
# Overview

MY BACKGROUND
- Pre academia
- Academic roles
- Non academic roles (internal and external)

CHALLENGES AND SOLUTIONS
- Clients and developers; projects and programs
- Focus on major influencers
- Adoption of new technologies
- Change and collaboration
- Structure and behavior


WESTERN SYDNEY
UNIVERSITY
MY
BACKGROUND
Prof Kerry London
2019 CANBERRA AUSTRALIA


chains…clusters
networks
journey
From Katherine Gorge to Federation Square and beyond
Northern Territory Government


WESTERN SYDNEY
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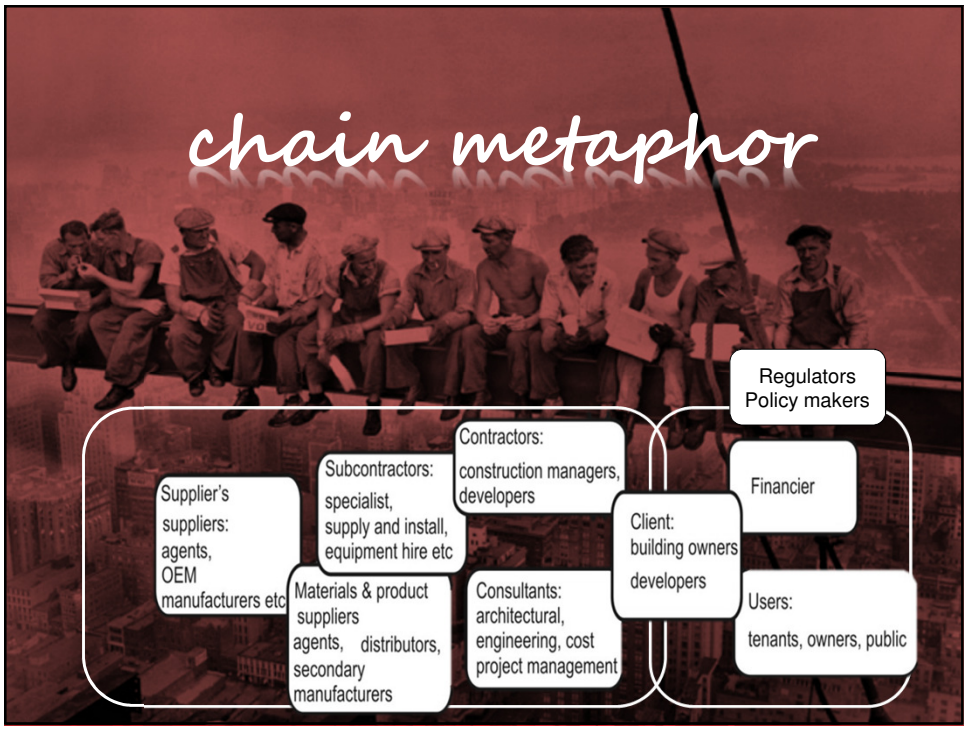
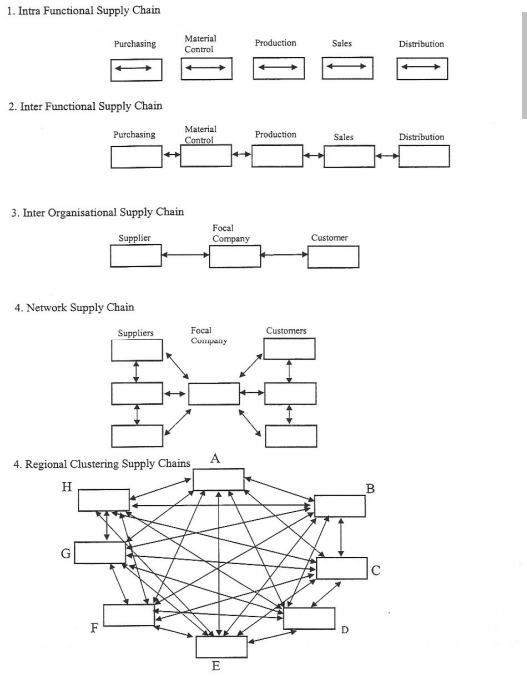
SUPPLY CHAIN LENS
CLIENT AND
MARKET LEADERS
Prof Kerry London
2019 CANBERRA AUSTRALIA


chain metaphor
Regulators
Policy makers
Contractors:
construction managers,
developers
Subcontractors:
specialist,
supply and install,
equipment hire etc
Supplier's
suppliers:
agents,
OEM
manufacturers etc
Financier
Client:
building owners
developers
Materials & product
suppliers
agents, distributors,
secondary
manufacturers
Consultants:
architectural,
engineering, cost
project management
Users:
tenants, owners, public

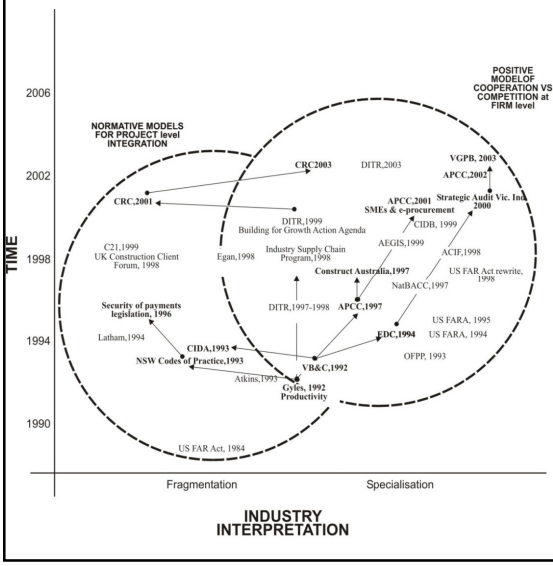



# Ways of looking at the chain

- 5 different levels
- Network and Regional Clustering modelling and research is difficult

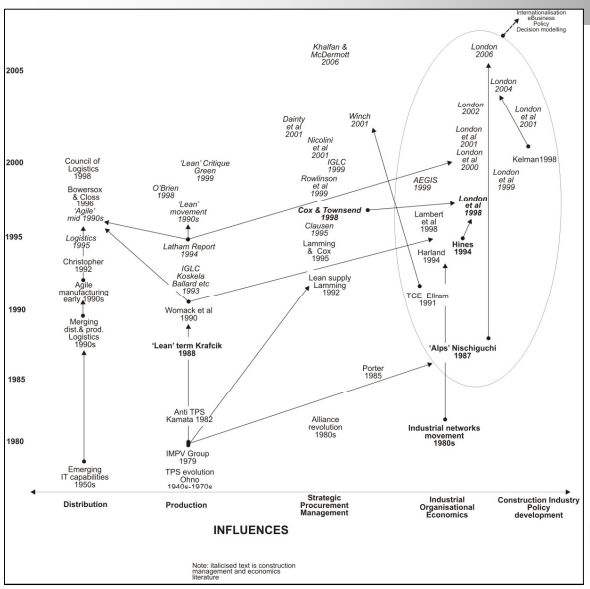
## Policy analysis

### International emergence of a Government call to action



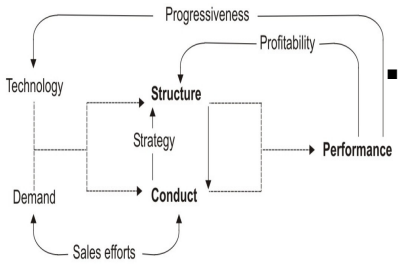

- 1990-2005
- 5 countries: Singapore, UK, US, South Africa, Australia
- Emerging awareness
- Industry was interpreted as fragmented and a problem or specialized and within the context of cooperation/competition
- Normative vs **Positive**

## SUPPLY CHAIN THEORY AND PRACTICE



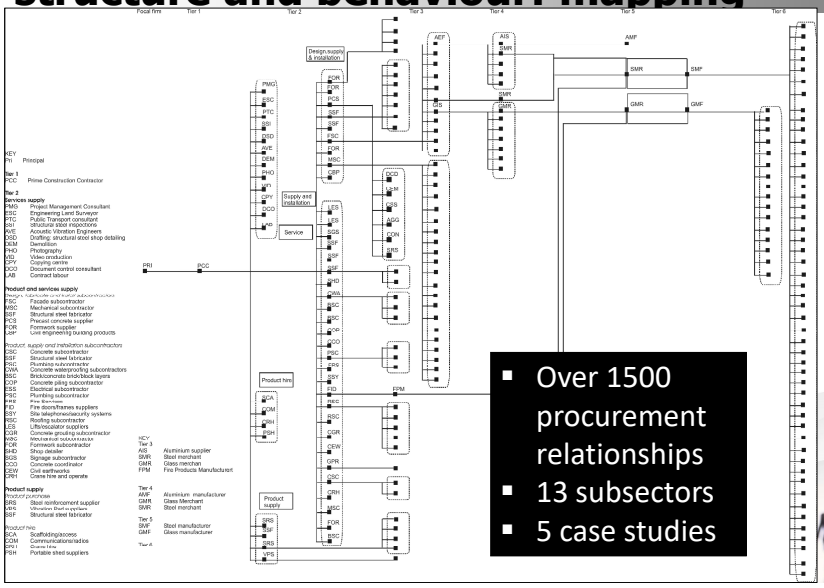

- 1980-2005
- 4 themes
- Distribution, production, strategic procurement management, industrial organizational economics
- Construction lack of research in IO ie networks and clusters

## Cross disciplinary conceptual model




- IO model: Structure Conduct Performance model; structural and behavioural characteristics
- Structure of an industry and conduct of firms interact (strategy) to produce firm and industry performance characteristics; performance produces profitability and can in turn influence structure (ie size & market dominance) and progressiveness towards technology which will in turn influence demand
- Government intervenes to regulate and/or influence structure, conduct, demand etc

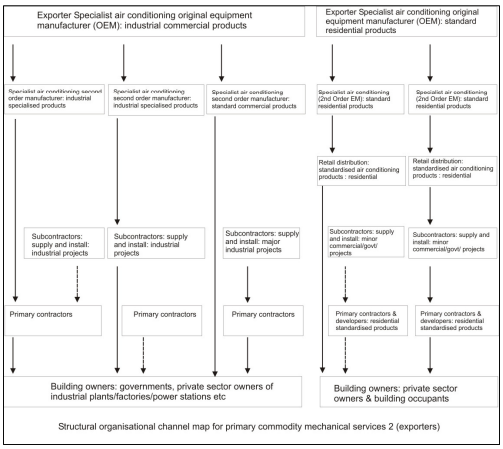
## SUPPLY CHAIN PROCUREMENT structure and behaviour: mapping



- Over 1500 procurement relationships
- 13 subsectors
- 5 case studies

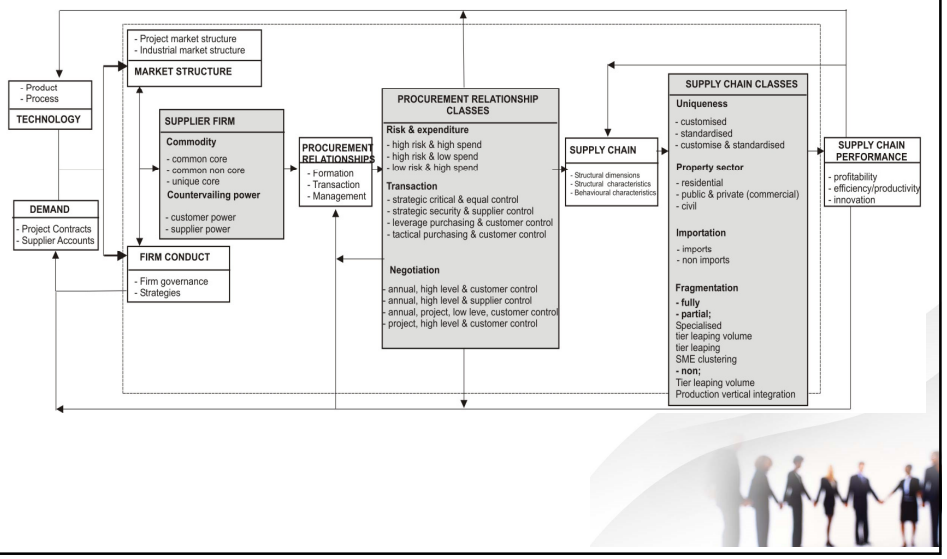
## SUPPLY CHAIN SECTOR AGGREGATED MAPS

moving from positive to normative model

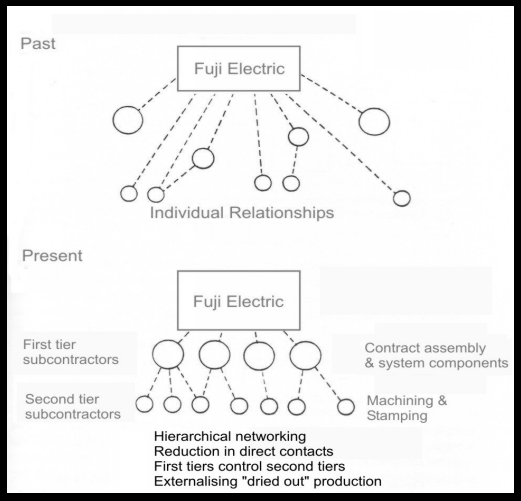



- Where is market power?
- At what tier?
- How can we catalyse change?
- Where is the risk?
- Where are we using power?
- Where are we relying upon influence?
- Change for efficiency, innovation and/or productivity

## SUPPLY CHAIN PROCUREMENT MODELLING normative model …



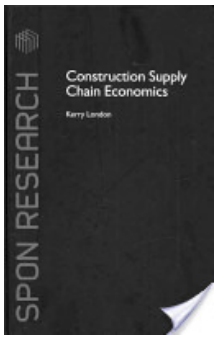

## Toyota Production System

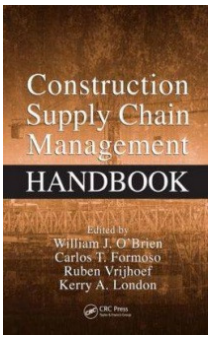



- Womack's *"The Machine that changed the world"*
  Reduce Waste
  Lean Production and Lean Construction [TPS]

  Nischiguchi's *"Strategic Sourcing"*
  Historical economic context; structural reorganization to achieve transformation ie TPS
  Industrial organization economic perspective and clusters and networks

## SUPPLY CHAIN PUBLICATIONS
## foundational principles




## 20 YEARS RESEARCH PORTFOLIO CONNECTED STUDIES

| | | | |
|---|---|---|---|
| SUPPLY CHAIN PROCUREMENT MODELLING | E BUSINESS ADOPTION & BIM DECISION MAKING | SUPPLY CHAIN SUSTAINABILITY | INNOVATION IN HOUSING SUPPLY CHAIN |
| 2000-2005 | 2005-2010 | 2007-2008 | 2009-2010 |
| REDUCING WASTE: SUPPLY CHAIN MANAGEMENT | GLOBALISATION PASSPORT: BIM EDUCATION | OSH SUPPLY CHAINS China/Aus Study | **EFFICIENT CONSTRUCTION: OSM SUPPLY CHAINS** |
| 2010-2012 | 2011-2012 | 2012-2013 | 2014-2019 |
| **RETHINKING HOUSING: DIGITAL COLLABORATION** | STAKEHOLDER MANAGEMENT IN OSM SUPPLY CHAINS | **COLLABORATIVE ROBOTICS IN CONSTRUCTION** | BIM WHS TENDERING |
| 2018-2020 | 2018-2021 | 2018-2019 | 2019-2020 |

Interconnecting **threads**:
supply **chain** theory and practice
**improve** industry or respond to **societal** problems

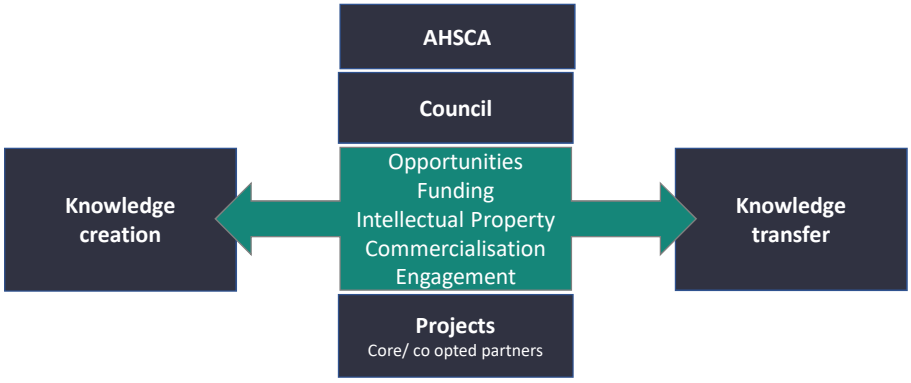
# AHSCA charter

**The Alliance's role is to develop strategies to enable the vision that through rigorous research we shall develop, implement and test defined changes to improve the efficiency, effectiveness and capacity to ensure a sustainable Australian housing industry through:**

**Cultural change and continuous improvement**
**Supply chain management**
**Innovative products and processes**

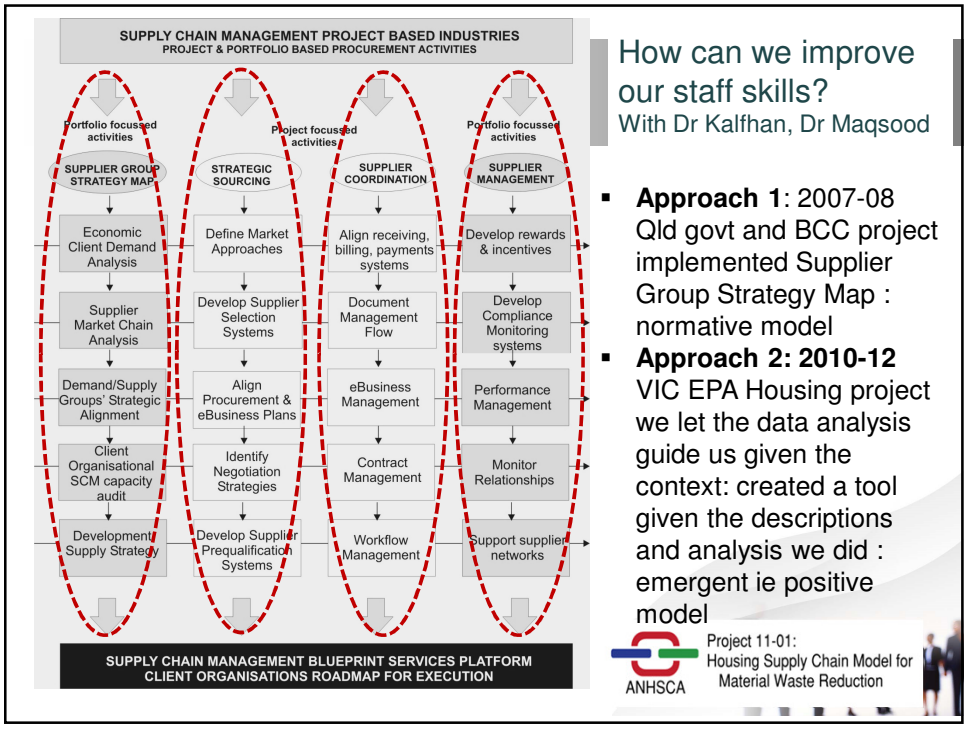
*Frasers, CSR, Boral, MBA, HIA, WSU, Metricon, VBA, FMG Eng*

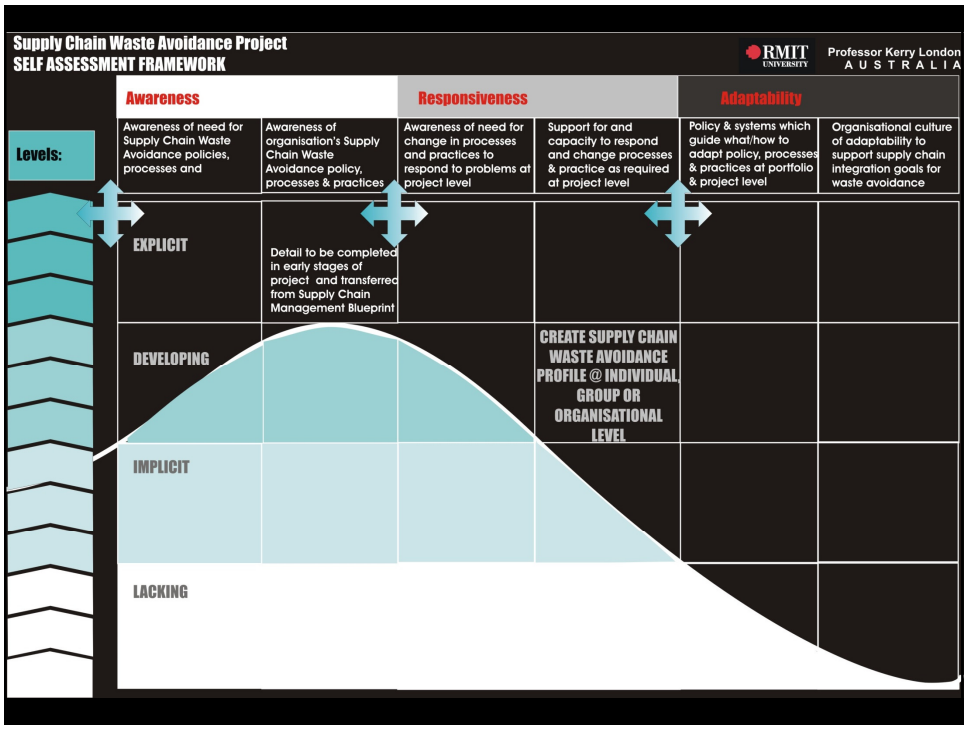
# Who is part of the Alliance?




***CULTURAL AND BEHAVIOURAL CHANGE FOR A MORE EFFICIENT, EFFECTIVE AND ETHICAL INDUSTRY***

BUILT ENVIRONMENT & URBAN TRANSFORMATION:
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

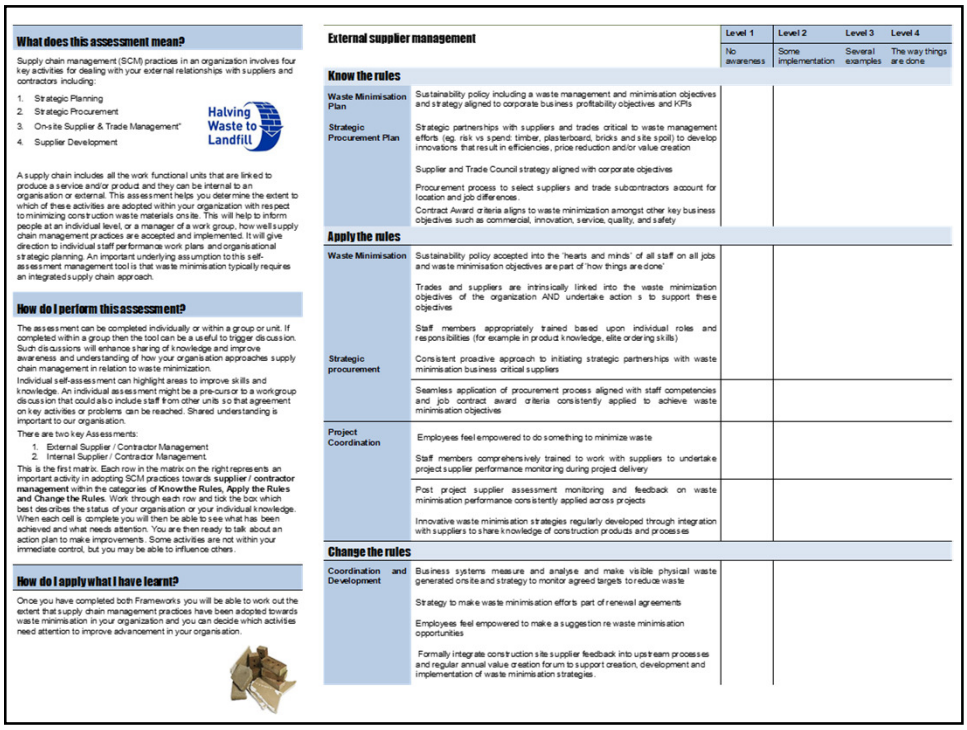

SUPPLY CHAIN MANAGEMENT PROJECT BASED INDUSTRIES
PROJECT & PORTFOLIO BASED PROCUREMENT ACTIVITIES
Portfolio focussed activities
Project focussed activities
Portfolio focussed activities
SUPPLIER GROUP STRATEGY MAP
STRATEGIC SOURCING
SUPPLIER COORDINATION
SUPPLIER MANAGEMENT
Economic Client Demand Analysis
Supplier Market Chain Analysis
Demand/Supply Groups' Strategic Alignment
Client Organisational SCM capacity audit
Development Supply Strategy
Define Market Approaches
Develop Supplier Selection Systems
Align Procurement & eBusiness Plans
Identify Negotiation Strategies
Develop Supplier Prequalification Systems
Align receiving, billing, payments systems
Document Management Flow
eBusiness Management
Contract Management
Workflow Management
Develop rewards & incentives
Develop Compliance Monitoring systems
Performance Management
Monitor Relationships
Support supplier networks
SUPPLY CHAIN MANAGEMENT BLUEPRINT SERVICES PLATFORM
CLIENT ORGANISATIONS ROADMAP FOR EXECUTION
How can we improve our staff skills?
With Dr Kalfhan, Dr Maqsood
Approach 1: 2007-08 Qld govt and BCC project implemented Supplier Group Strategy Map : normative model
Approach 2: 2010-12 VIC EPA Housing project we let the data analysis guide us given the context: created a tool given the descriptions and analysis we did : emergent ie positive model
ANHSCA
Project 11-01:
Housing Supply Chain Model for Material Waste Reduction


Supply Chain Waste Avoidance Project
SELF ASSESSMENT FRAMEWORK
RMIT UNIVERSITY
Professor Kerry London
AUSTRALIA
Awareness
Responsiveness
Adaptability
Levels:
Awareness of need for Supply Chain Waste Avoidance policies, processes and
Awareness of organisation's Supply Chain Waste Avoidance policy, processes & practices
Awareness of need for change in processes and practices to respond to problems at project level
Support for and capacity to respond and change processes & practice as required at project level
Policy & systems which guide what/how to adapt policy, processes & practices at portfolio & project level
Organisational culture of adaptability to support supply chain integration goals for waste avoidance
EXPLICIT
Detail to be completed in early stages of project and transferred from Supply Chain Management Blueprint
DEVELOPING
CREATE SUPPLY CHAIN WASTE AVOIDANCE PROFILE @ INDIVIDUAL, GROUP OR ORGANISATIONAL LEVEL
IMPLICIT
LACKING

Organisation
Action
research

Raise awareness
and begin
conversations

Know
Apply
Change
rules



## What does this assessment mean?

Supply chain management (SCM) practices in an organization involves four key activities for dealing with your external relationships with suppliers and contractors including:

1. Strategic Planning
2. Strategic Procurement
3. On-site Supplier & Trade Management*
4. Supplier Development

Halving Waste to Landfill

A supply chain includes all the work functional units that are linked to produce a service and/or product and they can be internal to an organisation or external. This assessment helps you determine the extent to which of these activities are adopted within your organization with respect to minimizing construction waste materials onsite. This will help to inform people at an individual level, or a manager of a work group, how well supply chain management practices are accepted and implemented. It will give direction to individual staff performance work plans and organisational strategic planning. An important underlying assumption to this self-assessment management tool is that waste minimisation typically requires an integrated supply chain approach.

## How do I perform this assessment?

The assessment can be completed individually or within a group or unit. If completed within a group then the tool can be a useful to trigger discussion. Such discussions will enhance sharing of knowledge and improve awareness and understanding of how your organisation approaches supply chain management in relation to waste minimization.

Individual self-assessment can highlight areas to improve skills and knowledge. An individual assessment might be a pre-cursor to a workgroup discussion that could also include staff from other units so that agreement on key activities or problems can be reached. Shared understanding is important to our organisation.

There are two key Assessments:

1. External Supplier / Contractor Management
2. Internal Supplier / Contractor Management

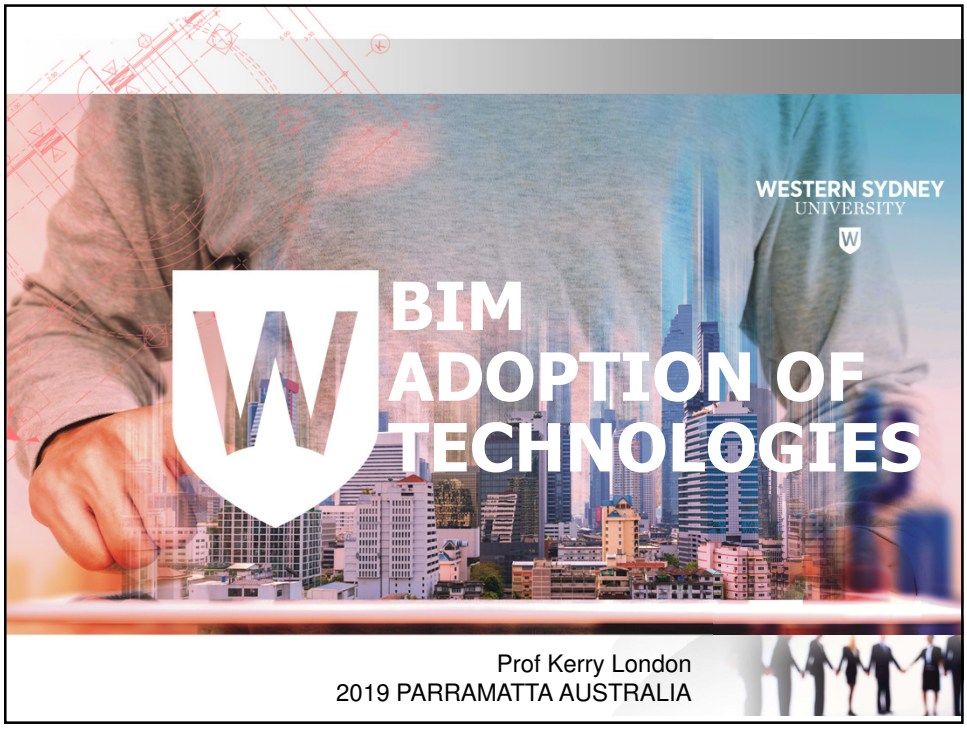
This is the first matrix. Each row in the matrix on the right represents an important activity in adopting SCM practices towards **supplier / contractor management** within the categories of **Know the Rules, Apply the Rules and Change the Rules**. Work through each row and tick the box which best describes the status of your organisation or your individual knowledge. When each cell is complete you will then be able to see what has been achieved and what needs attention. You are then ready to talk about an action plan to make improvements. Some activities are not within your immediate control, but you may be able to influence others.

## How do I apply what I have learnt?

Once you have completed both Frameworks you will be able to work out the extent that supply chain management practices have been adopted towards waste minimisation in your organization and you can decide which activities need attention to improve advancement in your organisation.



| External supplier management | | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| | | No awareness | Some implementation | Several examples | The way things are done |
| **Know the rules** | | | | | |
| Waste Minimisation Plan | Sustainability policy including a waste management and minimisation objectives and strategy aligned to corporate business profitability objectives and KPIs | | | | |
| Strategic Procurement Plan | Strategic partnerships with suppliers and tradies critical to waste management efforts (eg. risk vs spend: timber, plasterboard, bricks and site spoil) to develop innovations that result in efficiencies, price reduction and/or value creation | | | | |
| | Supplier and Trade Council strategy aligned with corporate objectives | | | | |
| | Procurement process to select suppliers and trade subcontractors account for location and job differences. | | | | |
| | Contract Award criteria aligns to waste minimization amongst other key business objectives such as commercial, innovation, service, quality, and safety | | | | |
| **Apply the rules** | | | | | |
| Waste Minimisation | Sustainability policy accepted into the 'hearts and minds' of all staff on all jobs and waste minimisation objectives are part of 'how things are done' | | | | |
| | Trades and suppliers are intrinsically linked into the waste minimization objectives of the organization AND undertake action s to support these objectives | | | | |
| | Staff members appropriately trained based upon individual roles and responsibilities (for example in product knowledge, elite ordering skills) | | | | |
| Strategic procurement | Consistent proactive approach to initiating strategic partnerships with waste minimisation business critical suppliers | | | | |
| | Seamless application of procurement process aligned with staff competencies and job contract award criteria consistently applied to achieve waste minimisation objectives | | | | |
| Project Coordination | Employees feel empowered to do something to minimize waste | | | | |
| | Staff members comprehensively trained to work with suppliers to undertake project supplier performance monitoring during project delivery | | | | |
| | Post project supplier assessment monitoring and feedback on waste minimisation performance consistently applied across projects | | | | |
| | Innovative waste minimisation strategies regularly developed through integration with suppliers to share knowledge of construction products and processes | | | | |
| **Change the rules** | | | | | |
| Coordination and Development | Business systems measure and analyse and make visible physical waste generated onsite and strategy to monitor agreed targets to reduce waste | | | | |
| | Strategy to make waste minimisation efforts part of renewal agreements | | | | |
| | Employees feel empowered to make a suggestion re waste minimisation opportunities | | | | |
| | Formally integrate construction site supplier feedback into upstream processes and regular annual value creation forum to support creation, development and implementation of waste minimisation strategies. | | | | |


WESTERN SYDNEY
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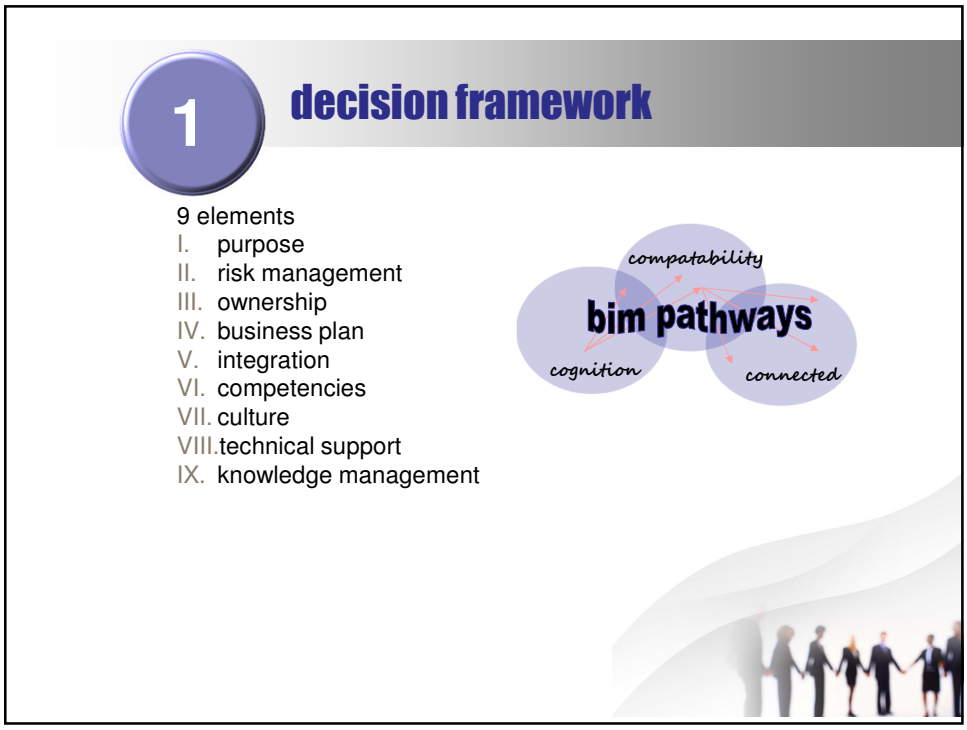
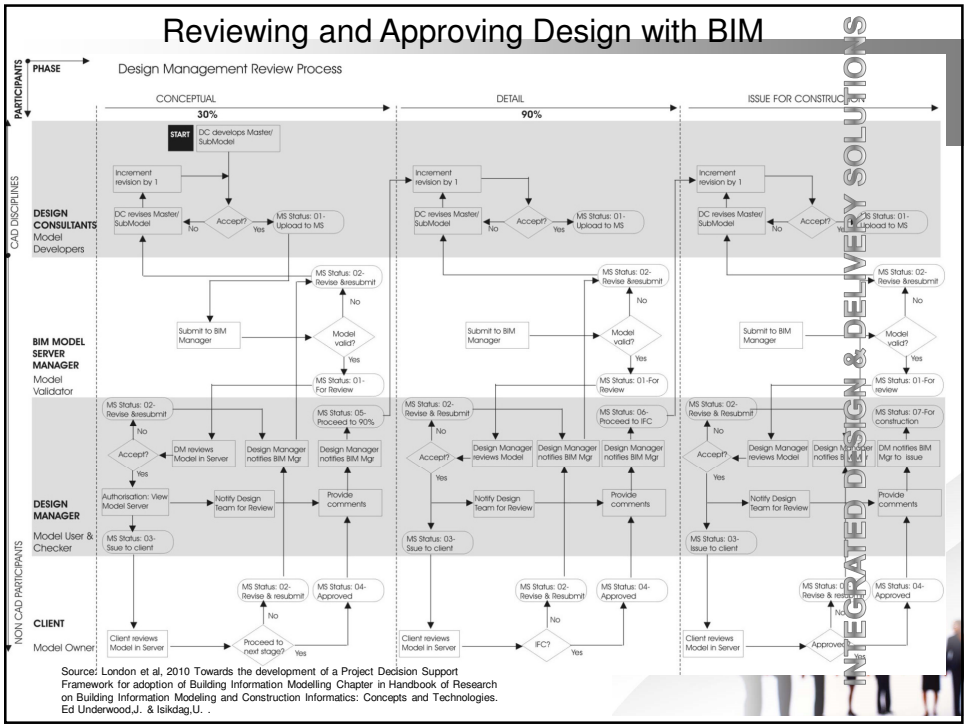
BIM
ADOPTION OF
TECHNOLOGIES
Prof Kerry London
2019 PARRAMATTA AUSTRALIA


1
decision framework
9 elements
I. purpose
II. risk management
III. ownership
IV. business plan
V. integration
VI. competencies
VII. culture
VIII. technical support
IX. knowledge management
compatability
bim pathways
cognition
connected


Reviewing and Approving Design with BIM
Design Management Review Process
INTEGRATED DESIGN & DELIVERY SOLUTIONS
PHASE
PARTICIPANTS
CAD DISCIPLINES
NON CAD PARTICIPANTS
CONCEPTUAL
30%
DETAIL
90%
ISSUE FOR CONSTRUCTION
DESIGN CONSULTANTS
Model Developers
BIM MODEL SERVER MANAGER
Model Validator
DESIGN MANAGER
Model User & Checker
CLIENT
Model Owner
START
DC develops Master/ SubModel
Increment revision by 1
DC revises Master/ SubModel
Accept?
MS Status: 01- Upload to MS
MS Status: 02- Revise &resubmit
Submit to BIM Manager
Model valid?
MS Status: 01- For Review
MS Status: 01-For review
MS Status: 02- Revise & Resubmit
MS Status: 05- Proceed to 90%
MS Status: 06- Proceed to IFC
MS Status: 07-For construction
DM reviews Model in Server
Design Manager notifies BIM Mgr
Design Manager reviews Model
DM notifies BIM Mgr to issue
Authorisation: View Model Server
Notify Design Team for Review
Provide comments
MS Status: 03- Issue to client
MS Status: 04- Approved
Client reviews Model in Server
Proceed to next stage?
IFC?
Approved
Source: London et al, 2010 Towards the development of a Project Decision Support Framework for adoption of Building Information Modelling Chapter in Handbook of Research on Building Information Modeling and Construction Informatics: Concepts and Technologies. Ed Underwood,J. & Isikdag,U. .


WESTERN SYDNEY UNIVERSITY
COLLABORATING FOR CHANGE
Prof Kerry London
2019 BRISBANE AUSTRALIA

# Past project…2014

China Australia Industrialised Building Project

Integrated International Construction Supply Chains - Knowledge Transfer for Seamless Off-site Housing Systems

- Conducting joint public guest lectures and workshops in universities of China.
- Visiting the relevant off site housing systems manufacturing facilities in China.
- Capturing, sharing, transferring and documenting knowledge related to off site housing systems acquired before, during and after the visit.

BUILT ENVIRONMENT & URBAN TRANSFORMATION:
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

# China Challenges

## Modular Housing stakeholders

- **Gaining certification** from foreign countries' government, and meeting foreign countries' regulations, standards and requirements
- **Transportation delays** impact servicing of contracts, increase lead times and affect profitability, company credibility
- Profitability is decreasing because of the **increase in competition**
- **Communication with clients on design**; changes of design and scope; lack of communication between design and construction units & drawing errors

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## China Challenges: High rise developer

**Government role**
- No support in the beginning for development of new technology
- Little policy/regulation on new technology
- Cost on generating new technology

**Technical**
- Lack of technologies
- Size of the parts can vary and are difficult to manufacture

**Skills**
- Lack of skills across range of stakeholders (labours, traders, professionals);
- Lack of experience in new technologies: mfrs don't know how to make components; designers don't know how to design for etc...

**Cost**
- Increased cost of building. Increase by 100-500RMB/$m^2$

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## Australia Challenges

### Economics and market
- **Insufficient demand** from housing contractors for profitability and ROI
- Market stability
- Fear of being innovator (first to market) only to have technology copied before ROI is achieved (ip)
- Fear of imported products/systems that are less costly
- Economic risk in **start-up capital costs** for land and factory

### Technical
- New products/systems bring with it new challenges
- Lack of knowledge of technology and thus R&D investment
- Lack of onsite capability to problem solve installation
- Unexpected site constraints delay installation : IR
- Lack of compliance to current regulations and thus increased time to negotiate new approvals for compliance

BUILT ENVIRONMENT & URBAN TRANSFORMATION:
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

## Australia Challenges

**Skills**

- Lack of technical knowledge for **onsite installation**
- Level of PM capabilities (reliance of subcontractor system)
- Assurance in quality
- Lack of **predictability/standardization** of construction methodology
- Lack of **input at early decision making stage**
- Lack of Building Information Modelling

**Economics and market**

- Nervousness of **equivalent quality** provided by **alternatives**
- **Competition:** Cost of alternative product/system does not affect the price point for a particular customer range

BUILT ENVIRONMENT & URBAN TRANSFORMATION:
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change


# So where to now?

Informed and positioned the ARC Linkage project:
Shared understanding & we could talk about:

- ❑ innovation
- ❑ off site manufacturing
- ❑ supply chains

**BUILT ENVIRONMENT & URBAN TRANSFORMATION:**
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

# What were our project goals?

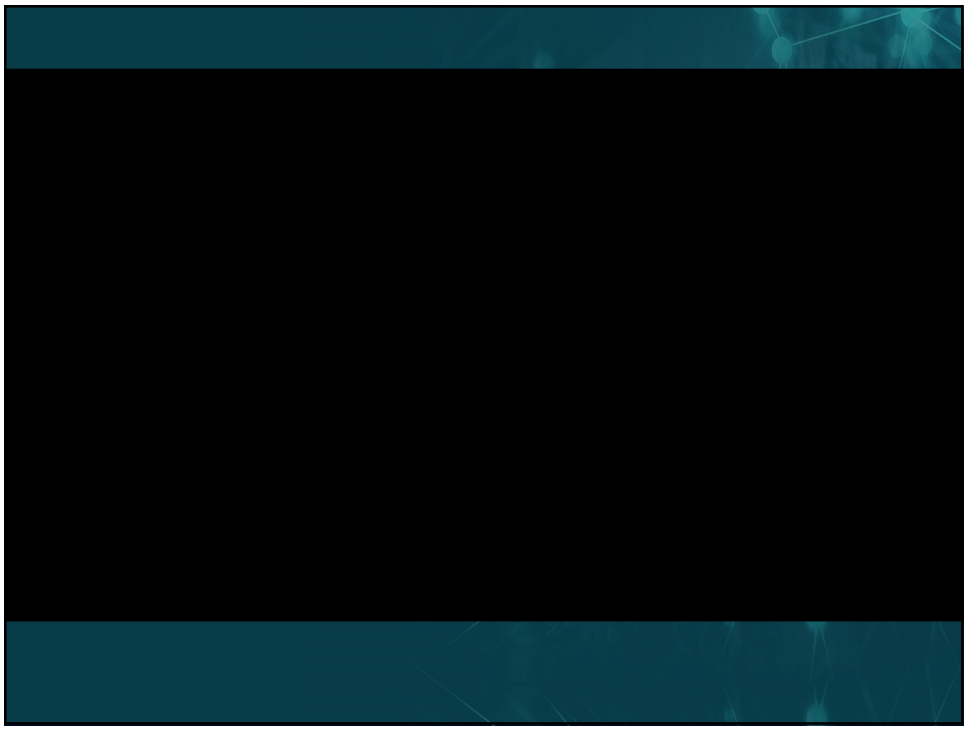
## OBJECTIVES

- Identify drivers & barriers to OSM
- Examine the nature of collaboration in OSM networks
- Explore collaboration and effectiveness link

## OUTCOMES

- Theoretical contributions: change, innovation, collaboration, supply chains
- Collaboration models for practice
- Training materials; recommendations for housing policy

**BUILT ENVIRONMENT & URBAN TRANSFORMATION:**
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change




## What is OSM?

The manufacture and assembly of components, systems, pods, and/or complete modular constructions in a controlled environment away from the construction site, often with the use of industrialized methods

BUILT ENVIRONMENT & URBAN TRANSFORMATION:
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

## What is OSM?

| | |
|---|---|
| Building components | • windows, roof trusses, prefabricated concrete columns and beams, etc |
| Building systems | • timber cassette floors, panel wall systems |
| Pods | • Kitchen and bathroom pods |
| Modular detached units | • affordable housing, volume customised housing, disaster relief shelters, construction camp dwellings, mining camp offices |
| Modular housing units | • Complete units stacked into low-medium or high-rise buildings |

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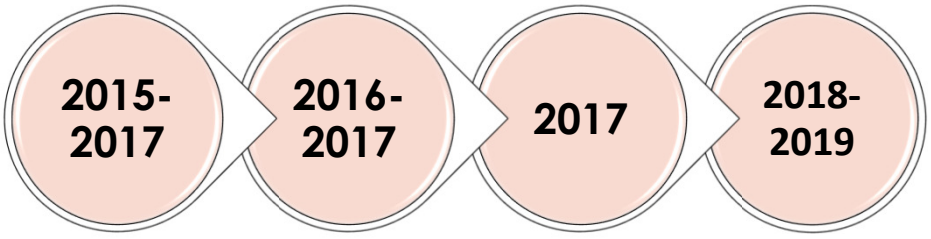
Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

## How did we investigate?



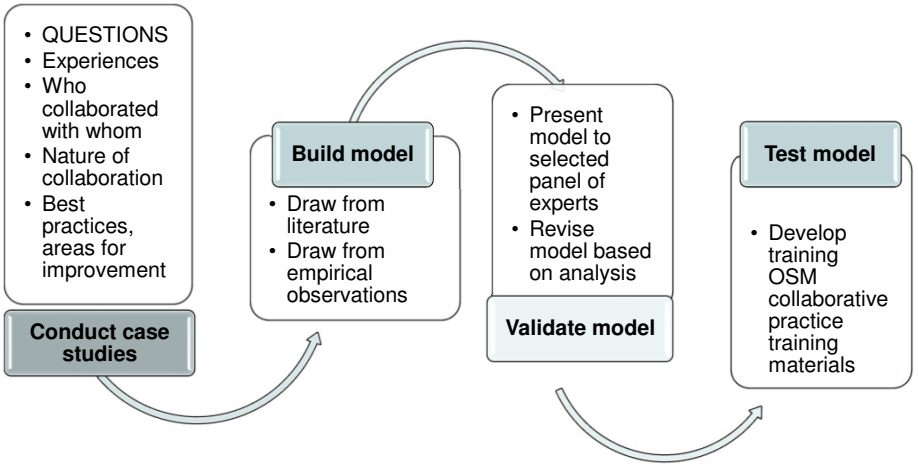

- 5 X OSM supply chains
  29 X interviews
  Intensive qualitative analysis
- Project Steering Committee every 3 months
- Academic publications

- Identification of 102 themes from data
- Categorization into nine Collaborative Practice Elements
- Events

- Development of suite of training materials based on elements

- Testing and refinement
- Commercialisation
- IP and Licensing
- Marketing assets

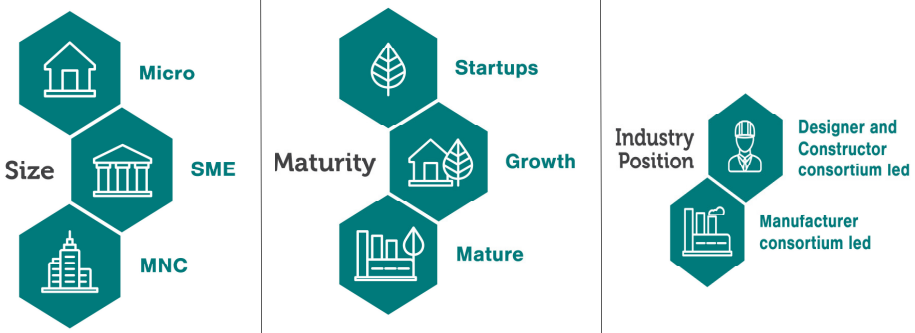
## Methodology



## What did we investigate?

| CASE 1 | CASE 2 | CASE 3 | CASE 4 | CASE 5 |
|---|---|---|---|---|
| VIC | SA | TAS | VIC | VIC |
| MNE | SME | SME | Startup | Startup |
| Systems | Modular detached | Components | Components | Components |
| Low to medium rise | Single storey, detached | Housing and commercial, low to medium rise | Housing, low-rise, detached | Housing, low-rise, detached |

## Who does OSM?

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Off Site (OSM) Manufacturing Collaborative Practices to Deliver Change

# CASE TYPOLOGIES

| FIRM CHARACTERISTICS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEVEL OF MATURITY | STARTUP | | | | GROWTH | | | | MATURITY | | | |
| | | | | C4 | | C2 | C3 | | C1 | | | |
| SIZE | MICRO | | | | SMALL/ MEDIUM ENTERPRISE | | | | MULTI-NATIONAL | | | |
| | | | | C4 | | C2 | C3 | | C1 | | | |
| LEVEL OF OSM | COMPONENTS | | | | SYSTEMS (WALL, ROOF, FLOORING) | | | | COMPLETE HOUSES | | | |
| | | | C3 | | C1 | | | C4 | | C2 | | |
| NATURE OF PRODUCT | HOUSING, DETACHED, SINGLE STOREY OR LOW RISE | | | | HOUSING, SINGLE TO FIVE STOREYS | | | | HOUSING AND COMMERCIAL | | | |
| | | C2 | | C4 | C1 | | | | | | C3 | |
| COMPLEXITY OF DESIGN/ LEVEL OF CUSTOMIZATION | LOW: OSM PRODUCT DESIGNS SHOW MINOR VARIATIONS | | | | MEDIUM: OSM PRODUCT DESIGNS INVOLVE A DEGREE OF MASS CUSTOMIZATION | | | | HIGH: DESIGNS VARY FOR EVERY PROJECT | | | |
| | | C2 | | | C1 | | | | | | C3 | C4 |
| LEVEL OF EXPERIENCE/ LENGTH OF HISTORY WITH OSM RELATIVE TO FIRM LIFE | LOW: ZERO OR SMALL PORTFOLIO OF COMPLETED OSM PROJECTS | | | | MEDIUM: GROWING PORTFOLIO OF OSM PROJECTS, BUT TRADITIONAL BUILDS STILL DOMINATE | | | | HIGH: SUSTAINED HISTORY OF CARRYING OUT OSM PROJECTS | | | |
| | | | | C4 | C1 | C2 | | | | | C3 | |
| INFLUENCE OF A CHAMPION IN PUSHING FOR OSM | LOW: OSM NOT PUSHED BY A KEY PLAYER | | | | MEDIUM: OSM PUSHED BY A KEY PLAYER, BUT INFLUENCE DAMPENED BY OTHER FACTORS | | | | HIGH: PUSH BY A KEY OSM CHAMPION IS DECISIVE | | | |
| | | | | | | C2 | | C4 | C1 | | C3 | |
| EASE OF TRANSITION FROM TRADITIONAL MINDSET TO OSM MINDSET | LOW: MOVE TO OSM WAS CHALLENGING BECAUSE OF FACTORS LINKED TO LONG HISTORY IN TRADITIONAL BUILDING | | | | MEDIUM: MOVE TO OSM WAS NEW BUT EASED BY A CULTURE OF INNOVATION | | | | HIGH: FIRM WAS ESTABLISHED AS "DOING OSM" FROM THE START | | | |
| | C1 | | | C4 | | C2 | | | | | C3 | |

"C" STANDS FOR "CASE"; C1=CASE 1

# CASE TYPOLOGIES

| OSM DRIVERS ACROSS FIRMS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COST REDUCTION | LOW | | | | MEDIUM | | | | HIGH | | | |
| | | | C3 | | | C2* | | | C1 | | | C4** |
| QUALITY/ CRAFTSMANSHIP RELATED TO CUSTOMIZATION | LOW | | | | MEDIUM | | | | HIGH | | | |
| | | | | | C1 | | | | | C2 | C3 | C4 |
| CAPTURING NEW MARKET NICHES | LOW | | | | MEDIUM | | | | HIGH | | | |
| | | | | | | | | | C1 | C2 | C3 | C4 |
| WORKER SAFETY/ COMFORT | LOW | | | | MEDIUM | | | | HIGH | | | |
| | | | | C4 | | C2 | C3 | | C1 | | | |
| SOCIAL SUSTAINABILITY (MANAGING IMPACT ON COMMUNITIES) | LOW | | | | MEDIUM | | | | HIGH | | | |
| | C1 | | C3 | | | | | C4 | | C2 | | |
| ENVIRONMENTAL SUSTAINABILITY (WASTE MANAGEMENT, ENERGY EFFICIENCY) | LOW | | | | MEDIUM | | | | HIGH | | | |
| | C1 | | | | | C2 | | C4 | | | C3 | |
| PROCESS PREDICTABILITY, PRECISION, CONTROL | LOW | | | | MEDIUM | | | | HIGH | | | |
| | C1 | | | | | C2 | | | | | C3 | C4 |
| SPEED AND EFFICIENCY | LOW | | | | MEDIUM | | | | HIGH | | | |
| | | C2 | | | | | | | C1 | | C3 | C4 |

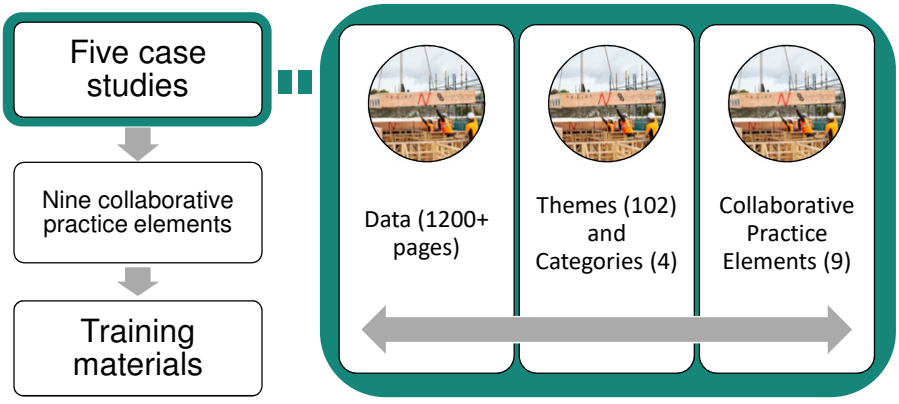
*MODIFIED FROM HIGH; COST REDUCTIONS TEND TO BE OFFSET BY TRANSPORT COSTS OF TRANSPORTABLES

** C4 DATA IS BASED ON CLAIMS; AS A STARTUP, THESE ARE YET TO BE DEMONSTRATED

# LINK TO PERFORMANCE

| | | |
|---|---|---|
| Capturing new markets/ niches | Better quality, craftsmanship | Addresses productivity constraints |
| Less cost (in some cases) | Speed and efficiency | Process predictability and control |
| Increased worker safety and/ or comfort | Social sustainability (community impact) and environmental sustainability | More sophisticated designs (in some cases) |
| Innovation/ learning | Process flexibility/ customization possibilities | Better waste management |

# How did we investigate?

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# What makes OSM work/fail?

*…when we're doing everything, that closes the door to other collaborations, or makes people sort of, not suspicious, but wary of collaborating with us. So it's wary for architects to collaborate with us because are we their competition? It's wary for builders to collaborate with us, because are we their competition, when we're neither.*

*So from assembly teams, to the guys working at the plant, they're all going to be rotating…[they will also] assemble. Because they've all got the same skill levels.*

*So the exciting thing about it is that we can partner with other people that aren't necessarily just the prefab lab or just on a workshop build. We've got the opportunity to work with other builders. We've got the opportunity to team up with other designers for another design thing.*

*Working in teams definitely works better depending on what you're working on. So certain components are relatively small and minor. It depends on what you're working on. Sometimes more people is better; sometimes a smaller team's better, sometimes on your own.*

SAMPLE DATA



# What makes OSM work/fail?

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*So from assembly teams, to the guys working at the plant, th… be rotating…[they will … Because they've all go… levels.*

THEME #2: CONFLICTS OF INTEREST

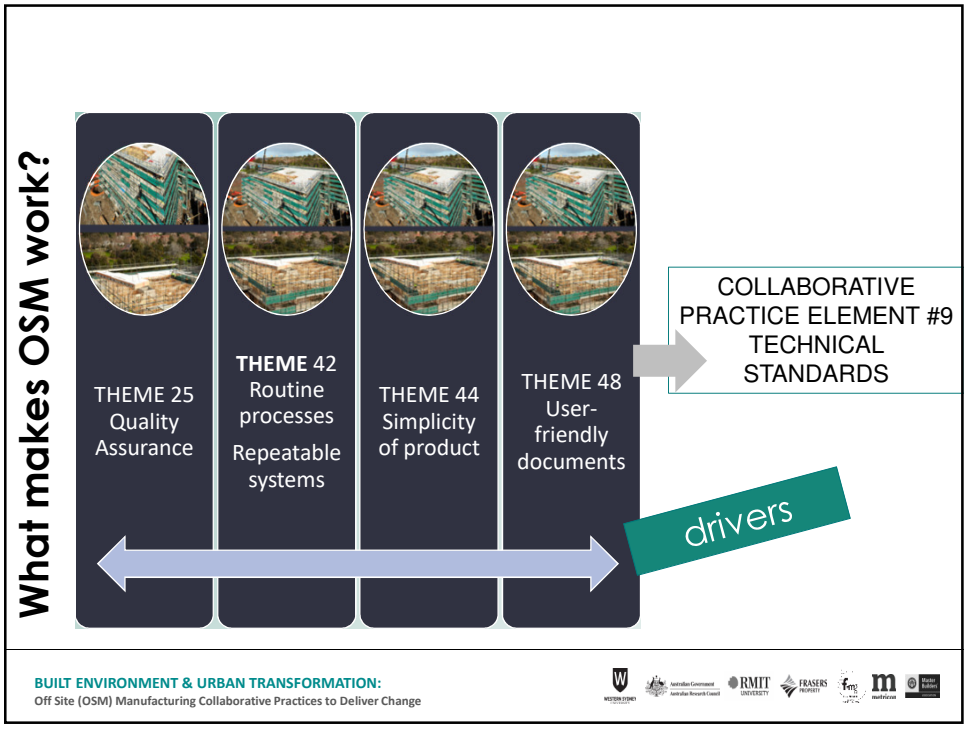
THEME #38: FLEXIBLE EMPLOYEE SKILL SETS

*So the exciting thing about it is that we can partner with other people that aren't necessarily just the prefab lab or just on a … We've got the opportunity … er builders. We've got the … to team up with other … r another design thing.*

*Working in teams definitely works better depending on what you're working on. So certain components are relatively small and m… on what you're working … more people is better; … smaller team's better … your own.*

THEME #32: FLEXIBLE STRUCTURE

THEME #37: OPTIMAL TEAM SIZE




# What makes OSM work/fail?

*…engineers will always be involved nice and early because in prefab very often everything has to be – you can't work it out onsite. So the engineers are producing more documentation than they probably would be in a traditional build. …*
*The prefabrication is a lot more work. Like, documenting that, in that method, there's a lot more work than just doing a traditional house.*

*Then we checked it and we would go to them and say "This is out. This is not within tolerance." And they would reply by saying, "It's only five millimetres. It's nothing." And I said to them we need to change our mindset, we need to persist and get more accurate in this and really put the effort in.*

*And again when I started, there's no agreements in place, there's no pricing grid there's no SLRs, there's no any of those things. So I'm trying to bring to that, like get some agreements in place. Because I want to understand timeframes, for me, it's about, time costs quality, and get that, and less of the handshake.*

*But because we know exactly how much quantity we're going to have the builders don't know that so if we talk to a builder– they'll say 'my plumber has cost me $3500 for that job to do that house' and we'll say, 'you know what, to buy a bit of plastic, put some pipes in and do all that stuff it's probably about $700 so tell me how you make up the labour at $3500?' That's the conversations we're having with the builders.*

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# What makes OSM fail?

THEME #4: INFORMATION-SHARING HURDLES

*…engineers will always be involved nice and early because in prefab very often everything has to be – you …s are …y probably …ke, documenting that, in that method, there's a lot more work than just doing a traditional house.*

THEME #14: LACK OF FORMAL AGREEMENTS

*And again when I started, there's no agreements in place, there's no p… those things… agreements… timeframes, for me, it's about, time costs quality, and get that, and less of the handshake.*

THEME #63: TIGHT TOLERANCES

*Then we checked it and we would go to them and say "This is out. This is not within tolerance." And they …imetres. It's … change our …e accurate in this and really put the effort in.*

THEME #22: INCREASED TRANSPARENCY

*But because we know exactly how much quantity we're going to have the builders don't know that so if we talk to a builder they'll talk to – they'll say my plumber has cost me $3500 f… know what, … do all that s… you make up the labour at $3500? That's the conversations we're having with the builders.*

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# ANALYSIS STAGE 1

OSM Drivers (33)

OSM Barriers (17)

Collaboration Drivers (28)

Collaboration Barriers (22)

# FORUM DISCUSSION

**SKILLS**

**PROFESSIONALIZATION**

**MANAGING CHANGE**

**ECONOMICS/ MARKETS**

**REGULATIONS/ STANDARDS**

**COLLABORATION**

# FORUM DISCUSSION

**SKILLS**

**PROFESSIONALIZATION**

**MANAGING CHANGE**

**ECONOMICS/ MARKETS**

**REGULATIONS/ STANDARDS**

**COLLABORATION**

- Importance of team collaboration around manufacturing
- Importance of suppliers seeing the benefits of OSM to get them on board
- Importance of building alliances, relationships, trust
- Importance of incentives that will make people collaborate better
- Engineers can be communication conduits
- Importance of building the idea that "we can pull this off together"
- Bring supply chain along with you
- Will fail if support is not there
- Initiatives require that one speak to all people involved/ the whole supply chain should be involved

# FORUM DISCUSSION

RELATED FINDINGS:

•Largely confirmed by findings.

•Collaborative drivers: include involving partners (preferably at early stages), building long-term relationships, incentivizing suppliers, and mobilizing the entire supply chain.

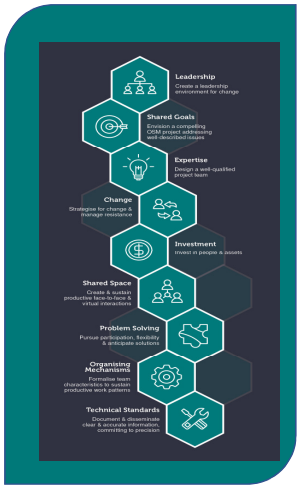
- Importance of team collaboration around manufacturing
- Importance of suppliers seeing the benefits of OSM to get them on board
- Importance of building alliances, relationships, trust
- Importance of incentives that will make people collaborate better
- Engineers can be communication conduits
- Importance of building the idea that "we can pull this off together"
- Bring supply chain along with you
- Will fail if support is not there
- Initiatives require that one speak to all people involved/ the whole supply chain should be involved

How did we develop training?

Five case studies

Nine collaborative practice elements

Training materials

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# OSM COLLABORATION TRAINING

Off Site (OSM) Manufacturing
Collaborative Practices to Deliver Change

## Highlights


- interactive collaborative training experience at MBAV
- customised at a given location
- 2-3 participants interacting with actors
- evaluation by organisational psychologists
- two training scenarios
- deep immersive
- individual and group assessment

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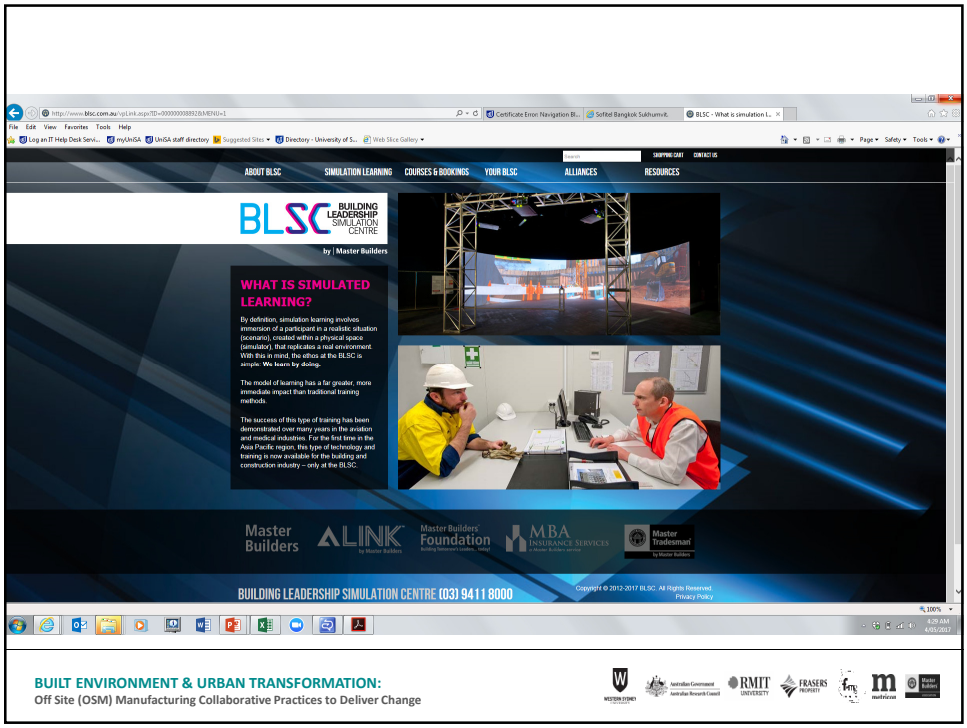




## What makes up the training package?

Five case studies

Nine collaborative practice elements

Training materials

1. Collaborative Practice Model
2. Collaborative Practices Actions (CPA) and Position Competency Matrix
3. CPA Index
4. Indicator Descriptors
5. Training Scenarios
6. Collaborative Practice Training

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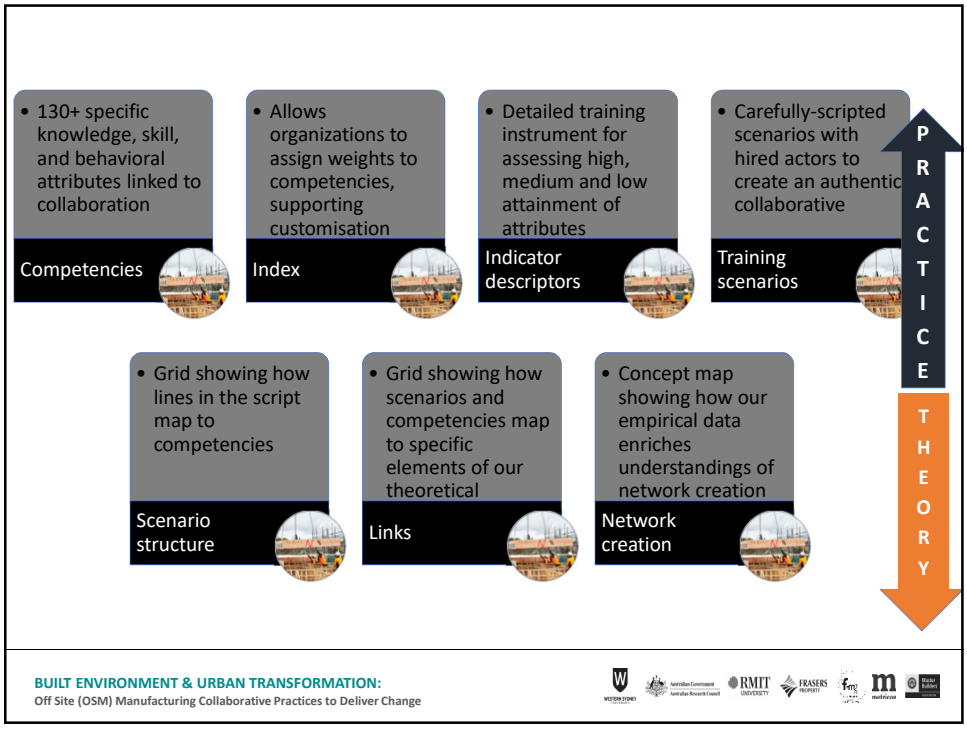
• 130+ specific knowledge, skill, and behavioral attributes linked to collaboration
Competencies
• Allows organizations to assign weights to competencies, supporting customisation
Index
• Detailed training instrument for assessing high, medium and low attainment of attributes
Indicator descriptors
• Carefully-scripted scenarios with hired actors to create an authentic collaborative
Training scenarios
PRACTICE
THEORY
• Grid showing how lines in the script map to competencies
Scenario structure
• Grid showing how scenarios and competencies map to specific elements of our theoretical
Links
• Concept map showing how our empirical data enriches understandings of network creation
Network creation
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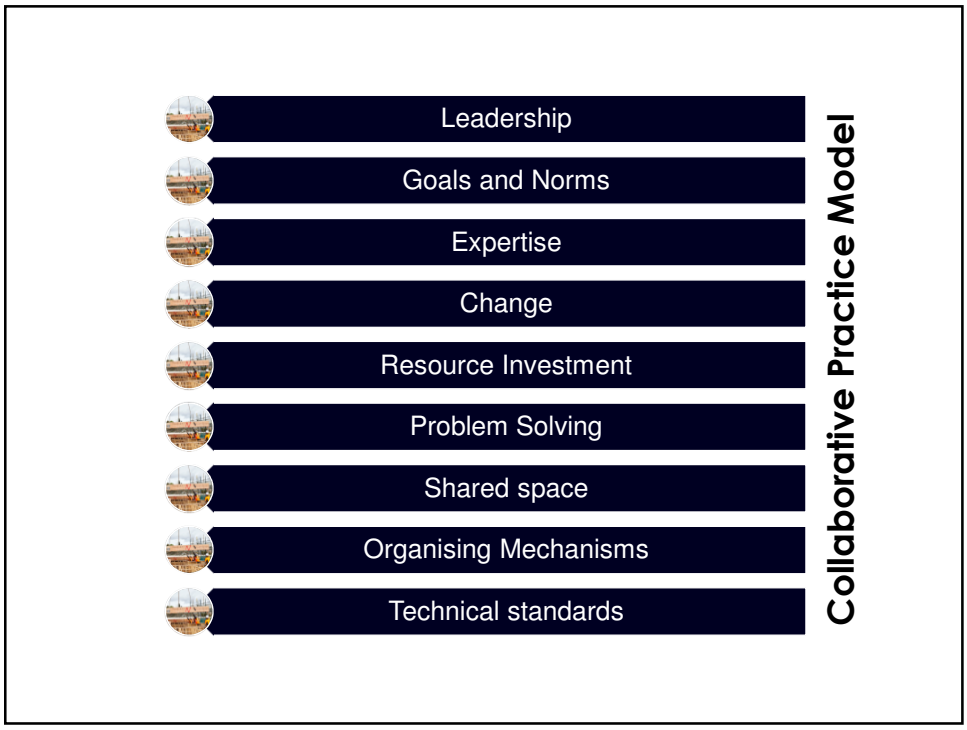
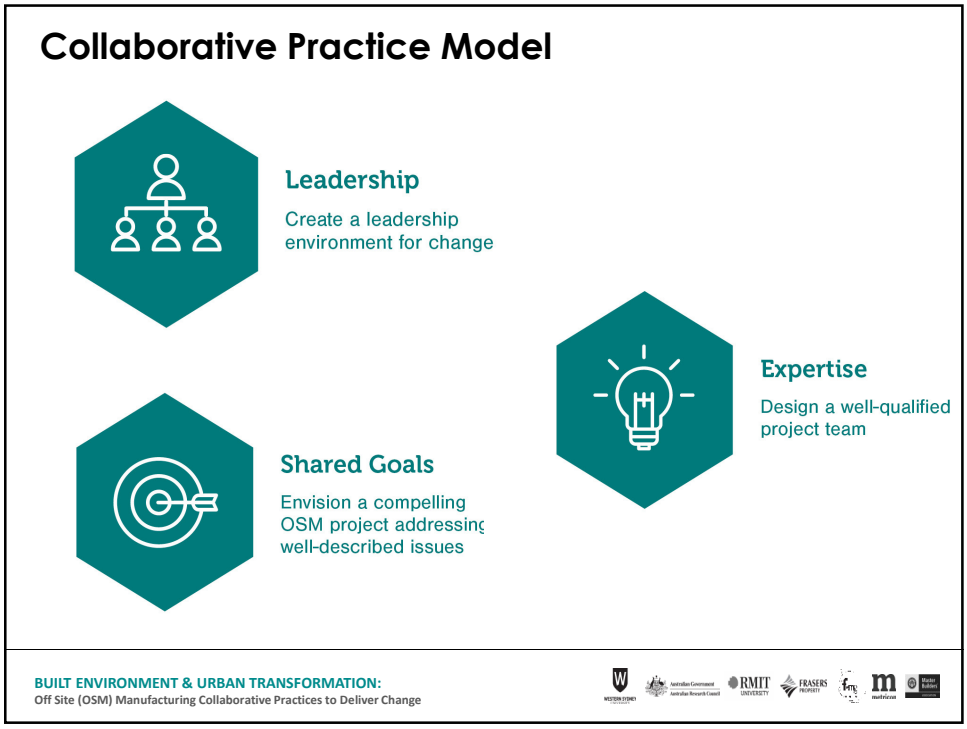

Leadership
Goals and Norms
Expertise
Change
Resource Investment
Problem Solving
Shared space
Organising Mechanisms
Technical standards
Collaborative Practice Model


Collaborative Practice Model
Leadership
Create a leadership environment for change
Expertise
Design a well-qualified project team
Shared Goals
Envision a compelling OSM project addressing well-described issues
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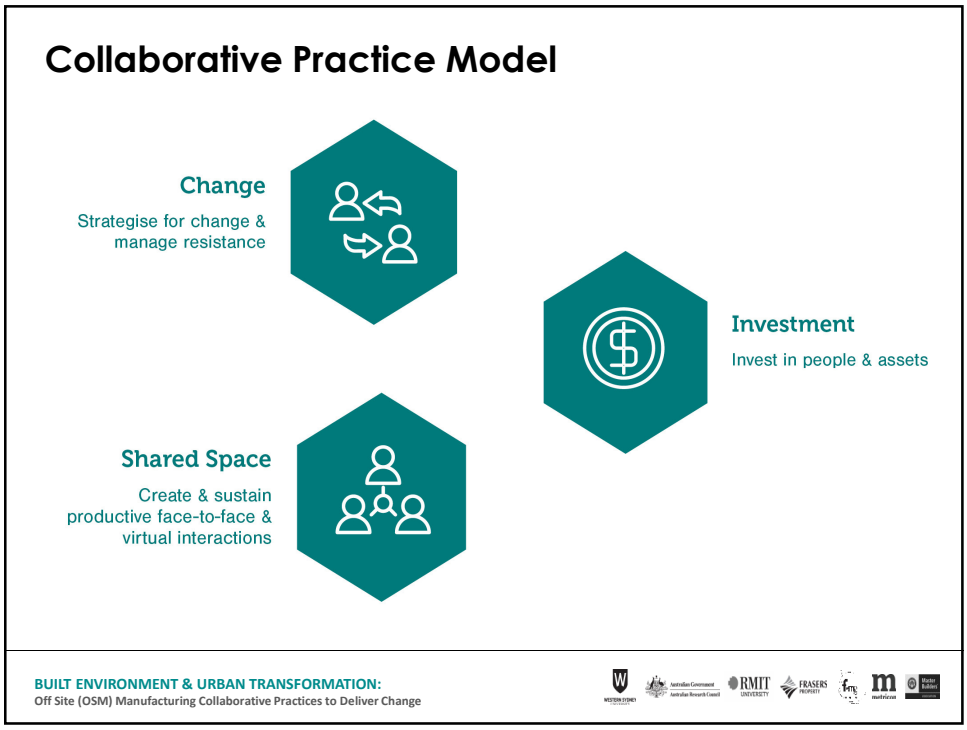
Collaborative Practice Model
Change
Strategise for change & manage resistance
Investment
Invest in people & assets
Shared Space
Create & sustain productive face-to-face & virtual interactions
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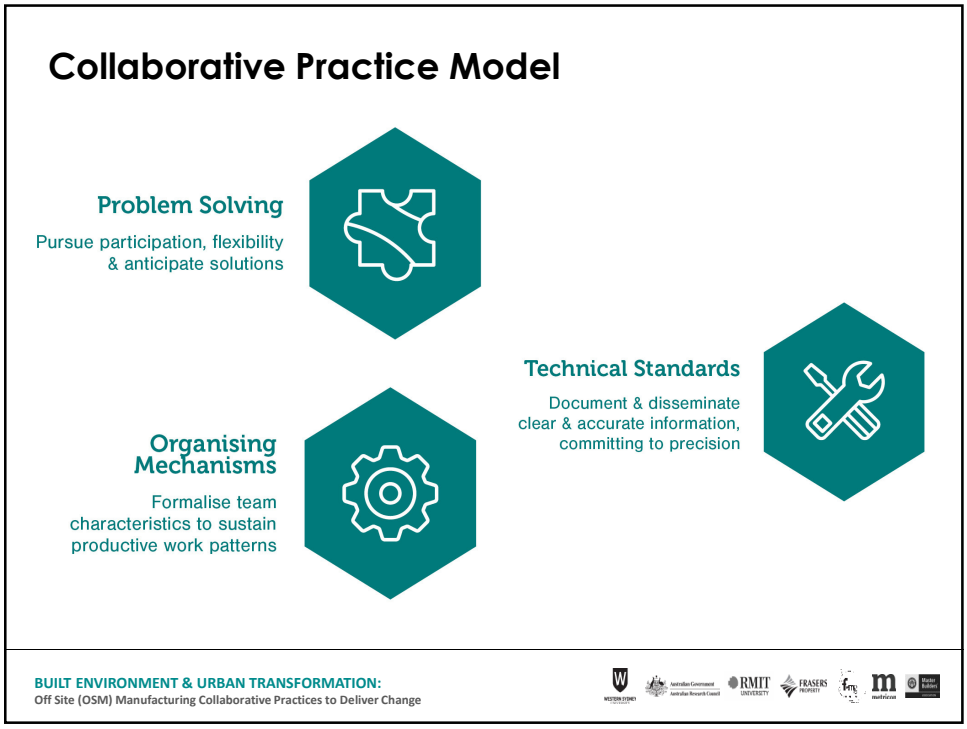
Collaborative Practice Model
Problem Solving
Pursue participation, flexibility & anticipate solutions
Technical Standards
Document & disseminate clear & accurate information, committing to precision
Organising Mechanisms
Formalise team characteristics to sustain productive work patterns
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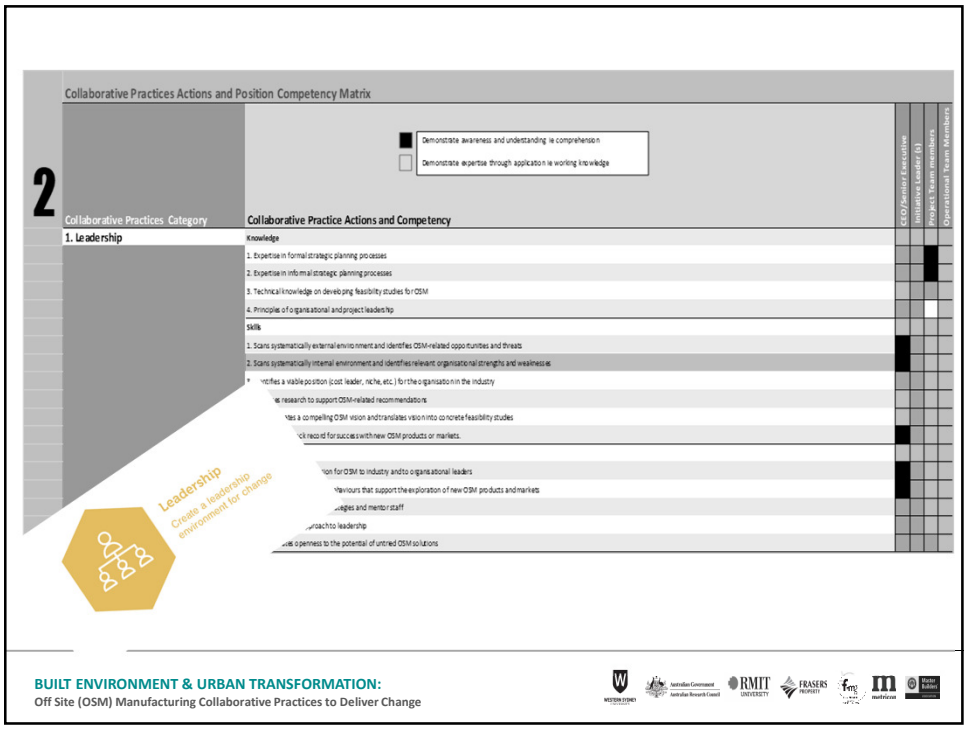
Collaborative Practices Actions and Position Competency Matrix
2
Demonstrate awareness and understanding ie comprehension
Demonstrate expertise through application ie working knowledge
Collaborative Practices Category
Collaborative Practice Actions and Competency
C-O/Senior Executive
Initiative Leader (s)
Project Team members
Operational Team Members
1. Leadership
Knowledge
1. Expertise in formal strategic planning processes
2. Expertise in informal strategic planning processes
3. Technical knowledge on developing feasibility studies for OSM
4. Principles of organisational and project leadership
Skills
1. Scans systematically external environment and identifies OSM-related opportunities and threats
2. Scans systematically internal environment and identifies relevant organisational strengths and weaknesses
Leadership
Create a leadership environment for change
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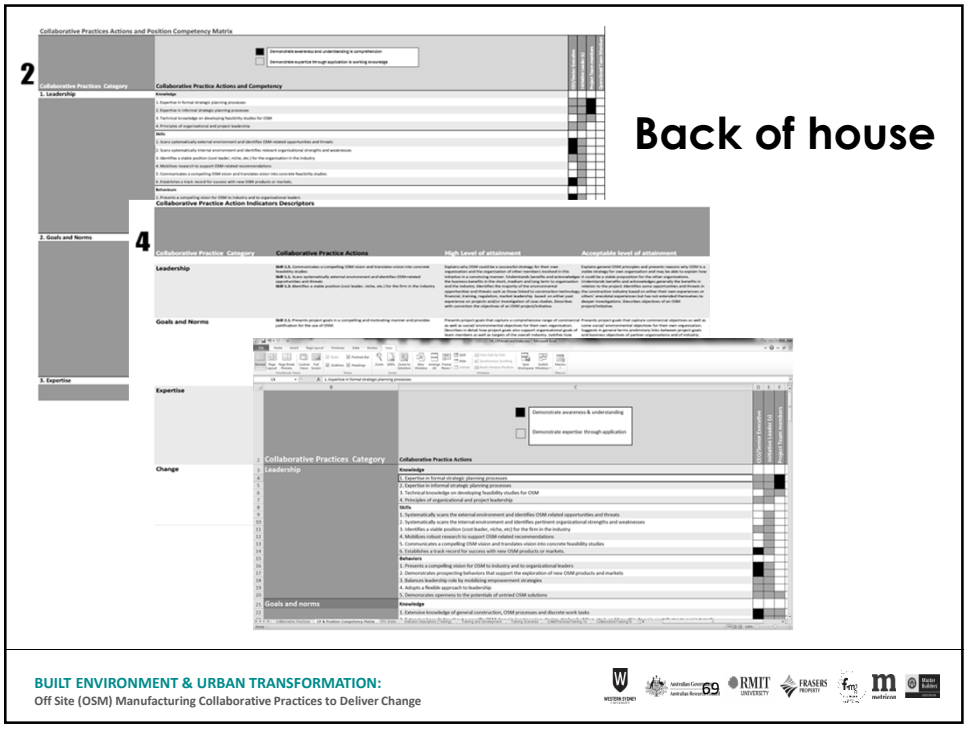


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## Collaborative Practice Action Indicators Descriptors

4

Collaborative Practice Action Indicators Descriptors

| Collaborative Practice Category | Collaborative Practice Actions | High Level of attainment | Acceptable level of attainment | Minimal level of attainment |
|---|---|---|---|---|
| Problem Solving | **Behaviour 7.1.** Establishes a non-threatening, accepting environment where problems can be anticipated and discussed without fear of reprisal.<br>**Skill 7.1.** Develops systems of rewards and incentives for participants, assists in the removal of hurdles to problem solving | Encourages team members to anticipate an exhaustive range of problems, objections and issues in relation to OSM. Creates intentional and regular opportunities for problem solving, for example by allocating a part of the meeting to discuss and address problems. Encourages participatory problem solving and the proposal of creative, outside-the-box solutions to OSM issues by supporting cross-disciplinary interaction leading to innovative solutions. Positively reinforces problem and solution identification through feedback. | Encourages team members to identify important problems, objections and issues in relation to OSM. Encourages participatory problem solving by identifying appropriate specialists needed to address issues, leading to expert-driven though not necessarily novel solutions. Positively reinforces problem and solution identification through feedback. | Demonstrates openness and acceptance when problems, objections and issues are raised by team members in relation to OSM. While care is taken not to penalise the practice of raising problems, no measures are taken to actively encourage it. |
| Organising Mechanisms | **Skill 8.1.** Defines team membership, taking into consideration issues such as size and functional diversity required<br>**Skill 8.3.** Defines roles per team member, identifies team strengths and weaknesses and identifies gaps in skills<br>**Behaviour 8.1.** Conducts efficient and effective team meetings | Defines a comprehensive list of roles, goals and performance indicators for key members. Organises team taking into consideration factors such as team size, hierarchy and degree of centralisation/ decentralisation. Systematically identifies strengths and weaknesses within the team and on required skill sets and also notes "missing" patterns or skill sets. Translates goals and roles into milestones. Uses meetings effectively to track accomplishments of these milestones (task element) while proactively managing interpersonal dynamics (relational element). | Defines a list of roles and goals for key members. Suggests a team structure. Identifies strengths and weaknesses within the team, pointing out obvious gaps like missing members but overlooking more nuanced gaps in skills. Translates goals and roles into milestones. Uses meetings effectively to track accomplishments of these milestones (task element). Addresses interpersonal dynamics (relational element) when the need arises. | Defines general roles for key members. Clarifies team membership but does not consider other organising mechanisms like size, hierarchy and structure. Identifies strengths and weaknesses within the team based on common sense notions of traditional project team membership. Focuses on task accomplishment during meetings, largely overlooks relational component. |
| Technical Standards | **Knowledge 9.1.** Understanding of the principles and strategies of sound information management and applies those in response to new knowledge generated out of the new OSM processes | Presents knowledge creation as a key goal of undertaking the OSM initiative. Leads discussions on formulating strategies for all stages of information management, highlighting the precise and information-driven nature of OSM operations. Acknowledges the importance of managing tacit as well as explicit knowledge. Notes the importance of sharing knowledge beyond the supply chain to the industry. | Notes the importance of information management, particularly in light of precision-driven OSM processes, but does not connect it to a larger knowledge-sharing vision. Proposes a number of strategies for key aspects of knowledge management, including knowledge capture (for example formal documentation, standards for plans and drawings). Emphasises the importance of information sharing within the team but does not mention the rest of the industry. | Notes the importance of key aspects of information management (for example information sharing), but overlooks some aspects of the process (for example how to set opportunities for creating information emerge from new OSM initiatives). Proposes key strategies in support of this narrow definition of information management. Does not recognise how the precise nature of OSM reshapes information related processes. |

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# Future directions

MY BACKGROUND

- Non academic roles (internal and external)

CHALLENGES

- major projects; cost over runs and time delays
- Phd students
  - cultural impact on leadership in oil and gas sector
  - clients on megaprojects and politics
- two speeds and 'bubbles'
- Bumping up against the internal client organization politics
- Connections between project team and key decision makers
- circles of influence and boundary spanners

OPPORTUNITIES: INFLUENCES AND INFLUENCERS

- Professional associations
- Large clients
- Education institutions; research and teaching


THANK YOU
DR PENG ZHANG
DR ZELINNA PABLO
JESSICA CHEN
CLAUDELLE TAYLOR
MICHAEL MEEHAN
DR PHIL ALVIANO
ADAM SIEGEL
CHARLIE CONDO
PETER BAYETTO
SIMON CROFT
ANGUS KELL
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