

# DEMATERIALIZATION OF CONSTRUCTION RELATED INDUSTRY BY APPLICATION OF SERVICE LEVEL AGREEMENT CONTRACT

Satoshi YOSHIDA M.Eng. M.S.<sup>1</sup>  
Tomonari YASHIRO Dr.Eng.<sup>2</sup>  
Kenji MISHIMOTO M.Eng.<sup>3</sup>  
Hiroyuki SHIDA B.Eng.<sup>4</sup>

<sup>1</sup> Be-508, Institute of Industrial Science, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan, yoshidas@iis.u-tokyo.ac.jp

<sup>2</sup> Be-507, Institute of Industrial Science, University of Tokyo, yashiro@iis.u-tokyo.ac.jp

<sup>3</sup> Be-507, Institute of Industrial Science, University of Tokyo, nisimoto@iis.u-tokyo.ac.jp

<sup>4</sup> Be-508, Institute of Industrial Science, University of Tokyo, shida@iis.u-tokyo.ac.jp

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## Summary

For promotion of construction ecology, it is essential to create a method of dematerialization of construction industry. The authors have proposed the concept of "service provider" as key principle of dematerialization of construction industry. While "product provider" gets the revenue by providing building as a product, "service provider" gets the revenue by providing service generated by building as a device. By creating and by evolution of new business model of "service provider", resource productivity of building is expected to be fundamentally improved, because industrial sectors do not need to use enormous quantity of resources to generate value by new building.

Based on the idea, the authors have tried to develop new business model where infills (= fit outs) of buildings are leased or rented as a device to provide services. The new business model developed by the authors demonstrated to general public through mock-up infill system model rooms. The demonstration raised the concern of sectors in building industry and several sectors created various business models. The paper introduced some examples of new service providing business model in Japan.

In order to prevent probable conflict that could be serious constrains for evolution of service providing business, through the collaboration with legal experts, the authors tried to design the standard contract format for infill leasing business as a prototype contract for service providing business. The designed standard contract format is based on the service level agreement (SLA) contract. The paper presents the structure of the standard contract format for infill leasing based on SLA, and it illustrates the method to define the scope and level of service generated by infill leasing in contractual document.

## 1. Introduction

Industrial ecology evolution in building related economic activities is a key issue for fundamental improvement of resource productivity in construction. This paper illustrates an experimental project of infill base phased refurbishment. The methodology developed by the experimental projects is based on the idea to define infill as movable property. The methodology is composed of those for demountable and movable infill system as well as those for attracting investment to refurbishment by which the investment is independent from financial difficulty of building owners. The paper also presents insights and lessons from an ongoing R&D project based on the service provider concept that is based on potential policy design to facilitate refurbishment using the developed methodology.

## 2. The idea of the service provider for better resource productivity

Product providers, which currently constitute most of the building sector, generate their revenues by providing 'products' to customers. A larger quantity of resource input brings larger revenue to product providers. Thus, the nature of the product providers' business gives weak incentives to dematerialization. On the other hand, service providers get their revenue by providing services to customers. For service providers, building is a device for supplying services, and the quality of service does not depend on the quantity of resource. Thus, the business model of the service provider has the potential to promote dematerialization.

Definition of infill as movable property can be alternative solution; If infill could be treated as movable property, infill can be the interdependent device to generate exclusive cash flow by getting revenue for providing 'services' embodied with the infill space. 'Services' here means convenience, comfort, security and various benefits embodied with function and performance of buildings. Eventually, the provider of services of infill can be termed as service provider as it is shown in Figure 1.

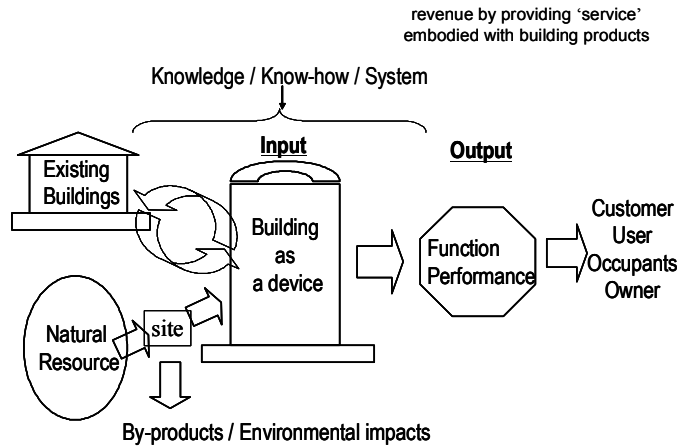


Figure 1 Idea of service provider

By defining infill as movable property used for generating services, cash flow generated can be understood as the output of independent project to provide customers services of infill. Thus, the diagram in Figure 1 indicates new business model; the model is expected to attract investment through project based finance scheme where magnitude of expectancy and risk of generating cash flow by providing service of infill is main concern by various investors.

### 3. Demonstration Projects of Service Provider; Leasing of prefabricated Infill Components

#### 3.1 Infill Components as Movable Property

The idea to define and treat infill of building as movable property, as it is illustrated by the diagram shown in Figure 2, can be the key idea for the integrated methodology. In the diagram, a building is separated into two parts; skeleton and infill. Skeleton can be termed as base building and includes structure, fabric and building services for common use such as lift, stair case, vertical pipe and wires, equipments for energy and water supply to whole buildings etc. Infill can be termed as fit-out and includes all installation and finishing to each spatial department of interior.

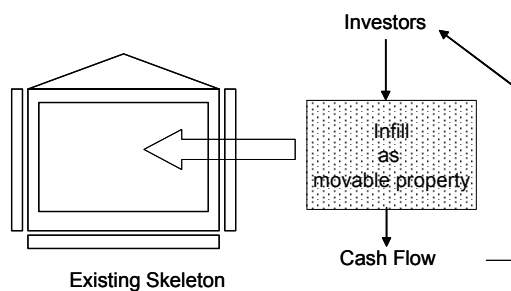


Figure 2 Infill as movable property could be the device to generate independent cash flow that is nothing to do with stakeholders to existing skeleton

There are two points for the integrated methodology with this viewpoint. First, attachable and detachable nature of infill as movable property has potential advantage to create the innovative method to enable quick installation and removable of infill like furniture. The method could be the seed for solution against probable inefficiency and inconsistency by spatially and temporally fragmented refurbishment works.

Second, more importantly, if skeleton and infill can be completely separated by refurbishment, probable complicated financial and legal relationship with various stakeholders around building's owner can be enclosed within the scope skeleton. In another word, the separation of skeleton and infill could make infill free from entangled relationship around building's owner.

### 3.2 Context and motivation

In the current business environment off-site infill component fabricators are typical product providers. The revenue of component fabricators depends on how many products are sold. In most cases, their task is completed when they sell their product.

However, because of the below mentioned context of the Japanese case, the authors identified the leasing business of infill components to generate sufficient feasibility and that it could be an effective demonstrator of the service provider business model.

- The infill component industry is powerful in terms of market share and innovation ability in Japan.
- Fabricators of off-site made infill components are seriously seeking new business areas, especially in refurbishment.
- Current social and economic circumstances accelerate the transition of requirement by building occupants and residents.
- Without reuse and/or recycling, frequent replacement of installed infill components has the risk to increase waste production.

### 3.3 Potential benefits

In the product provider's business model, products are handled in a one-way flow from production to usage to disposal. By contrast, in the leasing business model, products are returned to the supplier from the previous customer and re-manufactured for the succeeding customer. Thus, the repetitive use of 'devices' reduces the cost for transaction procedures of the business. Eventually, the leasing business is expected to give incentives to 'device' suppliers to create re-usability methods for infill components.

By enhancing the leasing business to a package of long term maintenance and upgrading service, occupants and residents can enjoy assured quality of services embodied with functions and performance of components for the duration of the contract. Though there is a risk for the suppliers' side on future expenses for maintenance and repair, it also could be beneficial for suppliers because of the potential to increase business opportunities reflecting the accelerated change of requirements.

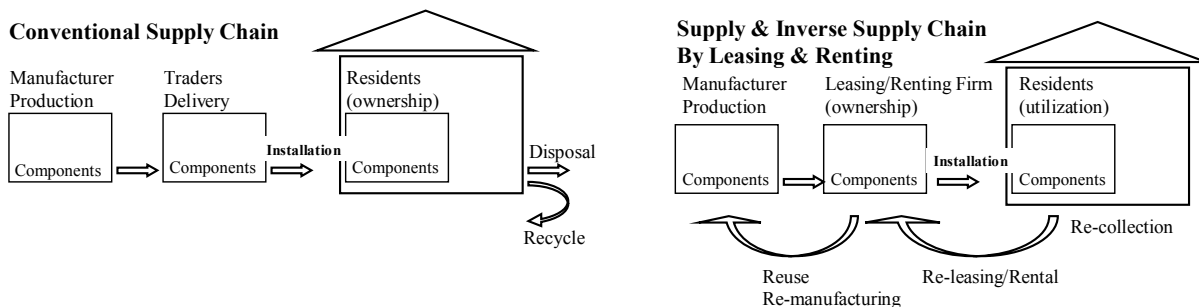


Figure 3 Sustainable system with leasing model

### 3.4 Requirements to define infill as movable property

Definition of infill as a movable property could be the key idea to establish integrated methodologies to enhance refurbishment in Japanese contexts by breaking through physical and financial constrains. Then the following question is emerged; Is it legally and technically feasible to define infill as movable property?

Fortunately the author got the government research fund from FY2001 to FY2003 to implement feasibility of the definition and the new business model. The title of subsidized project is 'Morphological technology development toward redefinition of improved urban amenity'. The project is required to be, and is actually to be, implemented by academics - industry joined consortium. Key items to being investigated are;

Identification of legal requirements to treat infill as movable property

Demountable and adaptable infill system as movable independent property

The first and second item above give answers to the question on feasibility of the definition of infill as movable property.

The author collaborated with barrister to analyze legal case precedents on legal debates and conflicts relating to the independence of infill from skeleton. Though the final conclusion is varied in those cases, criteria of judgment are consistent among those cases. The courts give judgment based on the following criteria.

Demountability of elements of infill

Degree of socio-economic disadvantage by removal of infill

If elements of an infill are demountable without any damage to skeleton and if removal of infill does not generate serious socio-economic disadvantage by assuring re-usability of removed second-hand elements in other sites, the court judged that the infill is independent property from skeleton. In case removal of infill generate serious socio-economic disadvantage such as serious inconvenience of base building or such as quite a few waste production etc., the court judged that the infill is attached object to skeleton.

Though the judgment precedents do not have strong legal status, the consistency in the criteria of judgment could be the basis for legal requirement to define infill as movable property. Therefore, the author understood that the following is the legal requirements to treat infill as movable property.

Elements of infill are visibly or apparently demountable from skeleton within considerably short period of time and cost acceptable for end user or customer

Removed elements of infill are re-usable in other sites, and removal of infill does not cause unacceptable nuisance, inconvenience and damage to the stakeholders of the building

### **3.5 Demonstration Project**

In order to verify the feasibility of developed methodology for refurbishment based on the idea of infill as movable property, the developed infill system was installed to actually vacant building located in Tokyo.

The plan is composed of three module 'boxes' standing on the raised floor. Three boxes include those for kitchen, for bathroom and for toilet. The boxes are easily demountable and movable, thus the plan has been re-fitted from first phase to second phase. The re-fitting took only four days with two operatives. This fact suggests that the developed infill system has feasible adaptability to ever-changing various requirements by easily movable 'boxes', In addition, the fact also indicates that infill systems are demountable and reusable in the other buildings.

More than 500 people visited the site of demonstration project that includes those from local residents, local authority, community-based organizations, banking and financial facilities and building related industry. The author got positive offers from demand side sectors like financial institutions, local authorities and buildings' owners, and from supply side sectors which learned the significance of supply chain management and customization to individual customers. The project gave considerable impacts on both on demand side and supply side sectors.

In downtown area in Tokyo, Osaka and other mega-cities in Japan, small and medium size buildings for offices for rent are now losing tenancy because of reduction of demand and increase of new supply by recently completed large size urban renewal projects. Though those areas have historically significance with mix used compact neighbourhood, small and medium size buildings for offices are getting vacant. In some area, rent for flat is considerably higher than the rent for office, thus, many groups standing on suppliers' side believe and expect conversion from office to flat has economic feasibility like the examples in European cities where whole buildings are dramatically refurbished. Certainly, several successful examples of 'from offices to rent' are emerging in Japan.

## **4 Impact by demonstration project ; Emerging Service Provider**

This demonstration showed the practical method of infill lease model, and several companies related to construction have strong interesting in this project. Some of the companies and institutes have already started to develop new practical business model based on the concept. There are several examples of new service providing business model in Japan including leasing of elevators and building service equipments, clean air providing contract business as an alternative of providing air-cleaning equipment, office function providing services and etc. These business models focus on the utilization fee based on continuous maintenance instead of construction fee. The idea has same viewpoint as cell phone business and communication network business, which focuses on the profit of lasting service contract in place of temporary trade.

Shin Nippon Air Technologies, one of the Japanese mechanical companies, created a business model with leasing mechanical equipments including air conditioning units. Their idea is to provide financial merit to customers. The customers need not own the equipments, so they can reduce the initial cost that put a strain on customers' finances. The total customers' cost for air conditioning including maintenance is almost same as the case to purchase these equipments at the standing point of long-term cash flow.

In the other case, Mitsubishi Electric Building Techno-Service, one of the elevator maintenance companies, provides the total building mechanical and electrical equipments leasing system, including elevators, air conditioning equipments, plumbing equipments, electronic transformer equipments, automatic doors etc.. Customers reduce the large initial cost and the special staff to take care maintenance of these equipments.

The list of the examples of impact by demonstration project is as follow. In every case, customer need not buy physical objects, and the supplier provide service as follow.

Table 1 Service Business Models based on Service Provide in Japan

	lease service
Shin Nippon Air Technologies Co. Ltd.	air condition system with maintenance
Mitsubishi Electric Building Techno-Service Co. Ltd.	electric light bulb, fluorescent light tube
Matsushita Electric Industrial Co., Ltd.	mechanical & electronical equipment
CW Facility Solution Inc.	finishing, furniture, security

(Source; 2004-7-26 Nikkei Architecture, 2004, pp073-pp077)

## 5. Service Level Agreement (SLA) for contractual agreement

### 5.1 Concept of SLA

In order to evolve and disseminate these new business models in market place, it is essential to establish contractual method between customers and service providers, because 'service' generated by building is invisible. Without clear contractual agreement of the scope and definition of service, conflict could be generated between supplier and customer.

In order to prevent probable conflict that could be serious constrains for evolution of service providing business, through the collaboration with lawyers, the authors tried to design the standard contract format for infill leasing business as a prototype contract for service providing business. The designed standard contract format is based on the service level agreement (SLA) contract which is generally used in software industry. In this case, the provider, that offers various services, warrants the quality of continuous service.

### 5.2 The structure of the standard contract for infill leasing based on SLA

It is necessary to define the "service" to make a clear contractual agreement between supplier and customer. Without clear contractual agreement of the scope and definition of service, conflict could be generated.

Firstly, it is important to understand the basic functions of requirement. Each "object" has its own requirement that is composed with three items, "structure", "initial specification" and "maintenance specification." For example, toilet seat has a "structure" with Body, Tank, Piping and Toilet Paper Holder. Each item need to be decided its "initial specification" with a clear standard. "Maintenance specification" of toilet seat is several items such as cleanliness of seat, non-condensation of tank and pipe, noise reduction, wash power, strength of seat or trap function.

Secondly, it is necessary to get the information of customer's requirement, and the point is how to understand each customer's requirement. Table 2 is a part of check-list customer's check list that is the tool to understand the customer's requirement, and this list includes the physical measurement and commissioning.

It is necessary to make clear Initial Specification and Maintenance Specification including physical service for supplier and customer, because subjective judgment must be removed from the contract. Check-list is the tool by which suppliers and customers periodically could have common understanding on the content and benchmarking of services, so this proposal planes other check-list on each step. Especially, quality and specification check-list for maintenance indicates the necessity of customer's requirement and common maintenance

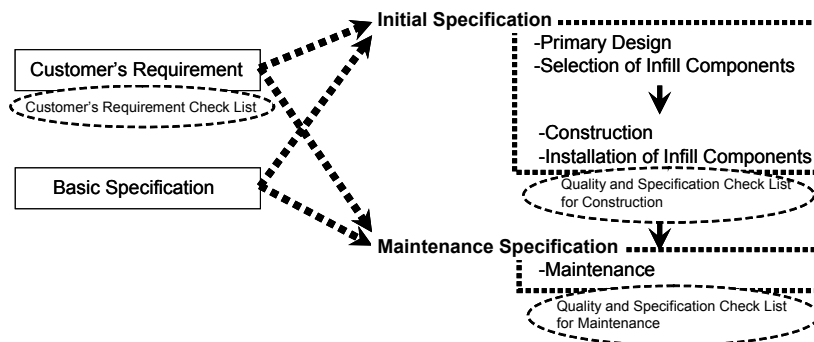


Figure 6 Framework of Initial Specification and Maintenance Specification

Table 2 A part of Customer's Requirement Check-List

Toilet Box	quantity	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> ( )	Parts in Toilet Box	toilet seat	<input type="checkbox"/> yes	
	size	<input type="checkbox"/> 1200 <input type="checkbox"/> 1800 <input type="checkbox"/> ( )		washbowl	*manufacturer( ) product no.( )	
	depth	<input type="checkbox"/> 1200 <input type="checkbox"/> 1800 <input type="checkbox"/> ( )		shower toilet	<input type="checkbox"/> yes	
	height	<input type="checkbox"/> 2100 <input type="checkbox"/> 2300 <input type="checkbox"/> 2400 <input type="checkbox"/> ( )		washing pump	*manufacturer( ) product no.( )	
	exterior	wall material <input type="checkbox"/> aluminum <input type="checkbox"/> board <input type="checkbox"/> membrane <input type="checkbox"/> ( )		socket	quantity <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> ( )	
		finish *manufacturer( ) product no.( )		requirement ( )	switch	quantity <input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> ( )
	interior	wall material <input type="checkbox"/> aluminum <input type="checkbox"/> board <input type="checkbox"/> membrane <input type="checkbox"/> ( )		requirement ( )	lighting	*manufacturer( ) product no.( )
		finish *manufacturer( ) product no.( )		handrail	<input type="checkbox"/> yes	
	floor	finish <input type="checkbox"/> wooden <input type="checkbox"/> plastic tile <input type="checkbox"/> carpet tile <input type="checkbox"/> ( )			*manufacturer( ) product no.( )	
		heating system <input type="checkbox"/> yes				
		*manufacturer( ) product no.( )				
	ceiling	material <input type="checkbox"/> aluminum <input type="checkbox"/> board <input type="checkbox"/> membrane <input type="checkbox"/> ( )				
		finish *manufacturer( ) product no.( )				

The contract is based on the information of these check-lists. It is necessary to make clear the right and duty for customer, supplier and property owner. Following table is the standard contract outline for infill leasing business as a prototype contract for service providing business. Through the collaboration with legal experts, we tried to make clear the points that prevent probable conflict that could be serious constrains for evolution of service providing business.

- Provisions (purpose of contract, outline of service, contract schedule)
- Infill Design Service (basic design, basic design revise, construction document, construction document revise)
- Infill Installation Service (procurement of infill, infill installation, customer's inspection of infill)
- Service with Infill
- Infill Maintenance Service (supplier's maintenance, customer's maintenance, insurance of infill, damage of infill)
- Infill Removal Service
- Revise of Infill Component
- Payment for Service
- Responsibility of Infill Accident
- Contract Period

## 6. Concluding Comments

This brief discussion paper illustrates the integrated methodology to facilitate phased refurbishment by re-fitting infill based on service level agreement (SLA). The value of infill base phased refurbishment is dependent on the degree of cooperation with agreed visions of the district by stakeholders and the degree of customization to each user and customer. So the methodology to get the agreement without misunderstanding between customer and supplier is essential to establish new contract model

The new business model for infill base phased refurbishment illustrated in this paper still has the legal incompleteness in terms of judgment on independence of infill from skeleton. To exclude the legal incompleteness, special law termed as Infill Act need to be drafted at the Parliament. However, for generating the initiatives and appeal for new Act, there is a need to demonstrate real examples by which general public understand the potential benefit by separation of infill from skeleton.

## References

- Yashiro, T., 2000. From product provider to service provider – Relevant industrial change for sustainable building implementation f international conference sustainable building 2000, 22-25 October 2000, Maastricht, The Netherlands, Aeneas Technical publishers (ISBN: 90-75365-36-5), pp79-81
- Yashiro, T. and Murata, T., 2001. "Life Cycle Value Index" for Industry Ecology in Housing. Proc. of Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing (EcoDesign 2001), IEEE Computer Society, pp892-pp894
- Yashiro, T., 2003. Service Provider, Shoukoku-sha
- Yashiro, T., Tomiyama T., Nishimoto K., Yamazaki K., Maruyama J., Yuki E., Hirose A. and Yamada H., Legal and contractual feasibility and potential of leasing of Infills, AIJ 18<sup>th</sup> Kenchiku Seisan Symposium, 2002, pp7-12