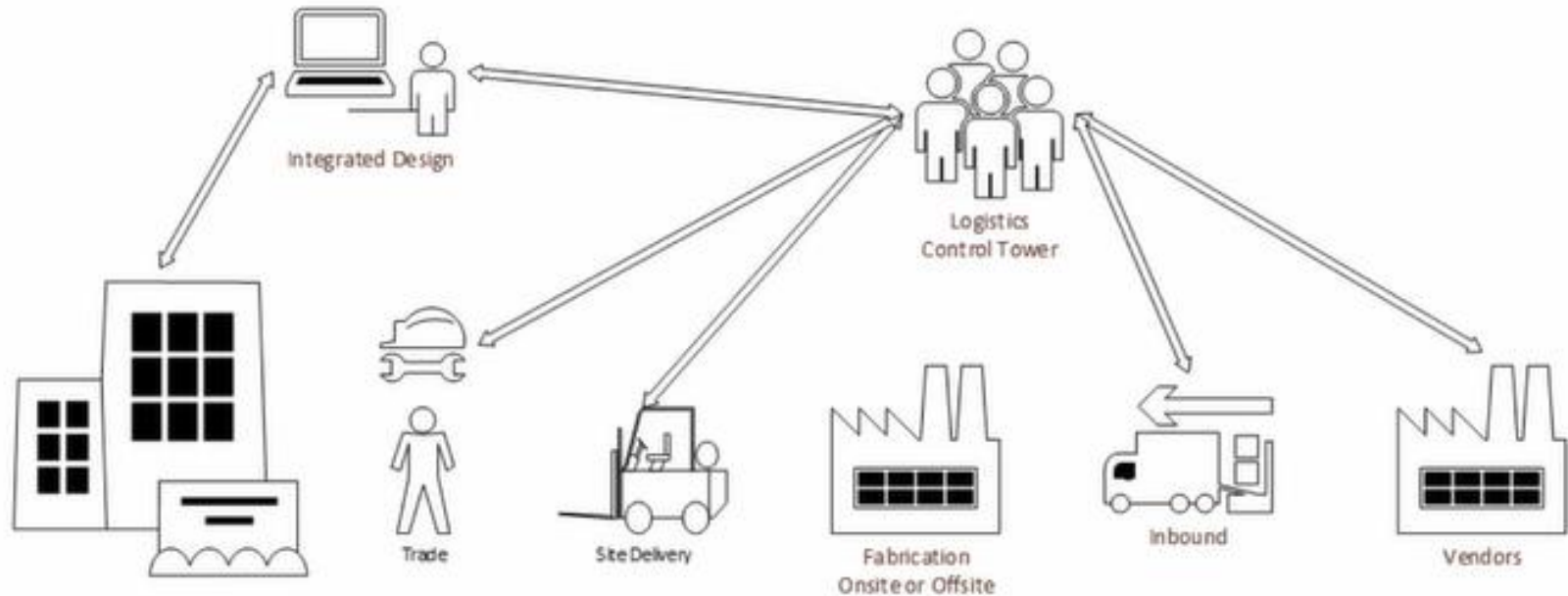


OFFSITE CONSTRUCTION IN JAPAN



OFFSITE PRINCIPLES

TOTAL PROCESS MANAGEMENT



Material
Delivery
Aligned with
Build Plan

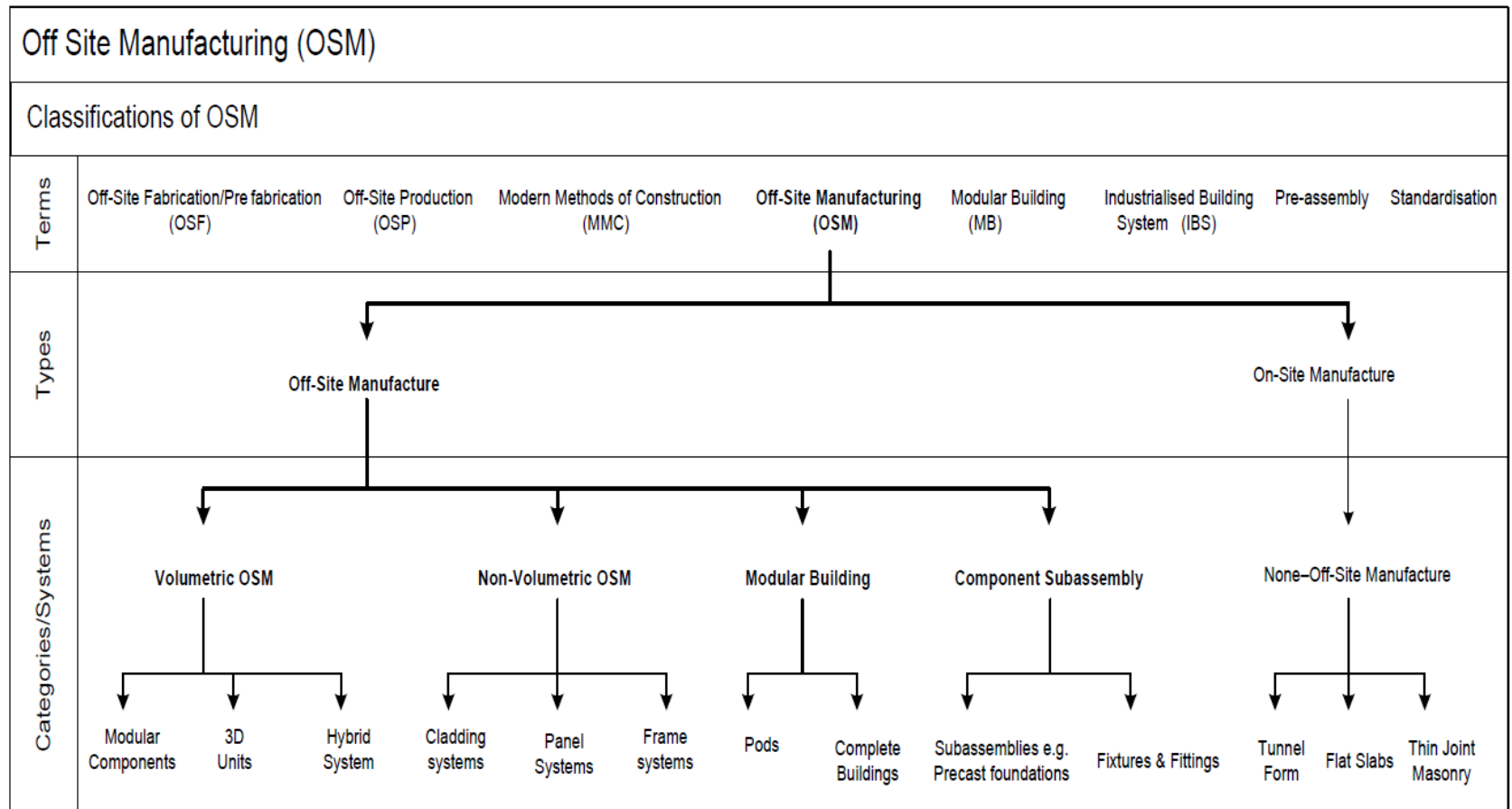


Assembly
Plan for
Materials
Aligned with
Build Plan



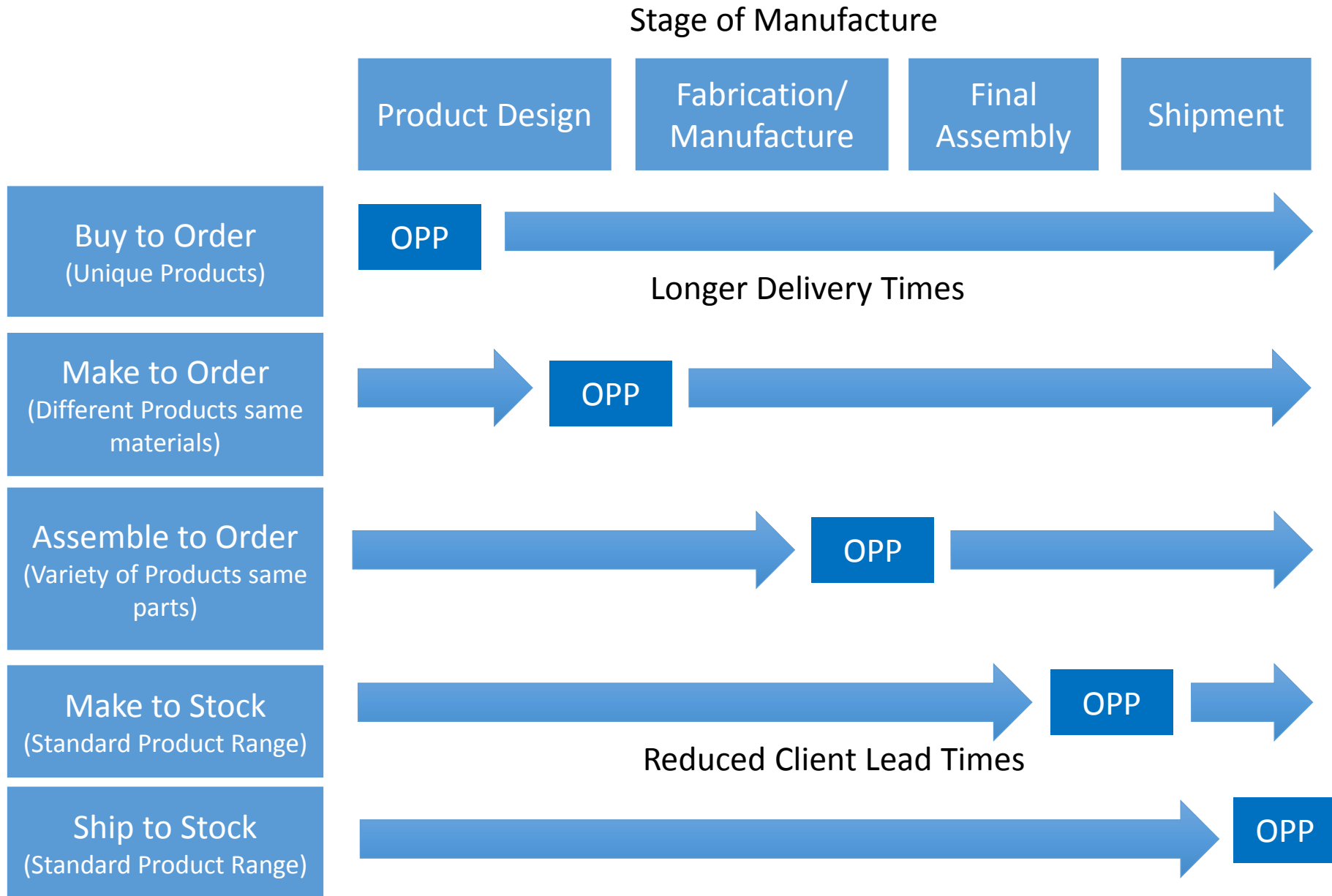
Inbound
Delivery Plan
Aligned with
Assembly and
Build Plan

CLASSIFICATION OF MODULAR FORMS



Classification of forms of Offsite Manufacture (Elhisain Elnaas 2014)

Order Penetration Point



WHAT MAKES JAPAN DIFFERENT

What makes Japan Different

- Buildable land is located in coastal areas and valleys.
- The various climates of Japan have spawned the development of local standards to cope with regional discrepancies and created several niches while complicating any overall approach to the market.
- The ability to withstand deformation and spread of fires is a particularly key requirement for buildings in a country regularly stricken by earthquakes and other extreme events.

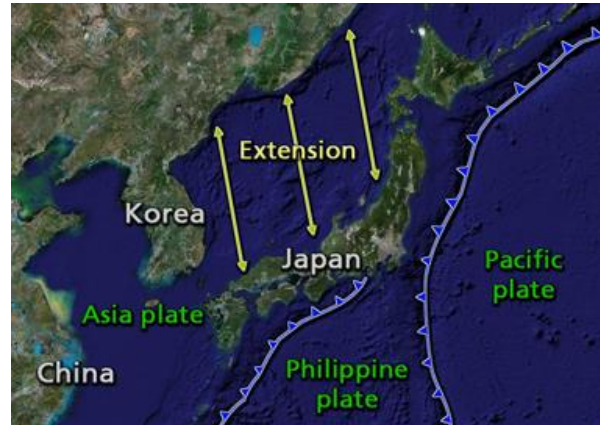
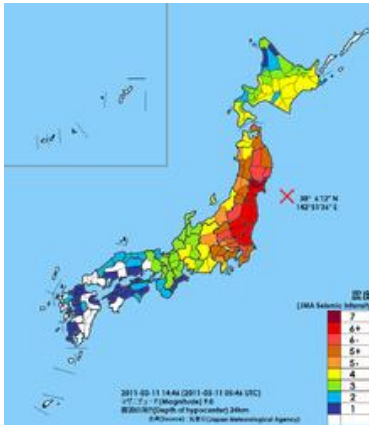
What makes Japan Different

- Despite declining trends, the population of Japan is about **25% of the EU total**, with three times higher density and huge but stable urban centres.
- In Japan, **prime contractors are liable for structural integrity and waterproofing for a decade after construction**, which makes the use of durable construction materials by subcontractors a key advantage.

What makes Japan Different

- Enacted in 2000, the **Construction Material Recycling Act** makes the contractors liable for sorting and recycling construction material waste. In 2012, about 96% of materials were recycled. Recyclability is therefore a significant aspect of BCMs.
- "This unstable environment has created a culture that accepts cycles of destruction and renewal as a natural part of life."
- Japanese prefab housing comes with a standard 20-year warranty and a strong focus on after sales service
- Sekisui House, one of the largest companies, produces 15,000 detached houses a year; the factory plant in Shizuoka produces around 20 houses per day.

Earthquakes



By Oghmoir

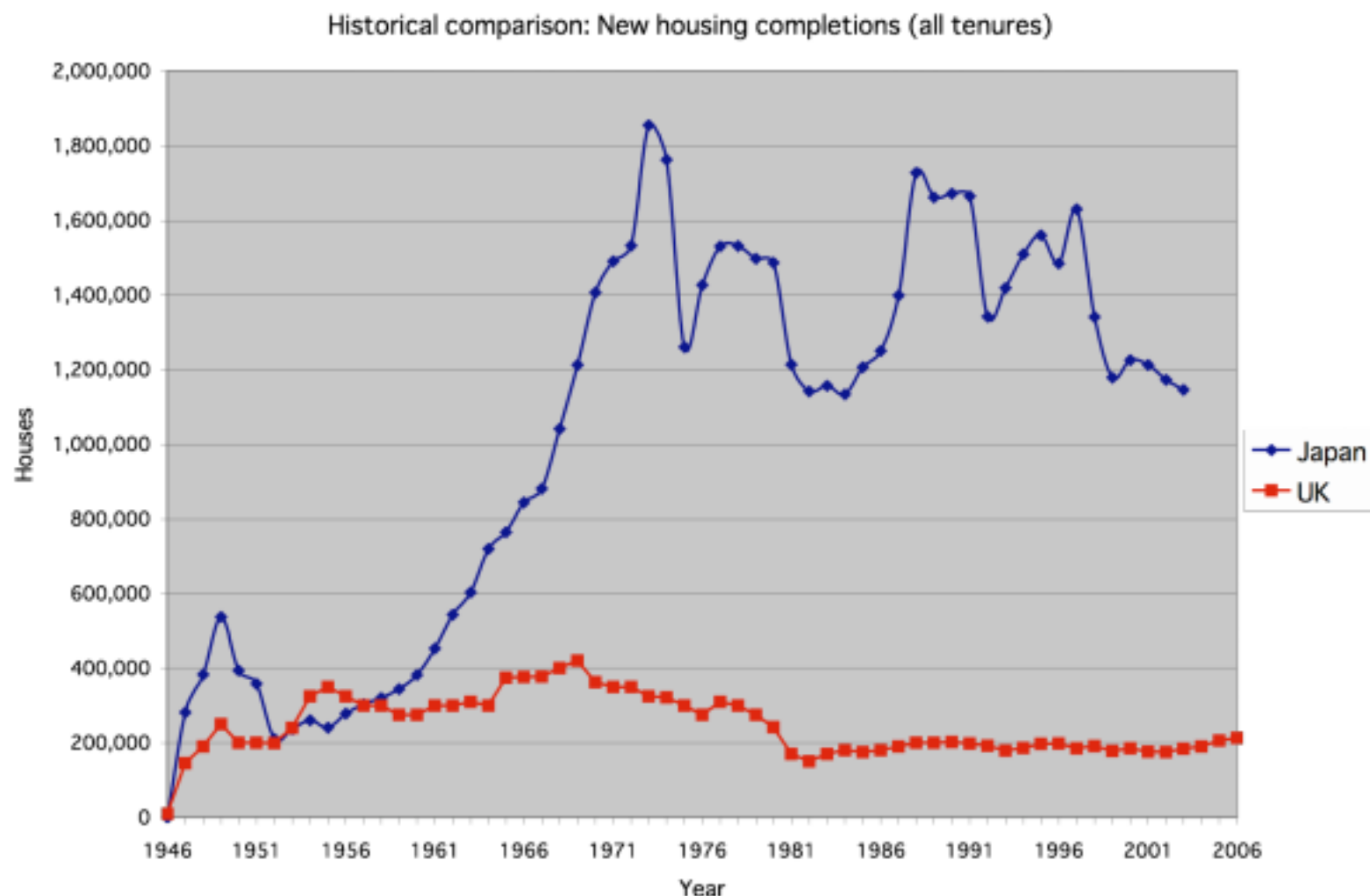


- March 11, 2011 Tōhoku earthquake
- 15,896 deaths, confirmed.
- This megathrust earthquake's hypocenter was reported to be off the Oshika Peninsula, the east coast of Tōhoku. It was the strongest to hit Japan and one of the top five largest earthquakes in the world since seismological record-keeping began. It was followed by a tsunami with waves of up to 10 m (33 ft). The disaster left thousands dead and inflicted extensive material damage to buildings and infrastructure that led to significant accidents at four major nuclear power stations.

What makes Japan Different

- Following damage caused to the country's infrastructure during the earthquakes and tsunami in 2011, the government announced plans to spend JPY6.5 trillion (US \$ 53.7 billion) between 2016 and 2021 for reconstruction in Northern Japan.

Figure 2: Housing completion in Japan and the UK since 1945



(Source: Adapted from Ministry of Land, Infrastructure and Transport (MLIT) statistics, supplied by Professor Seiichi Fukao, Tokyo Metropolitan University; Parliament Research Paper, 1999; Communities and Local Government, 2007c.)

Mortgages related to New Properties

- With mortgage lending orientated towards new-build properties, this has resulted in considerable squeezing of the second-hand housing market, which, while accounting for over 90% of total annual domestic property transactions in the UK, represents only 20% in Japan. (Barlow et al, 2003: 137; Interview: S. Matsumura)

LEAN APPROACHES

LEAN TOOLS

- 5S
- Process Cells
- TPM
- Setup Reduction
- Problem Solving
- Error Proofing
- Kanbans
- VSM
- Kaizen
- Visual Management
- Spaghetti Diagrams
- 3P
- DFM & A

LEAN CONCEPTS

Lean is the elimination of waste to improve the **flow** of information and material

8 Types of Waste:

1. Scrap/Rework
2. Transportation
3. Associate Motion
4. Wait Time
5. Inventory
6. Over Production
7. Over Processing
8. Under Utilization of People

A3

LEAN CULTURE

Bringing it all together:

- Leadership
- Communication
- Empowerment
- Teamwork

WHY LEAN ?

**SAFETY
& to make
money**

LEAN PLANNING

Create Value

- Profits
- Cash Flow
- Revenue

Leading Change

1. Sense of Urgency
2. Guiding Coalition
3. Vision & Strategy
4. Communication
5. Empowerment

Organization's Goals

What is a Lean?
Larry Rubrich



Housing units move on the production line as employees of Toyota Motor Corporation work during the installation process at the company's Kasugai Housing Works, one of the plants of Toyota home-brand houses on June 14, 2006 in Kasugai, Aichi Prefecture, Japan. The Japanese motor manufacturer Toyota entered the housing industry 30 years ago where it applies the plant technology and experience it gained through producing cars.

HOUSING FEATURES

Earthquake Resistant Modular



When the limit is exceeded, it suddenly falls. The danger cannot be avoided.



When the limit is exceeded, it gradually deforms to absorb the earthquake energy. The danger can be avoided.



Consecutive full-scale earthquake simulation testing of the xevo Σ at E-Defense

Sustainable Features



Misawa Homes Unveils Home with PV Wall Panels for Year-Round Power Generation. Because heavy accumulations of snow make it almost impossible for rooftop PV panels to generate any electricity, Misawa Homes designed a house with PV panels on the side in November 2010, and completed the prototype in May 2011.

Buy back at end of Life



- An interesting concept is that of the prefabrication company from Japan: Sekisui Heim. Sekisui Heim in China sells and guarantees that they buy back the buildings at the end of their lifecycle. These buildings are fully recyclable and are seen as a “Bank” for materials. This was only achieved through a full control of the building process.

HOUSING EXAMPLES



Sekisui House, a prefab display house at the Shizuoka Factory, Japan



Toyota Home



- Sekisui Heim

CONSTRUCTION ROBOTICS

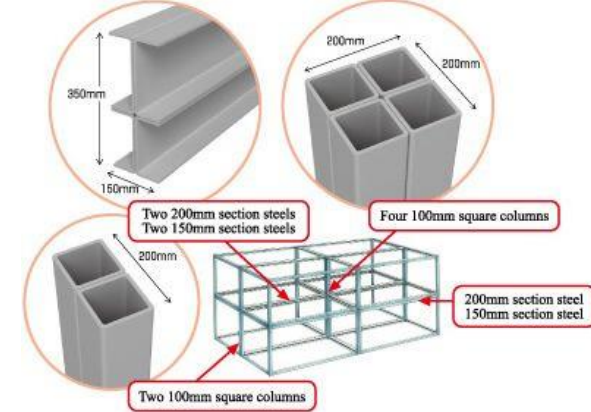


Figure 14.3 Automated workflow of the Heim manufacturing and factory assembling of units with robots. The robots position automatically various units depending on the steel component configuration. Every 3 to 5 minutes a new basic frame element is generated for the next step of wall production. (Still images: Sekisui Heim, Building my house: <https://www.youtube.com/watch?v=KWPINA6DhiM>, accessed on Oct. 6, 2013.)

Offsite MANUFACTURE JAPAN



- Due to their traditionally short lifespan, buildings in Japan are perceived as transient rather than permanent; a factor which is compounded by the Japanese preference for new homes. Residential building values consequently depreciate rapidly after construction – with many houses being deemed to be of little or no value after 10 or 15 years and likely subject to demolition costs upon renewal or sale of land.

- Barlow et al (2003: 137-8) assert that roughly half of all new completions in Japan are houses, of which over 90% are detached. Three-quarters of these newly built detached houses are commissioned by individuals and built on their own land, with speculative development accounting for just 25% of the market. This contrasts with the UK, where 80% of new homes are supplied speculatively.

- It is estimated that since 1945 the average lifespan of Japanese detached houses has risen from around 20 years to 40 years – with replacement on average occurring every 26 years. (Interview: S. Fukao; Barlow et al, 2003: 137)

- Since 1970 Japan has on average produced approximately 1,400,000 new houses per annum – the UK around 200,000. This means the volume of factory-produced prefabricated houses manufactured in Japan in 2004 actually exceeded that of total new build completions in England for that year. (DCLG, 2007c)

- “The Japanese model presumes that the physical house will be replaced every generation, with the mortgage mechanism concentrated on site value. This is being realistic about the longevity and flexibility of offsite constructions, but of course it is also culturally appropriate... The British prefer to constantly repair and remodel, valuing patina and historic character.”

(Richard Saxon CBE. Personal email, 3 July 2007.)

- The Japanese private housing sector, prefabricated housing manufacturers dominating a significant proportion of the housing market.
- Daiwa House Industry Co., Ltd. (大和ハウス工業株式会社 Daiwa Hausu Kōgyō Kabushiki-gaisha) is Japan's largest homebuilder

Figure 1: Daiwa House Industry prefabricated homes since 1955



Pipe House

1955



Midget House

1959



Daiwa House
A Type

1962



Sweet Home 20

1975



Daiwa House
Solar DH-1

1977



Legrand free system

1985



Statement

1995



Typical model

2007

(Source: Daiwa House Industry Co., Ltd., 2007)

- While prefabricated single-family homes have only accounted for approximately 14% of all housing completions in Japan over recent years, the particularly high volume of housing starts means that on average over 160,000 prefabricated units are produced annually.
- (See Figure 2; Sekisui House Ltd., 2004) This is almost equivalent to the entire output of the UK housebuilding industry, which produced 213,372 residential units in 2006; with only around 1% fabricated offsite.

- Japanese prefabricated housing manufacturers have developed sophisticated production and marketing processes to maintain their competitive position within the domestic housing market.

Any QUESTIONS ?

質問

