

Improving the Supply Chain of Prefabricated Housing with Transaction Costs Considerations

Hongjuan Wu, Queena K Qian*, Henk Visscher, Ad Straub

Queena K Qian, PhD

Assistant Professor,

OTB Research for the Built Environment

Faculty of Architecture and the Built Environment

Delft University of Technology



Organisers:

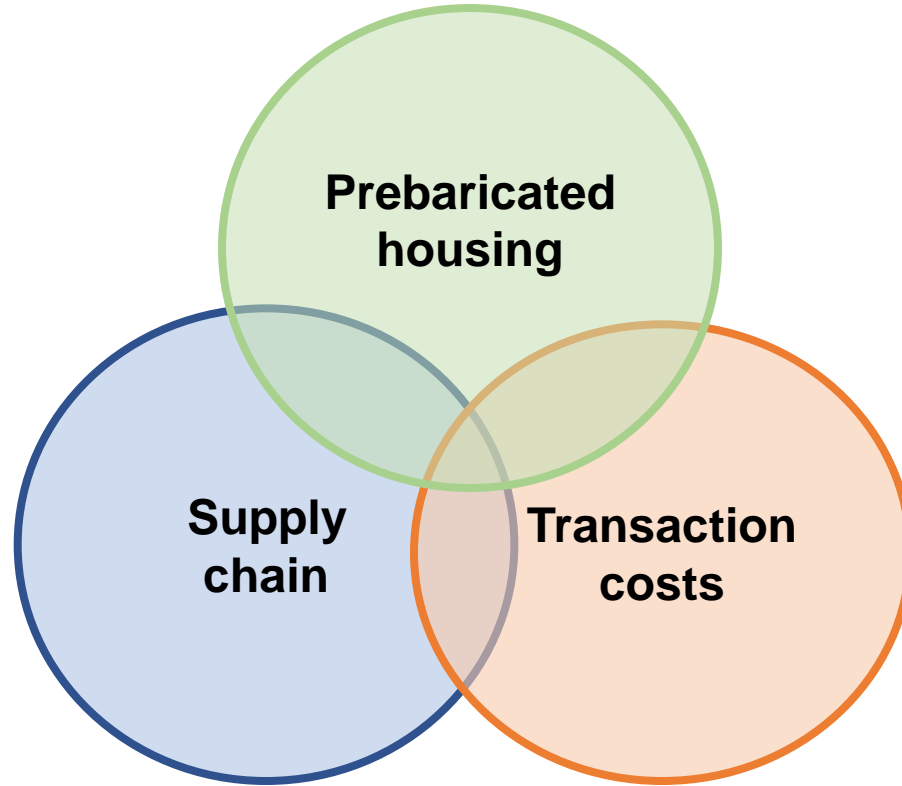


International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability





Transaction costs

Transaction costs (TCs): refer to those TCs in terms of risk, time delay, uncertainty, and information search, setting up costs as well as learning costs.

- Search Costs
- Feasibility Studies Costs
- Negotiation Costs
- Monitoring Costs
- Regulatory Approval Costs
- Insurance Costs

Reference : Lawrence Berkeley National Laboratory (LBNL)



Organisers:



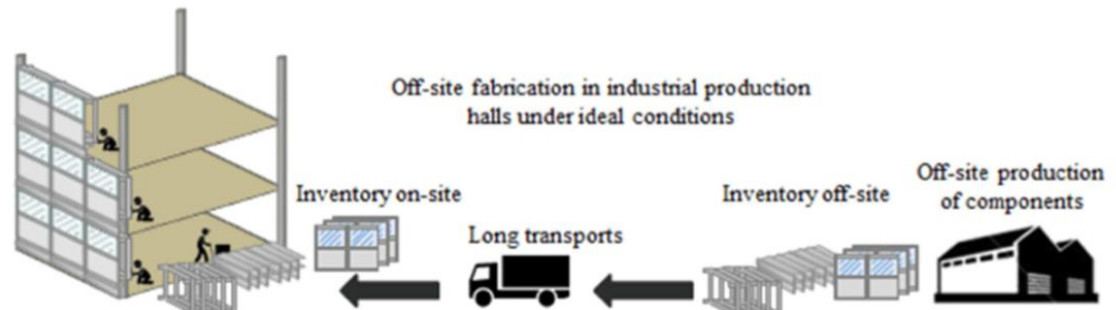
International Co-owners:



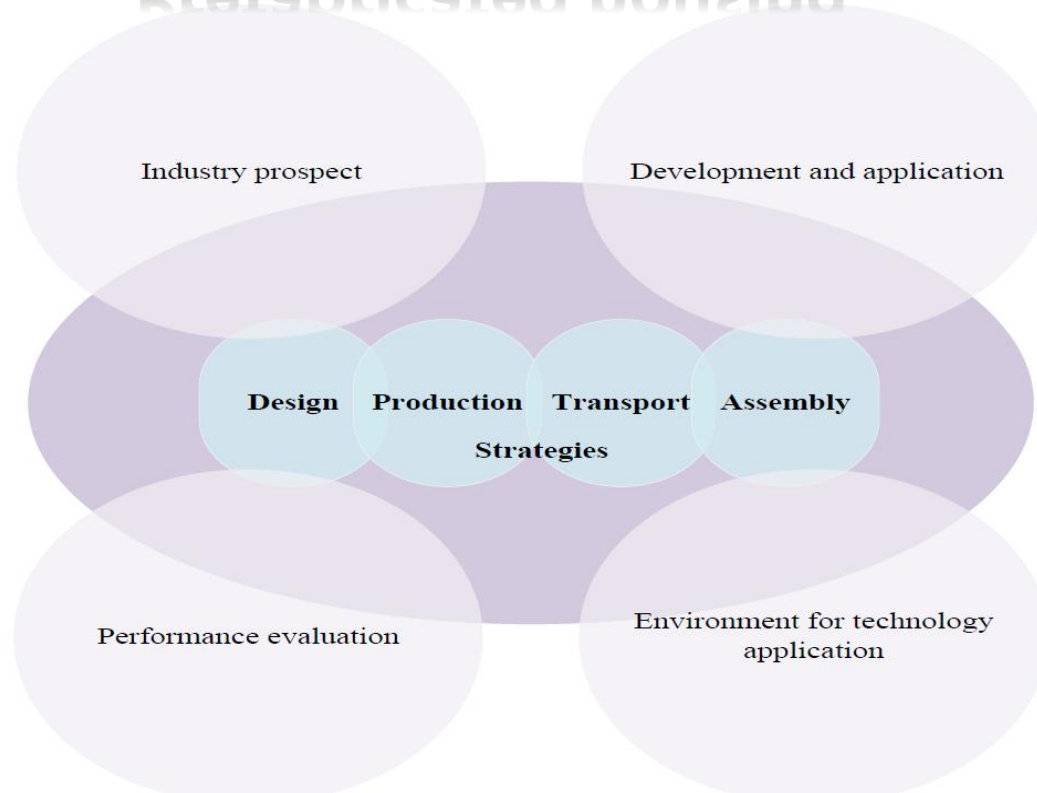
Prefabricated Housing

Prefabricated housing (PH) is a manufacturing and assembly residential production process, which can reduce cost, time, and improve the quality of the product/service compared with traditional mode.

- Time saving
- Cost saving
- Waste reduction
- Less energy consumption
- Quality improvement
- Safe work environment
- Increased capacity to cope with labor shortage



Prefabricated housing



- Few research about supply chain management of PH
- Economic problems throughout the whole supply chain of PH is rarely discussed

Supply chain management (SCM) is the integration of business processes from end user through original suppliers that provides products, services and information that add value for customers.

Manufacture industry

Construction industry



Organisers:



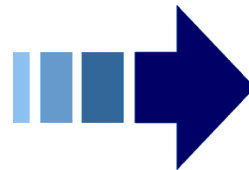
International Co-owners:



Background

Construction

- 1 • Energy consumption
- 2 • Pollution
- 3 • Source shortage
- 4 • High labour cost
- 5 • Low productivity



Sustainable



Green



Efficient

Background

BACKGROUND

- Construction is one of the pillar industries of China
- There is a great potential to promote PH in China
- Construction labour cost has been triple in the last ten years
- The authority has strongly advocated the implementation of PH



- The 12th Five-year Plan of Chinese Construction industry (2011-2015)
- The 13th Five-year Plan of Chinese Construction industry (2016-2020)



Problem statement

1 The cost of PH is still higher than expected.

It is believed that the cost of PH will decrease after the economies of scale in production are achieved (Jaillon and Poon, 2008). However, the current situation is that the construction cost raised by 40% when using off-site pre-made housing components (Chiang et al., 2006).

Problem statement

2 Less attention on hidden cost

Most researches in this area prefer to study on the production cost control to help enterprises boost profits in PH projects. However, they only focused on the normal construction cost, while there is a kind of hidden cost, Transaction costs(TCs), are relative obscure when compared with actual construction costs (Qian et al., 2015).

Most of those hidden costs are directly connected with **project management**.

Problem statement

3 Fragmented management of PH.

With a short development history, the supply chain of PH in China has not been built maturely. An incomplete supply chain causing low efficient project process management. The PH market contains many stakeholders who may potentially be involved in the execution of PH, but most of them may only focus on one certain aspect of PH.

A more holistic view - **supply chain management** - should be hold to understand the recent development of PH.



Organisers:



International Co-owners:



Problem statement

PROBLEM STATEMENT

4 Enterprises' lack of PH supply chain management experience and strategy

For enterprises, there is a conflict between innovative production process and old project management idea. As more and more cost and time are shifting from on-site to off-site, supply chain management is becoming harder and more important for individual enterprises.



Organisers:



International Co-owners:



Research question

Facing with those problems of PH in practical, understanding, analysing and improve the supply chain of PH through a TCs approach can be a feasible method to find solution.

How to smoothen PH supply chain from a TCs perspective?



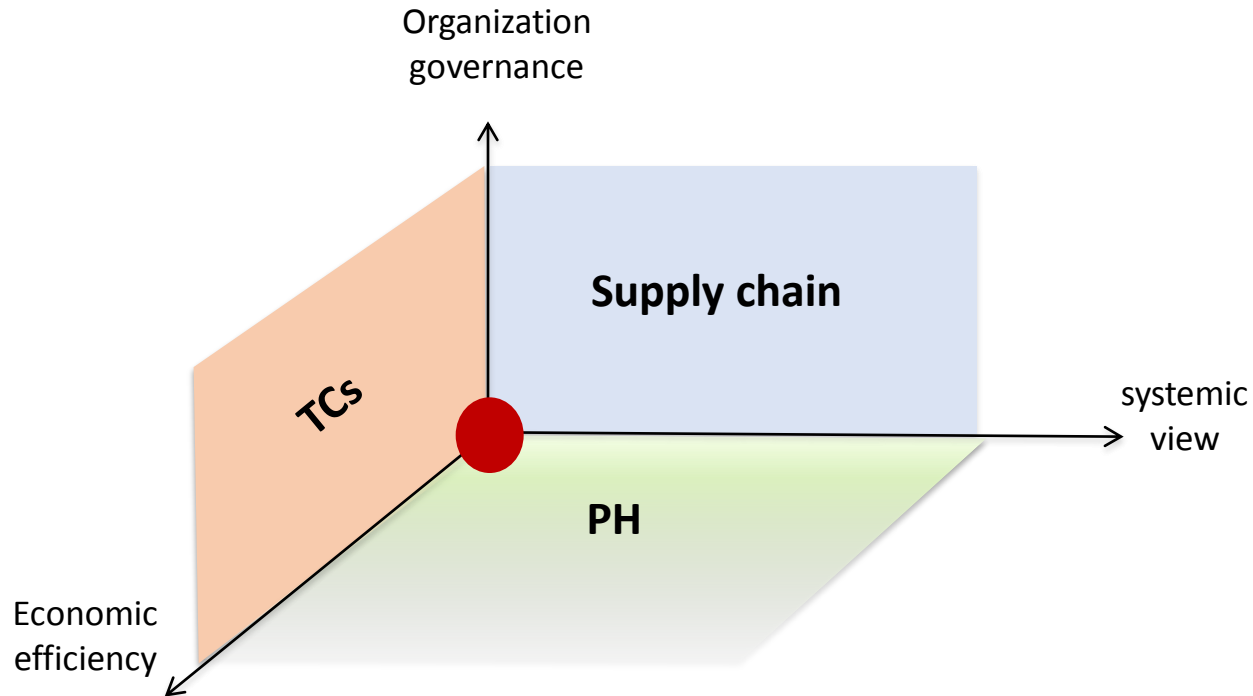
Organisers:



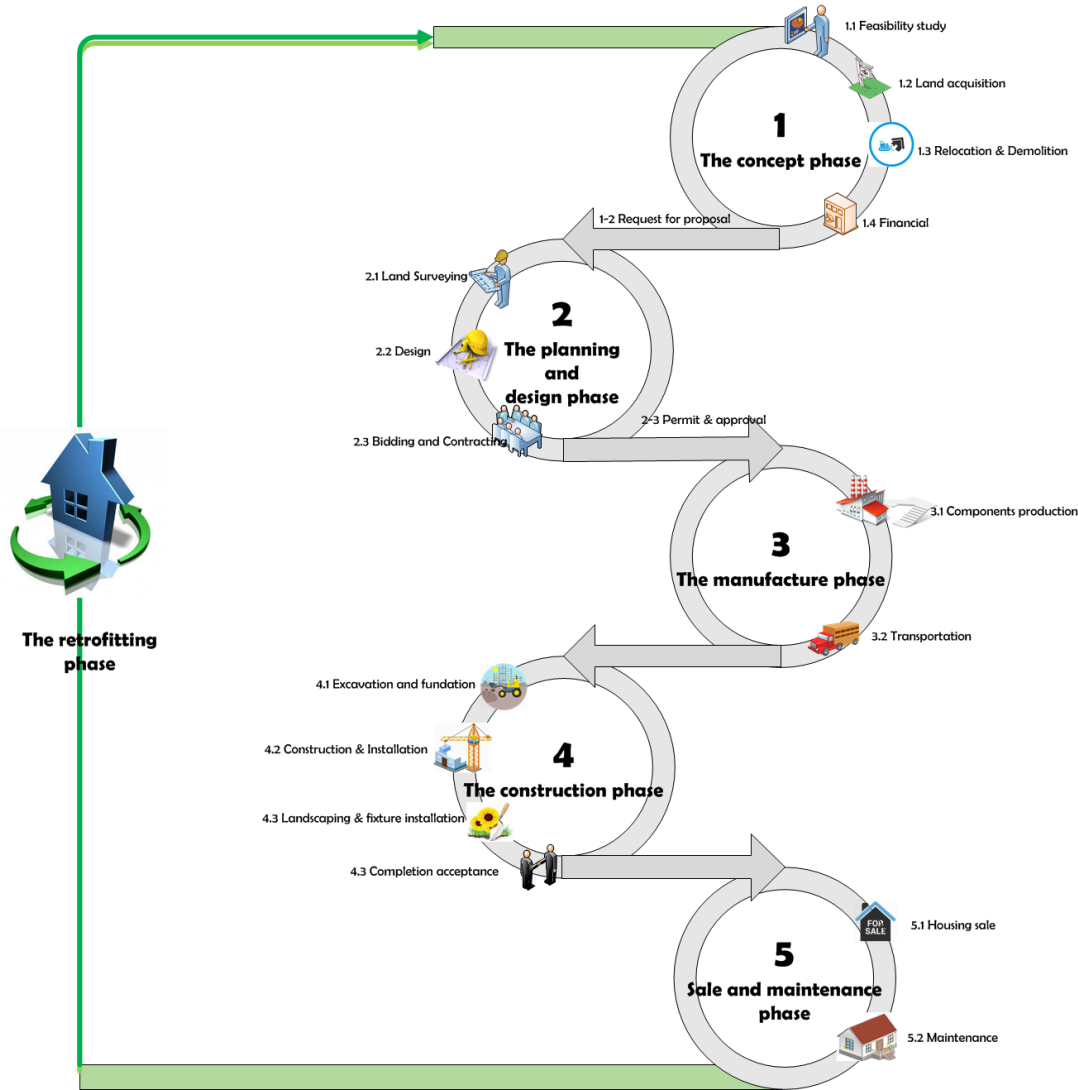
International Co-owners:



This study aims to explore the literature of supply chain management in PH area from TCs perspective to propose a framework.



1. PH & Supply chain management



2. PH & TCs

Transaction Costs	References
1. Project Search Costs	
Identifying the project	(Antinori and Sathaye, 2007)
Identifying project partners	(Nadim and Goulding, 2011)(Larsson and Simonsson, 2012)
Consultations with stakeholders	(Kamar and Hamid 2011)
The cost of making decisions to use prefabrication	(Walker and Kwong Wing, 1999)(Park et al., 2011)
others	
2. Feasibility Studies Costs	
Prefeasibility study	(Antinori and Sathaye, 2007)
Engineering/Technology Assessments	
Economic /Market Assessment	
Environmental Impact Assessment	
others	
3. Negotiations Costs	
Permit Costs	
Co-ordination Costs	(Walker and Kwong Wing, 1999)
Establishing the project organization structure	(Jaillon, 2009)(Blismas and Wakefield, 2009, Kamar et al., 2009, Lovell and Smith, 2010, Park et al., 2011)
Arranging Financing	(Pan et al., 2007)
Others	

Transaction Costs	References
4. Technical Costs	
Quality test	(Kamar et al., 2009, Pan et al., 2007, Park et al., 2011)
Transportation fee	(Smith, 2011)(Kamar et al., 2009, Park et al., 2011)
Skilled laborers	(Smith, 2011)
Storage costs	(Larsson and Simonsson, 2012)
Design fee	(Smith, 2011)
Longer lead-in times	(Goodier and Gibb, 2005)
Others	
5. Monitoring and Verification Costs	
Monitoring Agreements and Contracts	(Walker and Kwong Wing, 1999)
Purchase or Rent Special Equipments	(Smith, 2011)
Dispute solution	(Rajeh et al., 2013)
Verification and Certification	(Antinori and Sathaye, 2007)
Others	
6. Overhead	
Educating the public	(Blismas et al., 2005, Kamar et al., 2009, Pan et al., 2007)(Jaillon, 2009, Lovell and Smith, 2010)
Project Risk Insurance	
Others	

3. TCs & Supply chain

Transaction Costs	phase of the supply chain
1. Search Costs	
Identifying the project	1.1
Identifying project partners	1.4 · 2.1 · 2.2 · 2.3
Consultations with stakeholders	1.1 · 2.1 · 2.2 · 2.3
The cost of making decisions to use prefabrication	1.1
others	
2. Feasibility Studies Costs	
Prefeasibility study	1.1
Engineering/Technology Assessments	1.1
Economic /Market Assessment	1.1
Environmental Impact Assessment	1.1
others	
3. Negotiations Costs	
Permit Costs	1-2, 2-3
Co-ordination Costs	1,2,3,4
Establishing the project organization structure	1.4, 2.1, 2.2, 2.3
Arranging Financing	1.4

Transaction Costs	phase of the supply chain
4. Technical Costs	
Quality test	3.1
Transportation fee	3.2
Skilled laborers	2.2, 2.3, 3.1, 3.2, 4.2, 4.4, 5.2
Storage costs	3.1, 4.2
Extra Design fee	2.2
Longer lead-in times	1.4, 2.2, 2.3
Others	
5. Monitoring Costs	
Monitoring Agreements and Contracts	3.1, 4.1, 4.2, 4.3, 4.4
Dispute solution	3.1, 3.2, 4.1, 4.2, 4.3, 4.4
Verification and Certification	
Others	
6. Overhead	
Educating the public	5.1, 5.2
Project Risk Insurance	4, 5
Others	



Organisers:



International Co-owners:



Thank you



Organisers:



International Co-owners:

