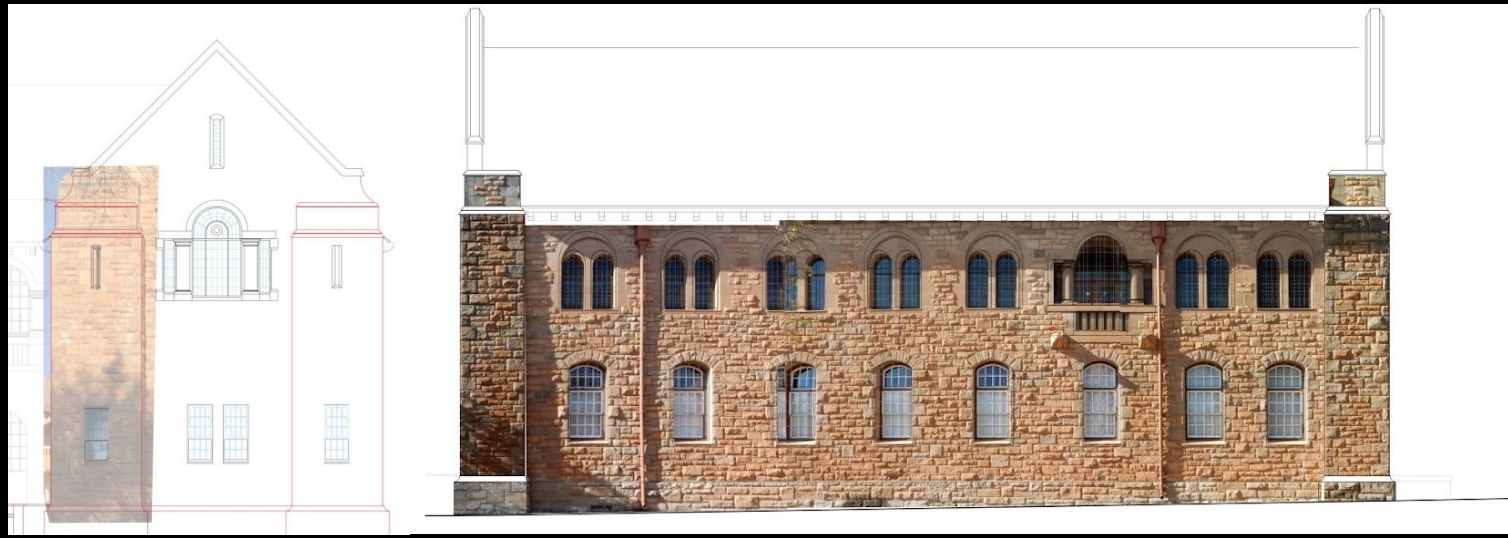


- **Hand-held profiling tool**



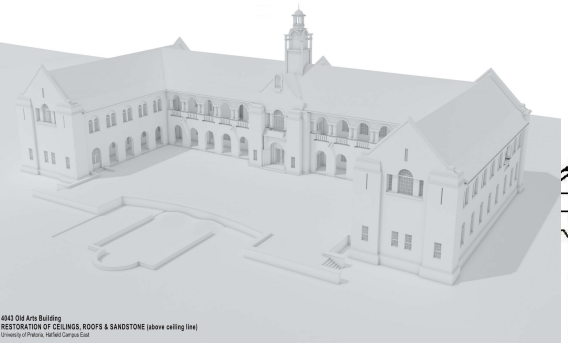
PROJECT OBJECTIVES: Appropriate Technologies & Limitations

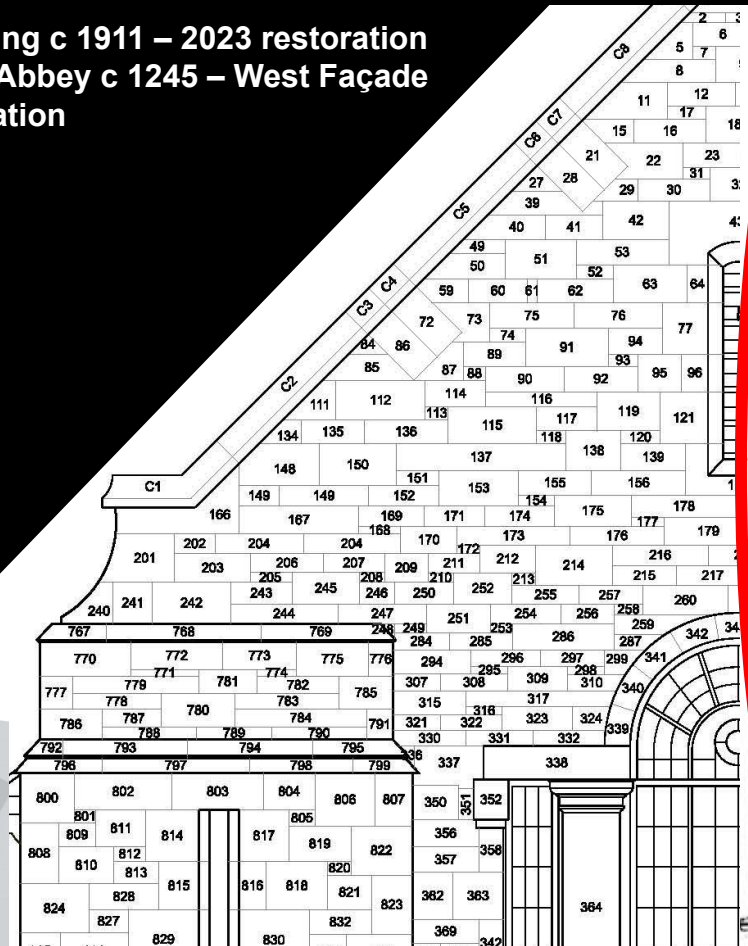
- Using combination of photos & laser measuring device

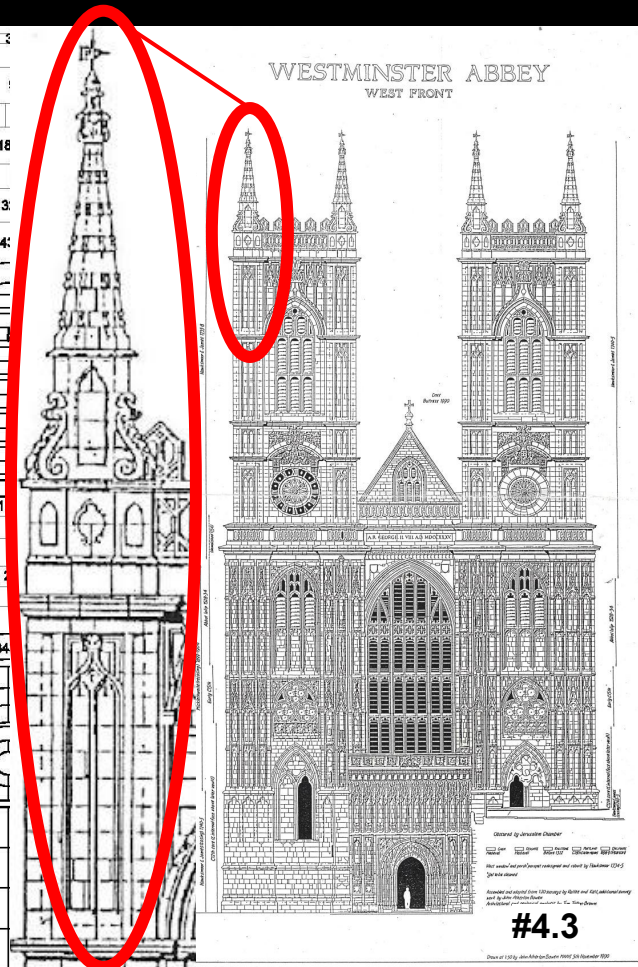


PROJECT OBJECTIVES: Appropriate Technologies & Limitations

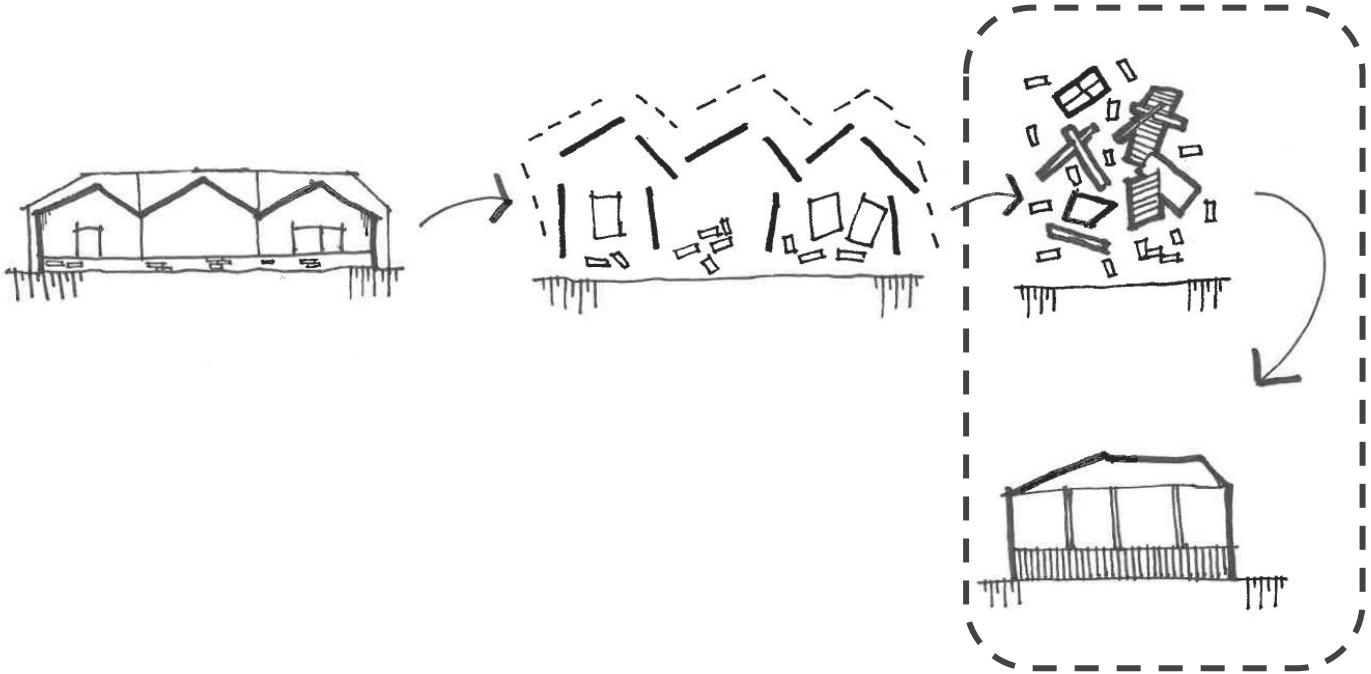
- Stone Mapping of Old Arts Building c 1911 – 2023 restoration
- Stone Mapping of West Minister Abbey c 1245 – West Façade
  1:50 hand drawing - 1990 restoration





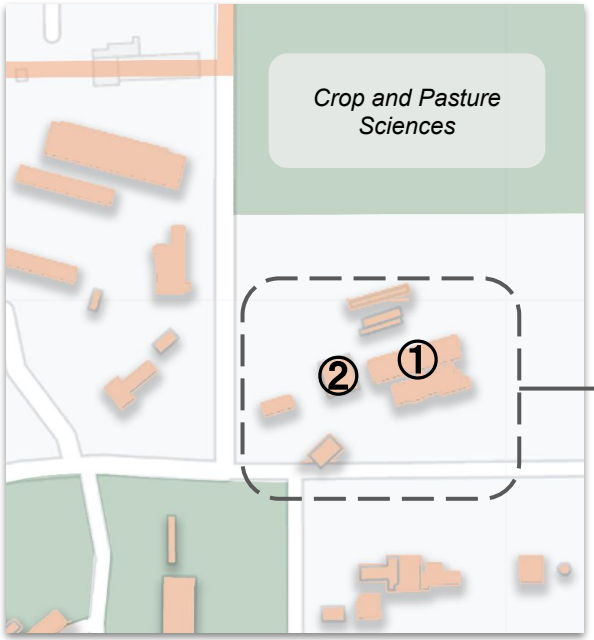


#4.3



Methods and Technologies

Micro site and context: where is our research situated?



UP Innovation Africa, Hatfield
-25.7507, 28.2561

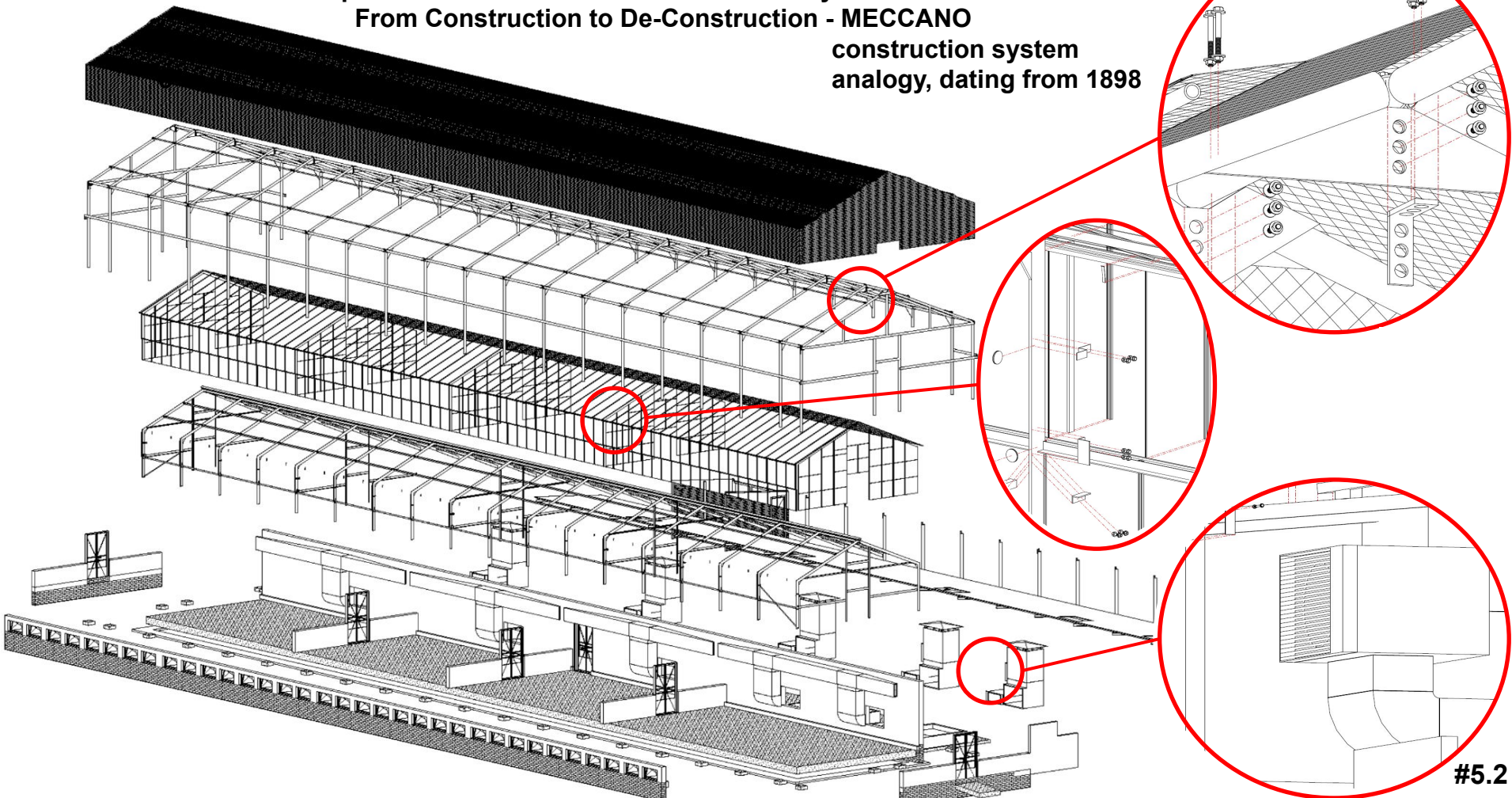
0 1 2 5 10
[scale] 1:50 000

Adapted: (Open Street Maps, 2023)

RESULTS from an Industry Perspective: (a) Unpack the model

Greenhouse 1 – NE view

Greenhouse 1 exploded CAD model – with 100% accuracy down to each nut & bolt.
From Construction to De-Construction - MECCANO construction system analogy, dating from 1898



RESULTS from an Industry Perspective: (b) Unpack the value / learnings

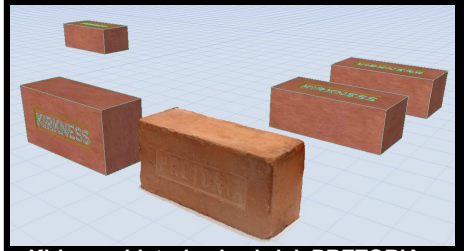
IPAD Pro 12.9- inch
6th Generation

Application (APP)

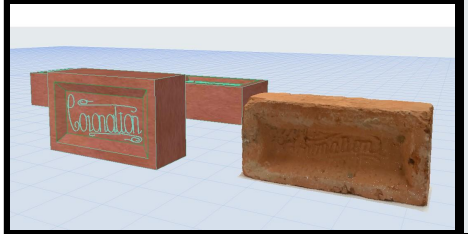
polycam

Learnings:

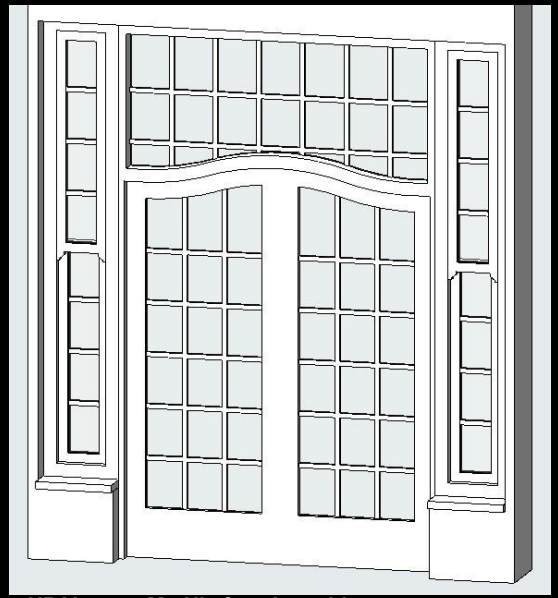
2. Scanning as a sole means of recording is not sufficient to produce the level of accuracy & detail required.
2. Point Cloud Data cannot be 100% accurately translated into any CAD model.
3. Accuracy required to capture complex historic fabric require accuracy to the millimetre. ***(5mm discrepancy over 100m = 500mm)
4. HPA also in the process to compile a 3D library of historic fabric



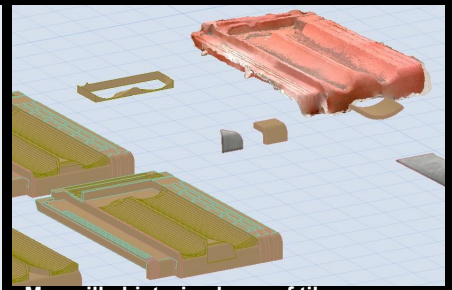
Kirkness historic clay brick PRETORIA (est 1888) - quarry @ UP Groenkloof Campus)



Coronation historic clay bricks DURBAN (est 1902 @ coronation of Edward VII)



UP Vergeet-My-Nie female residence – door to archive



Marseille historic clay roof tile (various models)

Pta City Hall Historic Kirkness clay roof tile

#5.3

RESULTS from an Industry Perspective: (c) Unpack the opportunities in SA

Skills Transfer & Development reporting as part of project roll-out

- To achieve BEE accreditation through the recording of

- Hours spent on skills transfer during project roll-out
- Monetary value associated with time spent to do on-the-job skills transfer
- Reporting by staff that benefitted from the skills transfer process
- There is a specific protocol to compile a BEE report that will be accompanied by an affidavit signed by all parties involved

Land survey

3D scanning

Health and Safety

HPA / FlowCentric / Austal Technologies Collaboration:

Developing a consolidated, integrated full lifecycle management system in the built environment with a Single Platform & ability to integrate any existing system (SAPS / Sage / SharePoint / ORACLE / Microsoft)

- Gain full insight into any piece of real estate from Inception - Planning – Construction - FM - Flexibility for future use
- Manage & save costs through a user-friendly & intuitive interface (minimal training required)
- System will reject incorrect procurement protocols & abortive costs associated with incorrect repairs & maintenance outcomes (check photo with AI)
- Digital Twin will do real-time monitoring of all building assets - heat pumps / HVAC / electricity / water / fire & safety/ drainage & storm water / IT / GAS / security / access control / waste disposal & recycling

hpa · architects & · heritage architects

FlowCentric Technologies

#5.4

AUSTAL

POSTGRAD RESEARCH 2023

BIM FOR CIRCULARITY & DE/RE-CONSTRUCTION

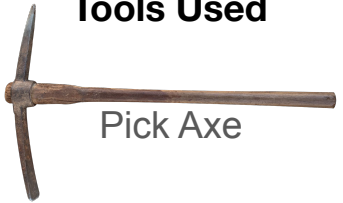
Condition Assessment

Using new tools

Determining structure

Analysing elements

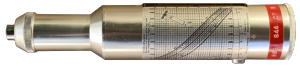
Tools Used



Pick Axe

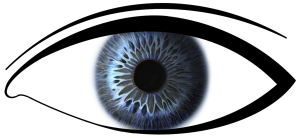
Shovel

Steel Rod



Schmidt Hammer

Measuring Tape



Our Eyes

Site Visit- 05/05/2023

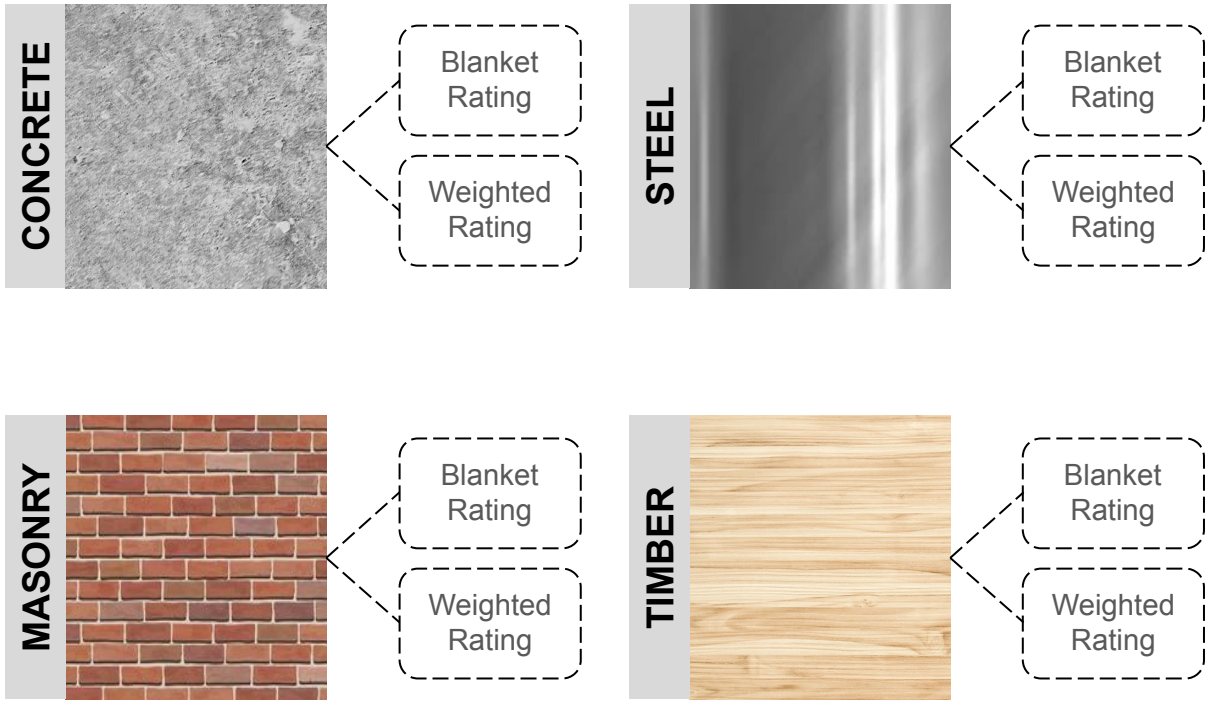
DATA COLLECTION

Department of Civil Engineering

Department of Architecture

CONDITION RATING	CONDITION	ACTION REQ'D
5	Very Good	Planned Preventative Maintenance
4	Good	Condition-based Maintenance
3	Fair	Repairs
2	Bad	Rehabilitation
1	Very Bad	Replacement

(Abbott et al., 2007, pp. 352)



Preliminary structural & material assessment


Architecture
Structural Engineering
Construction Economics
Civil Engineering
Quantity Surveying
Industry Partners
City of Tshwane
Public Sector
UP Facilities
Private Sector
Hatfield CID
Service Sector

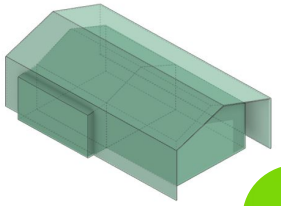
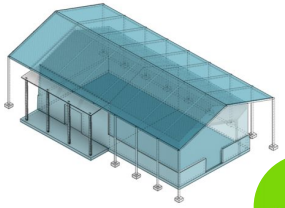

Architec-
ture
Civils +
Structural
Quantity
Surveying
Geography
Cities
Owners
Organiza-
tions
Industry
Partners

Results and Outcomes

Educator Perspective

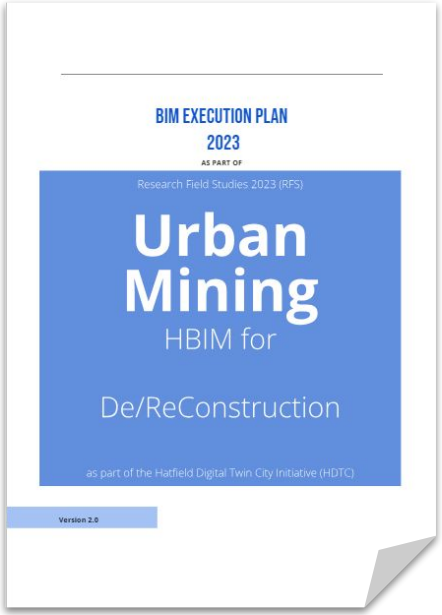
Creating **Intelligence** requires... **Intelligence**

Where are we in **BIM INFO GATHERING**

	LOD100	LOD200	LOD300
			
BIM	Info&Schedules : Material types and qualities	Info&Schedules : Material types And elevation component classification	Info&Schedules : Material types And elevation material classification on exterior and interior
MODEL	Model :Basic Block model	Model :Model elevations to be detailed on exterior	Model :Model elevations to be detailed on exterior and interior and LiDAR

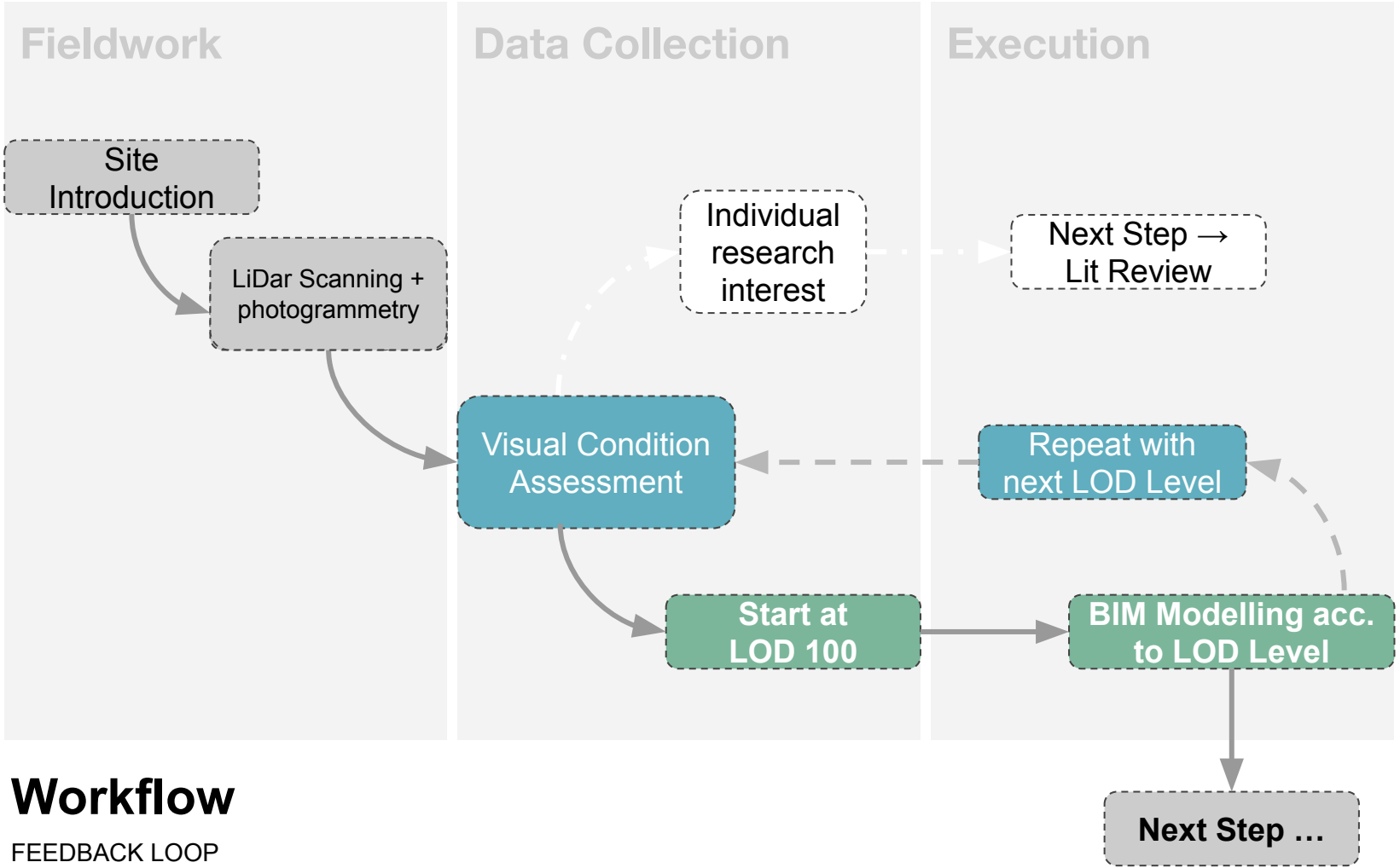
BIM Execution Plan (BEP) - 1st draft

It is a **foundational framework** to ensure **successful deployment** of **advanced design technologies** in **BIM projects**. The BEP is important for **optimizing work and model flow**.



OBJECTIVES

- 2 HBIM Models
  - Greenhouse 1 (✔)
  - Greenhouse 2 (✔)
- Classifications (∞)
  - Heritage
  - Structural
- Update + Mature (∞)
- End Goal
  - Bim Protocol 2.0
  - End of Year
- WIP (∞)



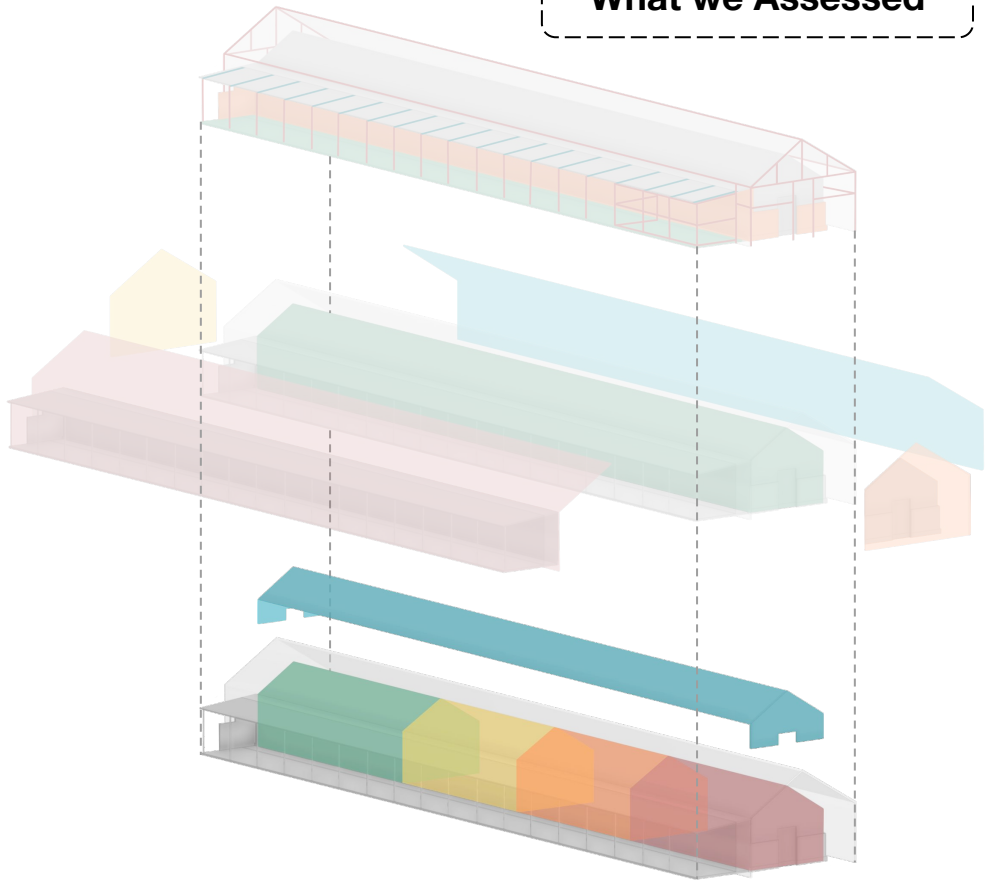
Workflow

FEEDBACK LOOP

LOD 300 - elemental

What we Assessed

Item	Concrete	Steel	Masonry	Timber
GH1_R1_FL	3 (3.3)	-	-	-
GH1_R1_…				

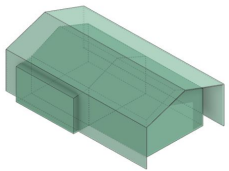


LOD 100
LOD 200
LOD 300
LOD 400
LOD 500

LOD Insights

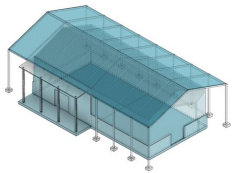
LOD100

	Material	Blanket	Weighted
GH1	Steel	3.0	3.1
	Concrete	3.0	3.5
	Masonry	3.0	2.5
	Timber	2.0	2.0
GH2	Steel	3.0	3.8
	Concrete	3.0	2.8
	Masonry	3.0	3.0
	Timber	2.0	2.5



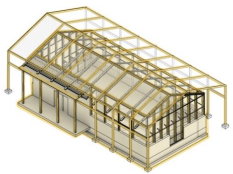
LOD200

	Material	Blanket	Weighted
GH1	Steel	3.2	3.1
	Concrete	3.0	3.1
	Masonry	2.5	2.7
	Timber	2.0	2.0
GH2	Steel	4.2	3.9
	Concrete	2.8	2.7
	Masonry	3.2	3.0
	Timber	2.0	2.0



LOD300

	Material	Blanket	Weighted
GH1	Steel	3.1	3.0
	Concrete	2.9	3.1
	Masonry	2.8	2.8
	Timber	2.0	1.5
GH2	Steel	3.0	3.0
	Concrete	2.7	2.4
	Masonry	3.6	3.6
	Timber	2.3	2.5

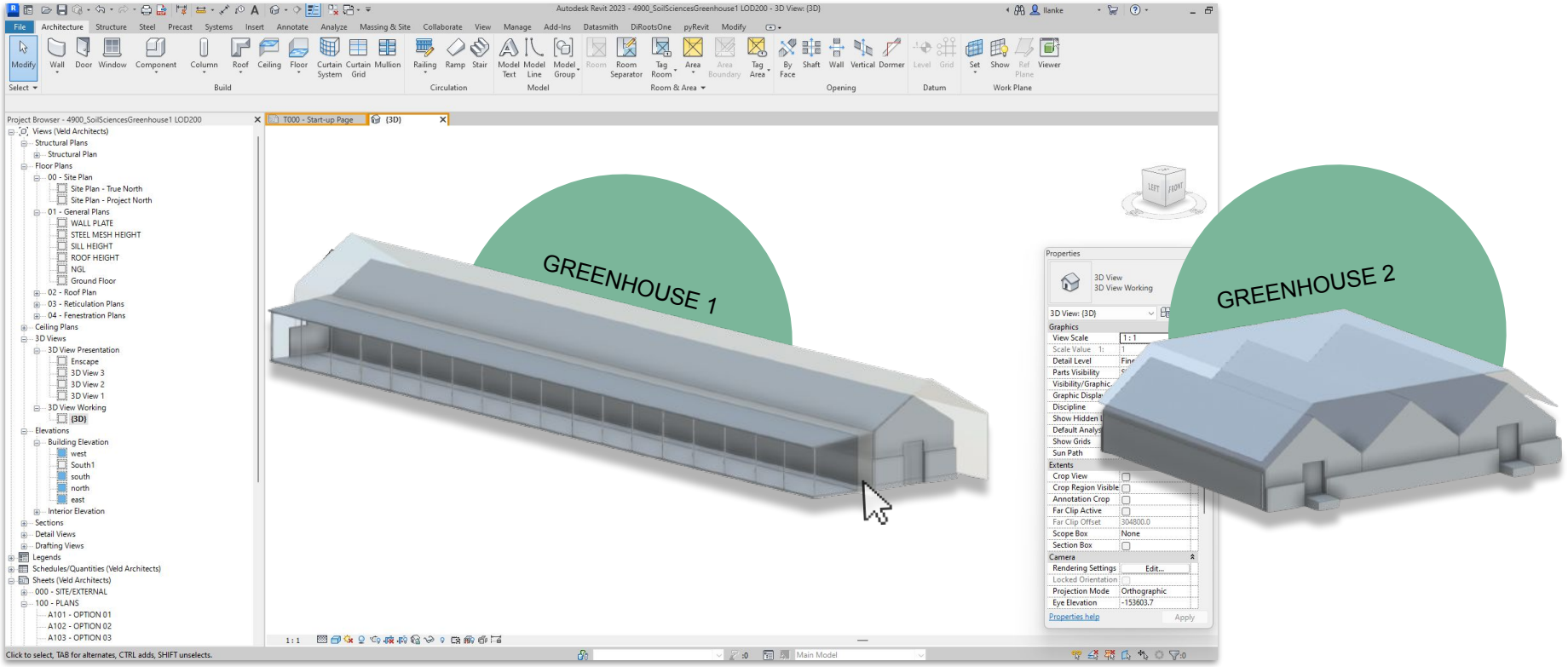


Honors Student Research Exhibition

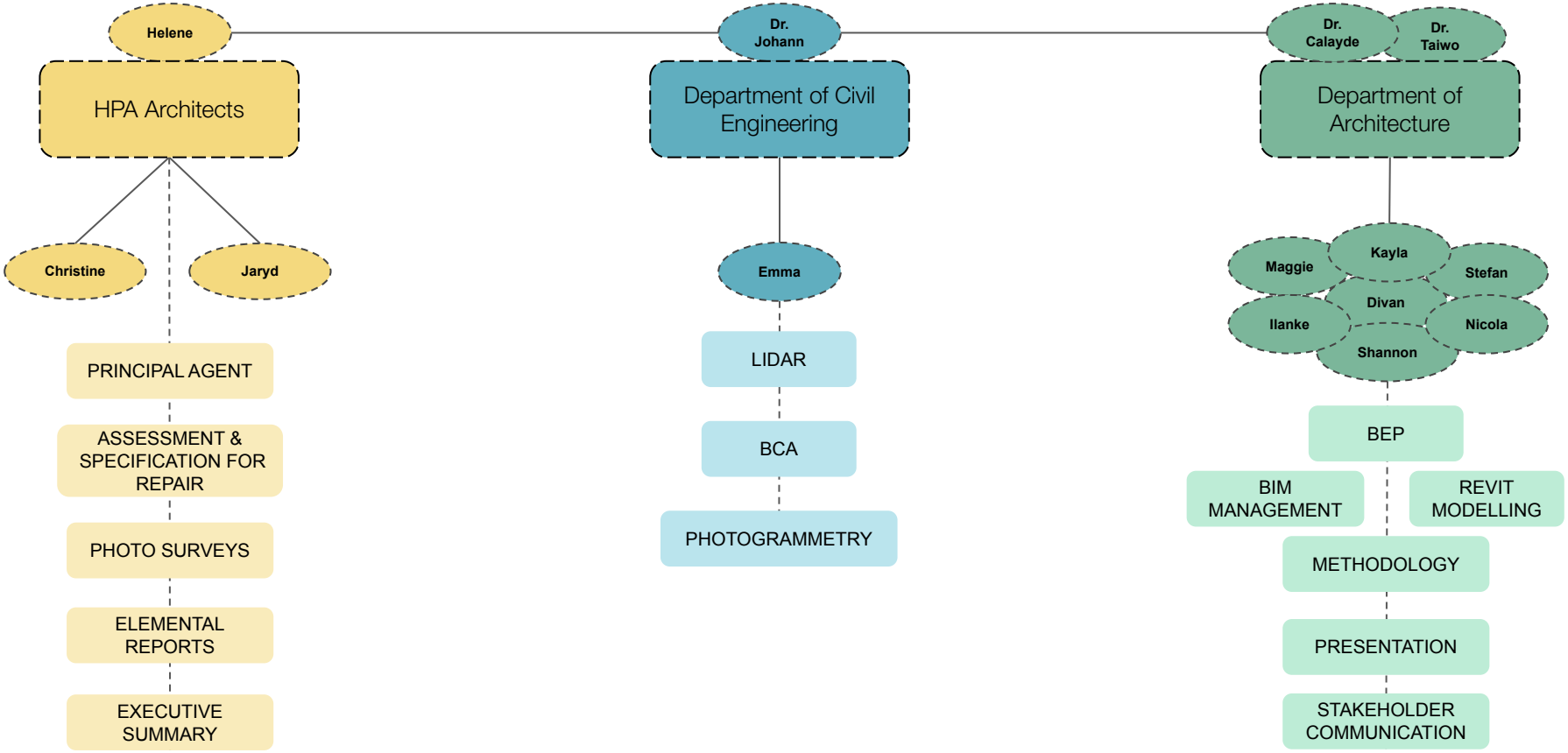
Arch, QS, Engineering Joint Effort


THURSDAY 27 JULY 2023
BIM Harambee 2024+
Student & Young Professional Conference…?

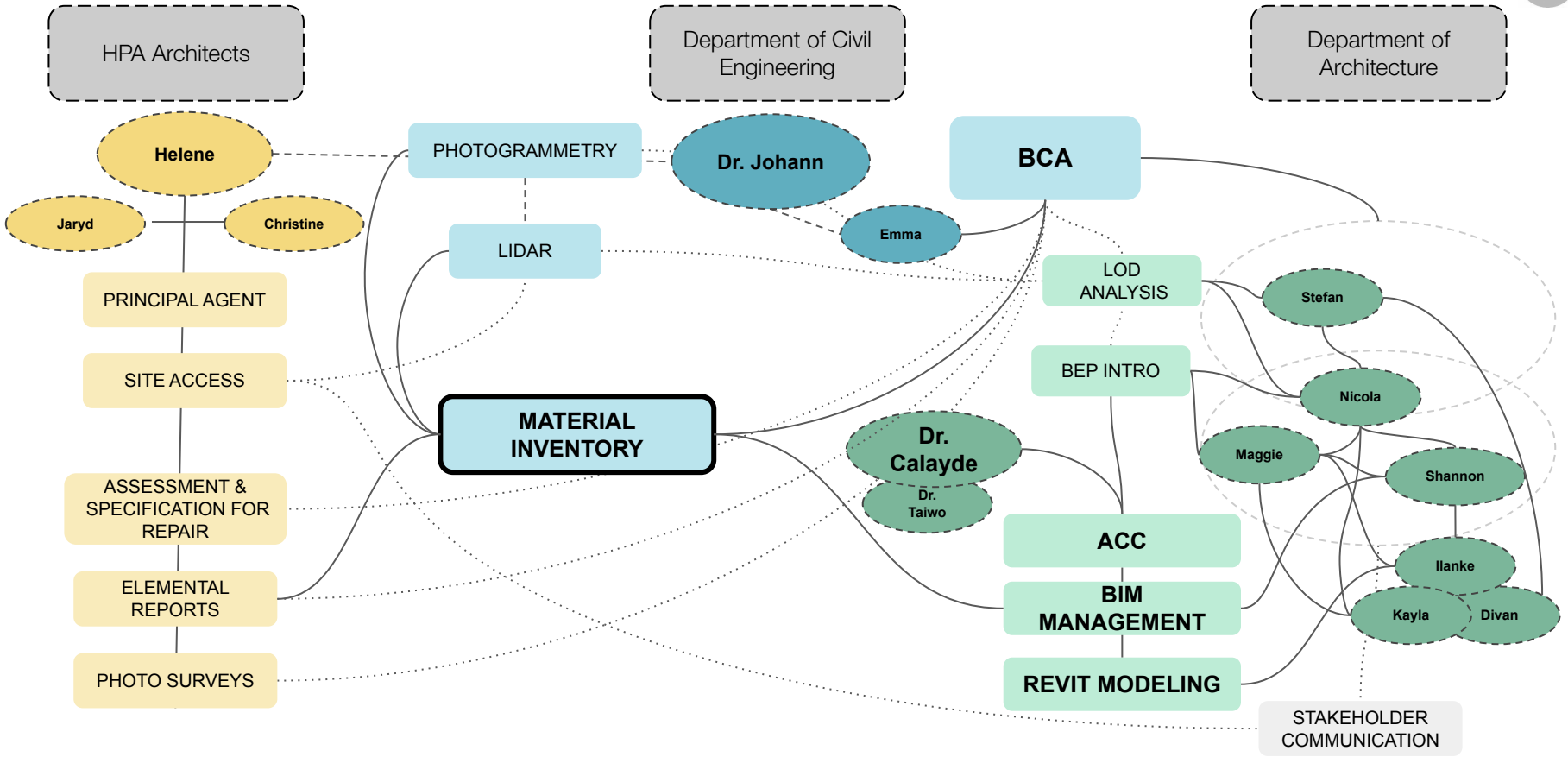
Project, Tools, and Models **change**. So too, do our **roles**.



Start: Task & Role Allocation Network



Current: Task & Role Allocation Network



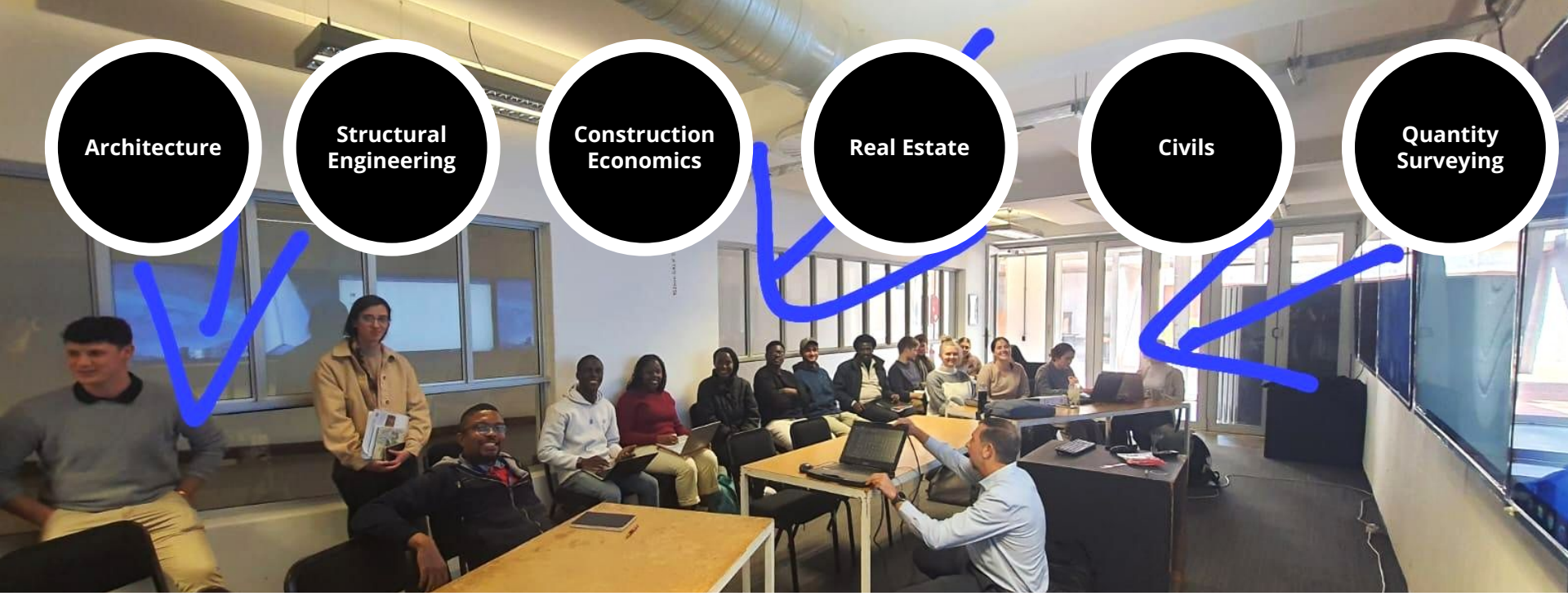
BIM workflows creates shared multi-stakeholder value

RFS 701

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

UPFM

	HPA Architects	Department of Civil Engineering	Department of Architecture
Contribution	➔ Elemental Reports ➔ Assessment & spec. for repair ➔ Photo surveys ➔ Executive summary ➔ Site Access	➔ BCA ➔ LiDAR, Photogrammetry & Point cloud ➔ On site material testing	➔ BIM Execution Plan assessment & revision ➔ Revit Modelling ➔ BIM Management ➔ Stakeholder Communication
Learning Opportunities	➔ Initiative collaboration between institutions and the workplace ➔ Student teacher pedagogy	➔ Material Assessment/quantity Learning opportunities ➔ Communication education ➔ LCA comparison/assessments	➔ Autodesk education ➔ LinkedIn Learning ➔ On site collaboration
Working Relationship & Fields of Interest	➔ Heritage condition analysis on buildings on campus ➔ Expansion and future developments and conservation	➔ Structural Engineering focus on material assessment ➔ Circular Economy & End-of-Life structural deconstruction	➔ Collaboration with AEC Parties for particular interest alignment
Value & Aim	➔ Lots of value! Improves internal processes, digitization learning, reduces costs, long-term value for clients (repeat business)	➔ Lots of value! Learning about BIM from architects, and qs! Better buildings and time spent on the “right work” not the “busy work”	➔ Lots of value! Learning about projects from engineer, and qs! Time spent on the “right work” not the “busy work”



Students *want* to work together.

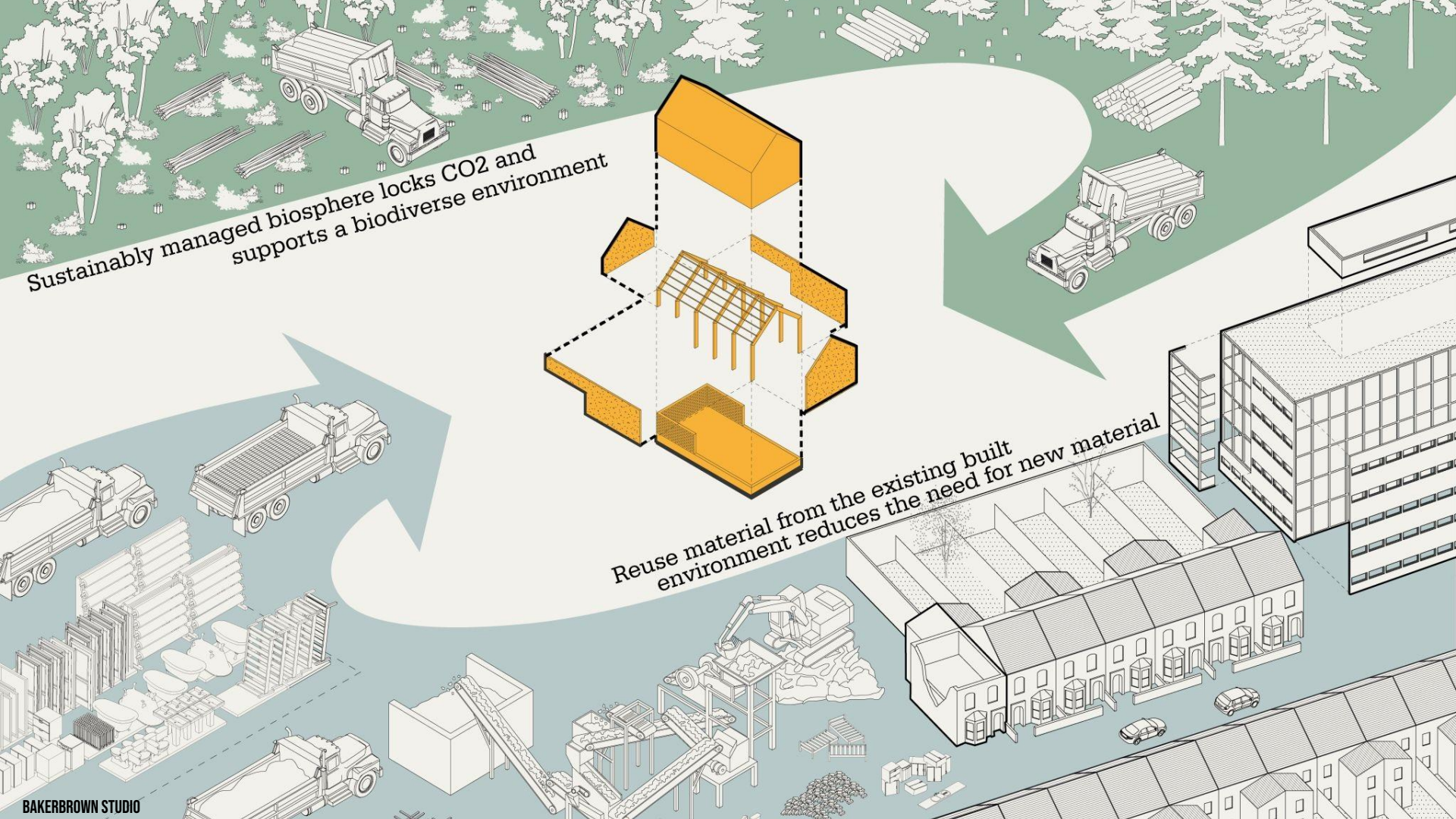
Allow them to shine by *letting* them work together to figure it out together.

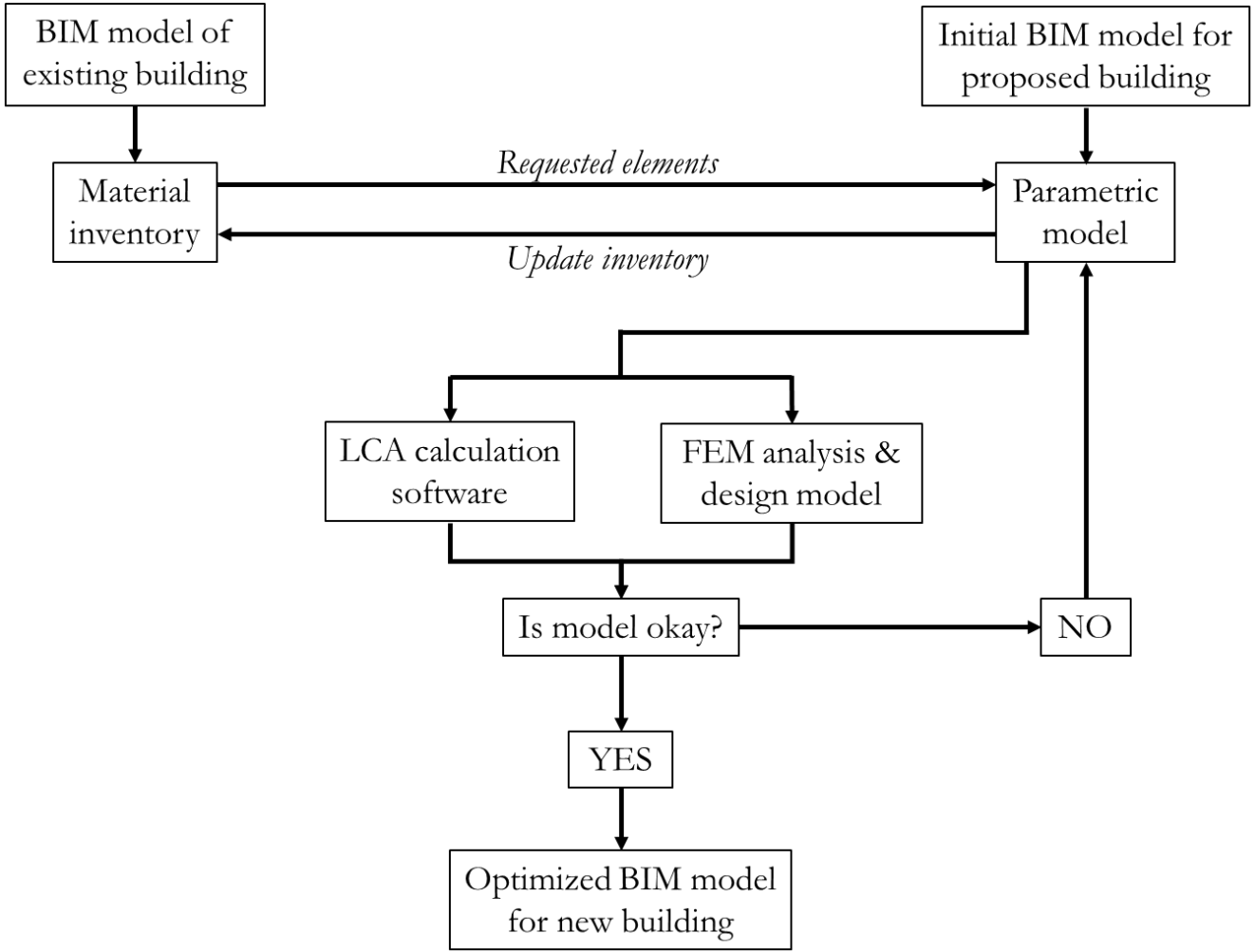
QS's & Engineers teaching Arch students fundamentals

! ! Volunteers ! !

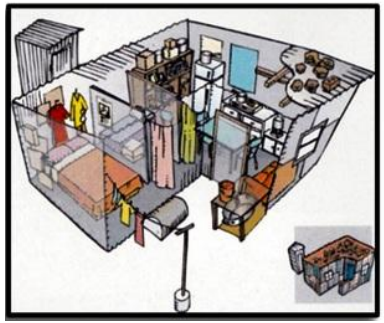
cross-skilling in flipped classroom

Reflection


Sustainably managed biosphere locks CO2 and supports a biodiverse environment
Reuse material from the existing built environment reduces the need for new material
BAKERBROWN STUDIO


BIM model of existing building
Initial BIM model for proposed building
Material inventory
Requested elements
Update inventory
Parametric model
LCA calculation software
FEM analysis & design model
Is model okay?
NO
YES
Optimized BIM model for new building

Typical Township Informal Dwelling



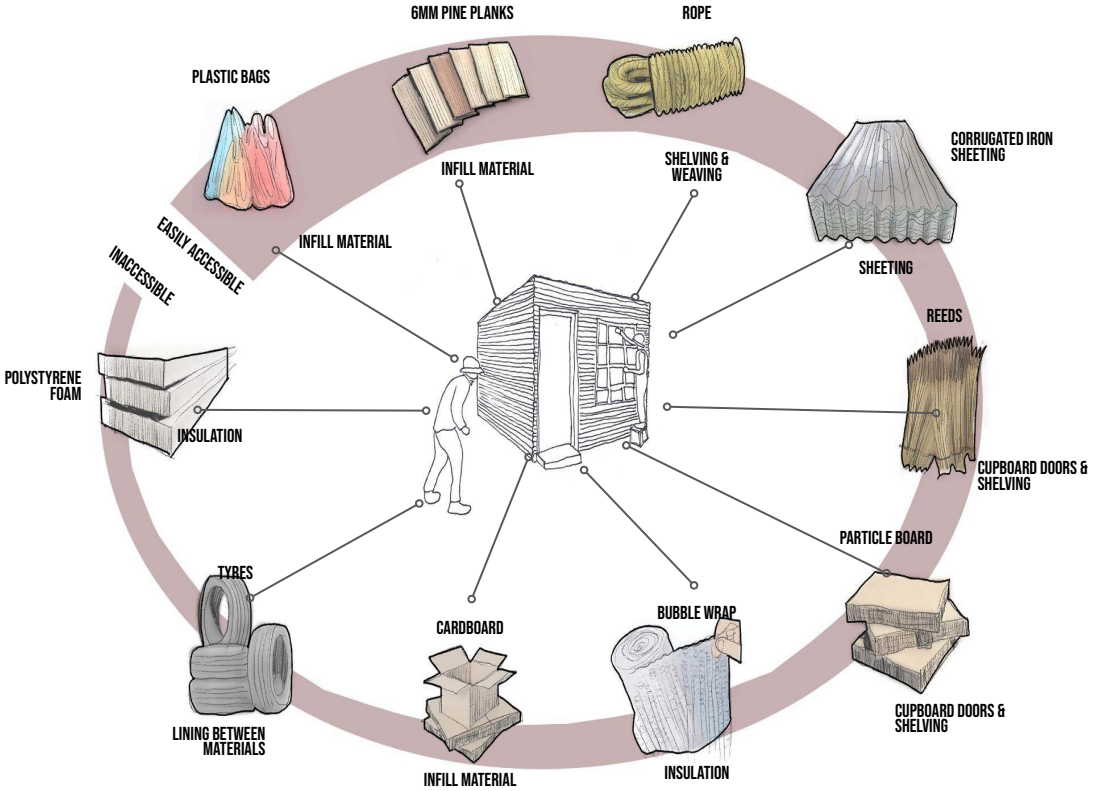
- No electricity
- Pit latrine
- Communal tap for water
- One or 2 rooms
- IBR/zinc walls and roof
- High unemployment
- isiZulu, IsiXhosa, South Sotho language groups

HOW CAN WE CONTRIBUTE TO HEALTH, SAFETY AND SECURITY OF THESE CASES ?

- THE WAY WE BUILD
- THE WAY WE USE MATERIAL
- IMPROVE INFRASTRUCTURE TECHNOLOGY

HOW CAN WE LEARN FROM REUSE IN THESE CASES ?

- REDUCING BY USING MATERIAL THAT IS ACCESSIBLE
- THINKING OF HOW WE CAN BUILD IN A COMMUNAL WAY IN THE CITY



LESSONS FROM INFORMALITY

GOVENDER, 2023
GREEFF, 2005
TAYLOR, 2023

REFLECTION – analogy of the BOTTEGA (15th -16th Century Renaissance)
The 21st Century Digital Eco System is our global modern-day Bottega

Bottega is the Renaissance term for workshop where young artists learned skills through the 'learning by doing' method

Skills transfer & development

The master was paired with his students, working together on projects

Interns

Learning by doing generated collective knowledge, with the Bottega as a space for creativity

Architecture as a creative profession is poised to find solutions for current problems eg sustainability

#6.1

19th century architect's studio:
Antonio Gaudi - Barcelona

*Conclusion:
The migration
from analogue
to digital
in the HBIM
environment
is work
in
progress…

21th century architect's studio:
Foster + Partners - London

#6.2


Social
Physical
Digital
Work in Complexity
Common Ground
Share Reality
Team work
Complex Problem-solving
Cross-skilling
Effective
21st Century Society
shared realities
Adaptable
21st Century Society
human talent

The digital ecosystem is our

21st Century Bottega

BIMHarambee 2023

Survey

BIM Harambee .Africa

POPIA

THIS SESSION IS BEING RECORDED