Offsite Fabrication

and Links to Product and Process Innovation

Off-site manufacture (OSM) is widely recognised as an effective model for improved productivity in commercial and infrastructure construction. The benefits of reduced project duration and improved quality mean total project cost savings. Yet the growth of OSM is hampered by perceptions of high expense and high risk.

Previous research focussed on barriers to implementing OSM. In contrast, SBEnrc proposes a system of OSM enablement. The primary success factor identified for implementing OSM is the approach of the Project Team. So our aim is to enable building a Project Team with skills, knowledge and intent to use an OSM procurement model. To support this process, SBEnrc has developed a toolkit to assist an OSM Project Team from the outset.

The early stage of the study created detailed construction project process and workflows models to support OSM adoption. An extensive report on the models and workflows is available, along with a video demonstrating an operational prototype for a workflow tool. Development of two additional instruments is based on the need to identify available OSM capacity and capability for increasing OSM adoption. The *OSM Project Team Evaluation Tool (V1.0)* is a set of 19 essential OSM questions about OSM expertise and production that is accessed from a project *OSM_KnowledgeBank*. These four enabling tools are available online from SBEnrc.

Industry need

Off-site manufacture (OSM) has been recognised as an effective procurement model for construction in many countries. In Australia, OSM was identified as a key driver for changing the construction industry, but adoption of OSM remains low. Previous research emphasised identifying barriers to uptake. This has been informative, but it has been left to market forces to drive further OSM uptake. The result is sporadic and opportunistic usage. A new approach is needed to assist clients, the ultimate beneficiaries of OSM on their projects, to be proactive in driving the uptake of OSM.

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Approach

The OSM building model encourages questions of constructability by shifting the resources allocation for both timing of construction and location of production. These changes often mean new management processes and systems are necessary for integrating OSM. This higher level perspective was studied by analysis of construction project phases and related OSM processes.

Construction Project Business Models with Identified OSM Intervention Points

The tool is a comprehensive visual representation of construction processes showing key activities/ resources/ data and stakeholders. The models show OSM intervention points identified by AEC experts for six building construction phases.

OSM Delivery Model Prototype Workflow Application

YAWL automated OSM related activities and tasks are explained in a video. The proto-type tool illustrates a mechanism for a process automation (workflow) system that supports and coordinates OSM-related activities. This workflow system also has the potential to integrate with other IT industry solutions (e.g., BIM, document and project management solutions).

These methods can be used to customise specific projects with specialist OSM components to support OSM adoption by enabling the Project Team to implement an OSM procurement model.

Figure 1: Level of Risk in Relation to Project Process Stage of OSM Stakeholder Engagement

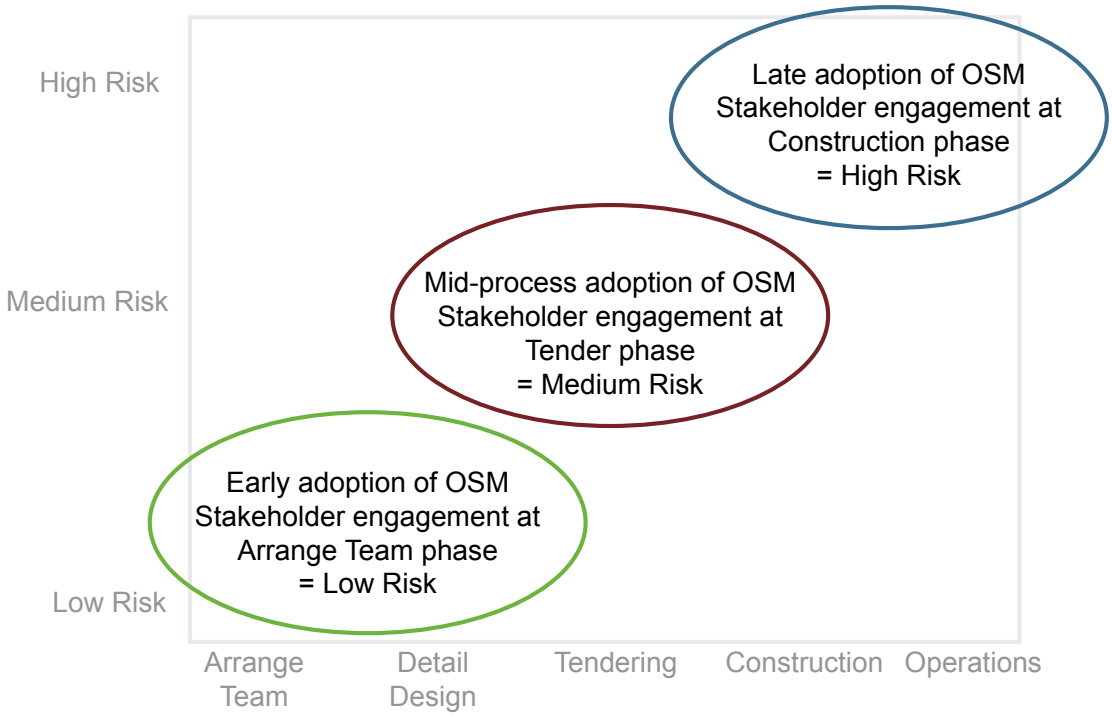


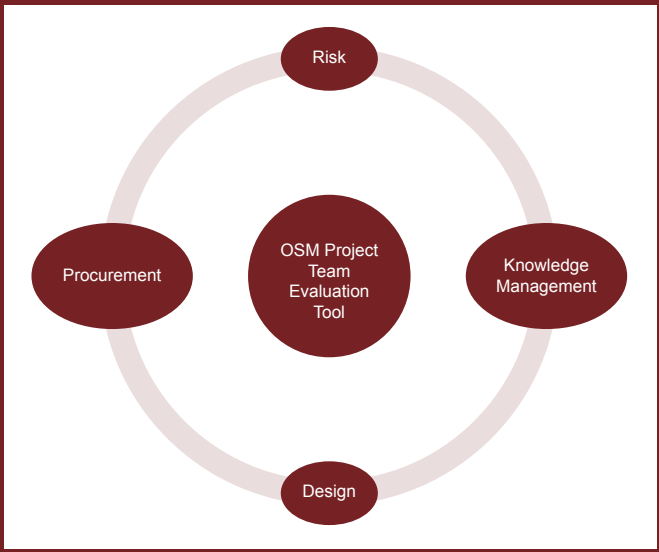
Figure 1 shows that the level of risk for successful project outcomes is related to the project team's OSM experience and knowledge of the OSM procurement model. Early adoption of the OSM procurement model, with input from a wide variety of OSM stakeholders, is considered the low risk option.

The solution

The study found that 'the earlier the better' is an important piece of advice for OSM adoption. This means that all OSM interested parties: the client, the project manager, the architect, the engineering consultants, OSM manufacturers, the construction manager, the builder, the sub-contractors, and the OSM suppliers should be involved with the project from inception. Realistically, the membership of the Project Team will change over time, as the construction progresses.

In this way the OSM procurement model transforms AEC professional relationships by enabling shared OSM expertise. The conventional construction method, Design—Bid—Build, based on task expertise is replaced with an OSM method of production that integrates design, procurement and construction through relationships. The competitive tendering process is replaced with a relationship-based project delivery strategy for increased project productivity.

Figure 2: Key Capability and Capacity Issues for OSM Project Team Evaluation



But not all clients know how to begin using an OSM procurement model. So the SBEnrc developed OSM adoption tools to motivate and enable the development of capability and capacity of OSM project teams because strategic change is necessary when using a new procurement model. The ability to change is centred on OSM capability and capacity in relation to **4 Key Issues**: Risk, Knowledge Management, Design and Procurement.

- Understanding the differences between project **risk** for conventional and OSM procurement models is a priority.
- Identifying the extent of OSM expertise as well as a range of **knowledge management** systems available can advance adopting an OSM procurement model.
- Integrating OSM at the **design** stage requires transition processes for OSM procurement strategy risk minimisation.
- If OSM is a new **procurement** strategy, clients and project teams need support for organisational change processes.

These **4 Key Issues** should be considered *after* the project requirements have been identified **but** *before* the feasibility study is undertaken. Issues of OSM capacity and capability in relation to **building constructability** should be addressed in the feasibility study to ensure that value for money is appropriately gaged.

Adopting an OSM procurement model needs details of OSM capability and capacity as indicted in Figure 2. SBEnrc has designed two tools for this purpose *OSM Project Team Evaluation Tool (V1.0)* and *OSM_ KnowledgeBank (a spreadsheet)*.

OSM Project Team Evaluation Tool (V1.0)

This tool is a device for rating the OSM capability and capacity. The tool uses a set of 19 essential OSM related questions as a framework to capture details of availability of materials, transport, production facilities, standards, codes, etc. All information is connected to a simple scoring system. The scoring system enables the client and project team to assess their knowledge of OSM capacity and capability. The indicative number can be used to evaluate: a) appropriateness of OSM Project Team members' experiences; b) level of risk based on availability of project OSM requirements; c) OSM project readiness.

OSM_KnowledgeBank (a spreadsheet)

Assembling an OSM_KnowledgeBank (spreadsheet) is a mechanism for building an OSM Project Team. This tool is a systematic method for collecting essential types of OSM capability and capacity information using essential question templates. Collection of OSM information about people, projects, products, production and processes provides the foundation for assessing or implementing an OSM project.

Benefits to industry

Off-site manufacture (OSM) is widely recognised as an effective model for improved productivity in commercial and infrastructure construction. The benefits of reduced costs and improved quality are significant. The major advantage of OSM is that the duration of the project can be significantly reduced, due to multi-location production possibilities.

SBEnrc proposes a system of enablement, based on the general acceptance that for OSM to be successful, (a) project teams must have the skills and knowledge to implement and manage it; and (b) that the project must be designed and documented with OSM in mind.

The recommendations are:

1. Ensure OSM Project Teams are organised 'as early as possible', at the Arrange Project Team stage
2. Support early adoption of the OSM procurement model, before the feasibility study
3. Facilitate input from a wide variety of OSM stakeholders before the Detail Design is completed
4. Collect essential OSM capability and fOSM capacity information to make a business case
5. Integrate OSM process and products into the total project.

Clients and projects that adopt these team building strategies will have greater success in implementing OSM and will benefit from the significant productivity gains and quality improvements that OSM can deliver.

A practical guide to the method summarised in this brochure along with the OSM Project Team Evaluation Tool (V1.0) is explained in the industry report titled *Building OSM Capablity and Capacity in Project Teams*.

Available online: www.sbenrc.com.au

The Sustainable Built Environment National Research Centre (SBEnrc) is the successor to Australia's CRC for Construction Innovation. The SBEnrc is a key research broker between industry, government and research organisations servicing the built environment.

The SBEnrc is continuing to build an enduring value-adding national research and development centre in sustainable infrastructure and building with significant support from public and private partners around Australia and internationally.

Benefits from SBEnrc activities are realised through national, industry and firm-level competitive advantages; market premiums through engagement in the collaborative research and development process; and early adoption of Centre outputs. The Centre integrates research across the economic, social and environmental sustainability areas in programs respectively titled: Driving Productivity through Innovation; People, Processes and Performance; and Greening the Built Environment.

This research wouldn't be possible without the ongoing support of our industry, government and research partners:

Queensland Government
GOVERNMENT OF WESTERN AUSTRALIA
NSW GOVERNMENT Transport Roads & Maritime Services
John Holland
PARSONS BRINCKERHOFF
Curtin University
QUT
SWINBURNE UNIVERSITY OF TECHNOLOGY

Project partners:

- QLD Dept of Housing and Public Works
- WA Dept of Finance
- John Holland
- Swinburne University of Technology
- Queensland University of Technology
- SurePoint
- PrefabNZ

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