CASE STUDY OF ROLES IN REHABILITATION

International Comparative Research on Rehabilitation Methods of Multi-family Dwellings Constructed during the Mass-Housing Period

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What is most important at present is how to renovate and rehabilitate many of the buildings constructed during the mass-housing period, especially the multi-family dwellings. We carried out this research with the purpose of gaining a perspective on the business of multi-family housing stock rehabilitation. This case study shows the results of the following analyses in our recent field research on rehabilitation, which was carried out in 6 countries; Denmark, France, Germany, the Netherlands, the United States of America and Japan.

1. *Analysis of roles of agents involved in rehabilitation such as design office, general contractor and subcontractor, and status of their training on rehabilitation, in order to determine how they contribute to promote efficiency of operation of the entire work group.*
2. *Analysis of know-how of individual roles in order to determine how it influences devices and innovation of rehabilitation methods.*

1. INTRODUCTION

1.1 Purpose, background and positioning

The period over which a great number of houses were systematically supplied, mainly in the form of multi-family housing, in order to cope with the postwar large-scale housing shortage is called the "mass housing period". In Japanese history, this applies to the time period from 1960's till the first half of 70's. Later in the second half of 70's, many developed countries came to take up the multi-family dwellings constructed during the mass housing period as an object of reassessment due to the uniformity of dwelling unit plans and residential building plots, and the low standards. Part of the dwellings has already been changed into new resource for various uses. However, many of them are still lived in and constitute a large part of the total housing stock in most of developed countries. Taking this background into consideration, it is an important issue to decide how to work on many houses constructed during the mass housing period, especially multi-family dwellings, and rehabilitate them into a suitable stock for residents to continue to live in.

In the light of such circumstances, our past international comparative research[*1] (see References) clarified details of rehabilitation of multi-family dwellings constructed during the mass housing period in overseas countries, including financial conditions concerning costs and expense-sharing and organizational issues problems involving residents. However, it is still unknown how the agents (referring to firms and offices) handle rehabilitation both systematically and technically, and to what extent they have common knowledge/understanding about problems underlying the rehabilitation business as well as feasible ideas to increase efficiency. It appears that they are separately groping for solutions within individual organizations.

This study determines the characteristics of rehabilitation processes, which require a special technical basis that is different from the basis for new construction, by the results of a research. We conducted this research in 5 overseas countries; Denmark, France, Germany, the Netherlands, the United States, where in fact the share of rehabilitation ranges from 40% to 60% of the total construction volume, and Japan (a total of 6 countries). We further analyzed responsibilities of roles in rehabilitation, including design office, general contractor and subcontractor (whose main job

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is specialized in a certain part of construction work, such as painting and waterproofing), to provide findings on know-how which brings efficiency to rehabilitation process as well as those on specialized organizations and educational systems that background the know-how. The purpose of this study is to offer suggestions on functions that agents involved in rehabilitation work in Japan may need to possess in the future.

1.2 Methods and Materials

In the 6 countries mentioned above, we conducted an interview-style research of 22 subcontractors, 2 general contractors, 2 building-component manufacturers, 7 architectural design offices and 1 public subsidized housing corporation, a total of 34 agents, in 1997 and 1998. All the agents had undertaken rehabilitation work in a relatively larger ratio to other kinds of construction work, compared to their respective competitors (see Table 1).

Table 1. Subjects of the research: Agents handling rehabilitaiton process

(¥: yen)

	Types of Business	Country	Capital (\ 0.1 billion)	Annual Sales (\ 0.1	No. of Employee (person)	Building Rehabilita-tion(%)	Housing Rehabilita-tion(%)
SF	Subcontractor	France	–	1,750.5	17,600	14	–
SJ1		Japan	0.50	5.0	10	100	100
SJ2		Japan	0.25	17.0	17	70	–
SJ3		Japan	0.32	3.5	18	100	–
SJ4		Japan	0.32	46.0	48	100	50
SJ5		Japan	0.10	34.8	60	100	20
SJ6		Japan	0.60	25.0	60	65	–
SJ7		Japan	1.10	100.0	99	50	50
SJ8		Japan	3.00	180.0	226	85	61
SJ9		Japan	0.50	40.0	40	100	40
SJ10		Japan	–	100.0	150	100	20
SJ11		Japan	0.20	73.3	296	35	40
SJ12		Japan	1.00	7.0	19	100	0
SJ13		Japan	0.30	6.0	200	100	50
SN		Netherlands	–	186.6	–	50	50
SU1		USA	–	1.1	25	20	–
SU2		USA	–	6.6	48	50	20
SU3		USA	–	25.3	48	20	20
GN	General Contractor	Netherlands	–	3,600.0	2,500	–	5
GD1		Denmark	36.0	309.8	2,413	6	3
GD2		Denmark	–	84.4	3,200	25	50
GU1		USA	0.66	14.3	42	75	45
GU2		USA	–	8.3	850	–	–
GU3		USA	–	2,200.0	958	–	–
MD	Manufacturer (Glass)	Denmark	–	–	–	–	–
MJ	Manufacturer (Paint)	Japan	256.00	1,587.0	3,055	60	30
ED	Engineering Office	Denmark	–	25.5	308	34	10
EU		USA	–	1.3	9	95	90
DD	Architectural Design Office	Denmark	–	2.3	25	63	56
DJ1		Japan	0.05	2.0	7	100	100
DJ2		Japan	0.01	0.5	1	100	100
DJ3		Japan	0.10	2.5	10	100	99
DJ4		Japan	0.10	1.7	9	95	70
DJ5		Japan	0.20	20.0	128	30	10
DN		Netherlands	–	–	–	–	–
PG	Public Subsidized Housing Corporation	Germany	2.5	1.6	36	–	–

※exchange rates: ・1 krone = ¥15, 1 franc = ¥15, 1 German mark = ¥50
・1 dollar = ¥110, 1 guilder = ¥45

As for the subcontractors, they were further divided into 3 groups, "General", "Independent from manufacturer" and "Independent from management company", because their jobs were diversified in both terms of service and scale (see Table 2).

Most of small-scaled subcontractors classified in the group "General" cover a relatively small scope of rehabilitation service and their main jobs are usually repair of exterior walls and waterproofing. Subcontractors of larger-scales tend to expand their services to interior finish work and equipment work from the small scope. Some large-scaled subcontractors even undertake new

construction. Subcontractors classified in the group "Independent from manufacturer" were formerly a subcontractor under contract to manufacturers of sash, tiles and other components, and later became independent as a specialist contractor. They are relatively large-scaled and have a close relationship with the manufacturers. The manufacturers sometimes influence scope of services and material choice of these subcontractors. Subcontractors classified in the group "Independent from management company" were formerly an agent whose main job was maintenance work such as cleaning of external facing of multi-family housings. Their role in rehabilitation is repair of external facing.

Table 2. Scope of services of subcontractors

: main jobs & services of the agent

	Country		Exam. & diagnos-tic check	Design of rehabil-tation	Estima-ing	Execution										
						Exterior Wall				Roof water-proof-ing	Interior finish	Equipment			Struc-ture	Others
						Repair of subst-rate	Paint-ing	Tile	Others			Plumb-ing	Gas	Electri-city		
General	SN	Netherlands														
	SJ1	Japan														
	SJ2	Japan														
	SJ3	Japan														
	SJ4	Japan														
	SJ5	Japan														
	SJ6	Japan														
	SJ7	Japan														
	SJ8	Japan														
Independent from manufacturer	SJ9	Japan														
	SJ10	Japan														
	SJ11	Japan														
	SJ12	Japan														
Independent from management company	SJ13	Japan														
General contractor	GD2	Denmark														

Table 3. Different points and problems of rehabilitation in comparison with new construction

	Comparison Aspects	Problems
Planning	Role of architect	Role of architect is half-defined (unclear) and generally no more than a coordinator. (DJ1,DJ2,DJ3,DJ4)
	Presence of existing building	Original drawing is not available. (DJ1,DJ2,DJ3,DJ4,SJ1,SJ2,SJ8)
		Limited conditions of work and planning (MD)
		Need for detailed planning based on examination/diagnostic check (GU3,GD1)
		Insufficient data of exam./check and poor performance of diagnostic tools (SJ1,SJ4,SJ8,DJ1,DJ4)
	Others	Compliance with the current reulations and laws is requested. (GU1)
		Time takes to obtain residents' consent.
Construc-tion	Presence of residents	Need cooperation of residents (SF,EU,SJ1,SJ2,SJ7,SJ8,SJ13,GD1,DJ1,DJ2,DJ4)
		Need to perform the work in habited buildings (GD1)
		Need to devise measures that are safer than those for new construction (SJ13)
		Need to avoid risks of burglaries
	Conditions	It is difficult to deliver materials. (GU1,EU)
		Frequently no space to store devices and materials within the site. (SJ3)
		Many choices are not allowed for decision of construction method. (SJ1,SU4,SJ8)
		Tools are not standardized. (SJ7)
	Training	It is important to train workmen. (SJ3,SJ8)
		Need a multi-skilled worker (PG,GD1)
		There is no standardized method to assess worker's performance. (SJ6,SJ7)
Costs & Fees	Cost	Costs are relatively high.(EU,SJ10,SJ11,ED)
		It is difficult to perform estimate cost closer to the actual cost.
	Decision of fee	It is difficult to charge reasonable fee which reflexes the work. (SJ3,DJ1,DJ2,DJ3,DJ4,DJ5)

2. CHARACTERISTICS OF REHABILITATION WORK

2.1 Characteristics and Problems/Challenges of Rehabilitation Work

The various factors that make rehabilitation a more difficult task than new construction are listed in Table 3. Problems centering on the aspect of design and planning include the followings:

- Technology and skills of examination and diagnostic check are not complete.
- The role of an architect is not clear.
- It is difficult to build residents' mutual consent to execution of rehabilitation work.

These problems are more significant in Japan, where the rehabilitation market is still in the stage of immaturity.

Challenges centering on the aspect of execution of rehabilitation work are associated with the fact that the work has to be carried out in habited buildings, as listed below:

- Cope with inconveniences of residents' daily life before, during and after the rehabilitation work
- Offer solutions to additional troubles incidental to the work, such as noise
- Devise safety measures
- Have ability to handle techniques specially required for rehabilitation work (e.g. delivery of materials, curing)
- Improve skills of workmen and enhance their knowledge

Problems concerning the financing aspect include the followings:

- Costs for rehabilitation are relatively high.
- It is difficult to estimate costs closer to the actual costs.
- In Japan, agents involved in rehabilitation often experience difficulty charging reasonable fee which reflex their performance.

2.2 Roles of agents in rehabilitation

Differences in scope of services of the interviewed agents in comparison between new construction and rehabilitation are summarized in Table 4. In Japan, where the average scale of rehabilitation work is small, specialist contractor (relatively small-scaled agents) play a role of a subcontractor in new construction but also play a vital role in the case of rehabilitation work. In a large-scaled or complex rehabilitation work, however, they position themselves as a subcontractor under a general contractor on a main contract basis, as in the case of new construction, due to their limited funds and technology. Architects also often face difficulty finding opportunities to demonstrate their ability in rehabilitation.

Conversely, in the countries in Europe and the USA, most of the interviewed agents responded that their scope of services did not change between new construction and rehabilitation. There were a few but noticeable cases such as "get technical assistance from other agents" (SU2: USA), and "organize a different team from that for new construction" (SN, GN: the Netherlands, G3: USA).

2.3 Presence or absence of a section specializing in rehabilitation

We asked the agents whether they had a section specializing in rehabilitation, in other words, whether they had a section responsible for new construction separately (see Table 4 for results). Of 35 responding agents, 4 were handling rehabilitation only. Of the remaining 31 agents, 23 responded that they had an in-house section specializing in rehabilitation. 8 agents who did not have such a section were; ① a design office (D4) and a subcontractor (S2) in Japan, ② general contractors (DC, GU2, GU3) in the USA, ③ 3 agents (DE, DM, HA) in Denmark and the Netherlands. The agents of Group ① are too small to divide their staff into more than two organizations, and the 5 agents who handle rehabilitation only could be categorized into this group if they should decide to expand their business into the field new construction. The role of the agents in Group ② is project management, thus they can use the same know-how in either case of new construction and rehabilitation. The agents in Group ③ have a distinct role within a socially established system of dividing rehabilitation work between different agents, and may be able to handle rehabilitation as a routine work.

Table 4. Differences in roles of agents in comparison to the conditions of new construction / Do they have a section specializing in rehabilitation?

	Types of Business	Country	Do you play the same role as that in new construction?		Do you have a section specializing in rehabilitation?
SF	Subcontractor	France	YES		YES
SJ1		Japan	NO	Need management ability of a general contractor when participating in a large-scaled rehabilitation work on buildings older than 25 years.	YES
SJ2		Japan	NO		NO
SJ3		Japan	NO		YES
SJ4		Japan	NO		YES
SJ5		Japan	NO		YES
SJ6		Japan	NO		YES
SJ7		Japan	NO		YES
SJ8		Japan	NO	Receive order on a main contract	YES
SJ9		Japan	NO		YES
SJ10		Japan	NO		YES
SJ11		Japan	NO		YES
SJ12		Japan	NO	General contractor becomes a main contract for the construction whose work volume is expcted to be sales of 3,000 million yen or more.	YES
SJ13		Japan	NO	General contractor becomes a main contract when the ordered work is large-scaled.	YES
SN		Netherlands	NO		YES
SU1		USA	-		YES
SU2		USA	NO	Receive technical assistance from other companies/offices.	YES
SU3		USA	YES		YES
GN	General Contractor	Netherlands	YES		YES
GD1		Denmark	YES		NO
GD2		Denmark	-		YES
GU1		USA	YES		YES
GU2		USA	YES		NO
GU3		USA	NO	Have a subcontractor specializing in rehabilitation work.	NO
MD	Manufacturer (glass)	Denmark	YES		NO
MJ	Manufacturer (paint)	Japan	-		-
ED	Engineering Office	Denmark	YES		NO
EU		USA	-		(specializing in rehabilitation)
DD	Architectural Design Office	Denmark	YES		YES
DJ1		Japan	NO	The role is mainly a coordinator.	(specializing in rehabilitation)
DJ2		Japan	NO	The role is mainly a coordinator.	(specializing in rehabilitation)
DJ3		Japan	NO	The role is mainly a coordinator.	(specializing in rehabilitation)
DJ4		Japan	NO	Boundaries of scope of services of relevant agents are unclear.	NO
DJ5		Japan	YES		YES
DN		Netherlands	-		NO
PG	Public Subsidized Housing Corporation	Germany	YES		YES

3. MEASURES TAKEN BY AGENTS IN REHABILITAION

In this chapter, we would like to report out findings on the measures that the questioned agents have taken to sort out special requirements and challenges in rehabilitation from different aspects as follows:

3.1 Planning

With regard to the process of examination and diagnostic check, the most critical stage in planning of rehabilitation, most of the responding agents in Europe and the USA have an in-house specialist team or use a third party on a contract basis. In Japan, on the other hand, the function of specialist of examination and diagnostic check has not been established yet.

As for original drawing and specifications at the time of new construction, they are available in Europe and the USA. In Japan, to the contrary, it is difficult to obtain these data, and design offices and contract constructors take measurements to cope with this problem.

All the agents, including those who did not give any comment on ideas to perform rehabilitation smoother, have been participating in building of residents' consent.

There is a unique case of DN who plans rehabilitation on an open-building basis.

3.2 Construction

3.2.1 How to cope with inconveniences of residents

The questioned agents have been making efforts to cope with inconveniences which residents may experience with the following activities:

- Communicate information on rehabilitation work to residents
- Use the service of communication specialist and/or employ a woman supervisor
- Select a workman who is good at approaching residents, and assign him to the site
- Encourage workers to perform cleaning
- Pay attention to prevention of burglary of residents' properties and building materials

3.2.2 Construction Techniques

The agents are providing technical solutions such as,

- Installment of a temporary elevator for quick delivery of materials without causing troubles for residents' daily lives.
- Utilization of prefabrication member
- Engagement of a multi-skilled worker
- Development of technology specific to rehabilitation work

3.2.3 Training

There are only a few agents who conduct special training program on rehabilitation. Most agents seem to be relying on individual worker's experience and ability. There is hardly a public/in-house system of qualifying rehabilitation specialist except for one agent in Washington DC, the USA.

3.3 Costs and Fees

Difficulty of estimating for rehabilitation was evidenced in the answers "estimate extra costs" (ED) and "obtain the consent of the owner to raise reserve fund" (SU1). Relative costs can be cut down by the efforts to enhance cost-effectiveness as seen in the described cases of utilization of prefabrication member and engagement of a multi-skilled worker (see 3.2.2).

As for design fee, there is a case in Denmark that the rehabilitation fee is fixed in the range from 117% to 120% of the design fee for new construction.

Table 5. Operating measures taken to sort out problems of rehabilitation -1

		Types of Business	Planning			Money	
			Presence of existing building		Others	Cost	Dicision of fee
			Conditions of work and planning	Examination/ Dignostic check	Building conset	Estimating	Fee
Japan	SJ1	Subcontractor			Explanatory meeting with residents / Distribution of handbills		
Japan	SJ12				Explanatory meeting with residents / Distribution of handbills		
Netherlands	SN		Open-building				
USA	SU1			Performed by third party			
USA	SU2			Performed by third party		Owner raises reserve funds.	
Denmark	GD1	General Contractor			Explanatory meeting with residents		Design fee is higher than that for new construction.
Denmark	GD2					Relatively high estimates.	Design fee is higher than that for new construction.
USA	GU1			Performed by third party			
Denmark	MD	Manufacturer (glass)		Performed by third party			
Denmark	DD	Architectural Design Office		Performed by design office			
Japan	DJ1			Performed by design office			
Japan	DJ2			Performed by design office			
Japan	DJ3			Performed by design office			
Japan	DJ4			Performed by design office			

Table 5. Operating measures taken to sort out problems of rehabilitation –2

		Types of Business	Construction-1				
			Residents			Construction Technoiques	
			Cooperation	Work on habited building	Burglary	Delivery of Material	Methods and Tools
France	SF	Subcontractor	Use the service of communication specialist				Make up a suitable team comprising of different types of experts.
Japan	SJ6		Communicate construction plans to residents whenever				Participation in Technical Associates
Japan	SJ7		Communicate construction plans to residents whenever				Participation in Technical Associates
Japan	SJ8						Participation in Technical Associates
Japan	SJ9						Participation in Technical Associates / Use electric tool equipped with dust collector
Japan	SJ10						Participation in Technical Associates / Engagement of multi-skilled worker
Japan	SJ11		Communicate construction plans to residents whenever				Participation in Technical Associates
Japan	SJ12						Participation in Technical Associates
Japan	SJ13						Participation in Technical Associates
USA	SU1		Cooperate with property manage	Daily cleaning		Temporar y elevator	Utilization of prefabrication member.
USA	SU2		Cooperate with owner				Utilization of prefabrication member.
USA	SU3		Cooperate with owner.		Installment of fence, key-		Execution of most delicate and flexible work
Denmark	GD1	General Contractor	Hold meetings with residents.				Utilization of prefabrication member.
Denmark	GD2		Use the service of spokesman.				
USA	GU2		Cooperate with owner.				
Denmark	MD	Manufacturer (glass)	Notification by documents	Employ woman	Increase number of		Engagement of multi-skilled worker
Denmark	ED	Engineering Office					Give flexibility to the products.
USA	EU		Cooperate with propery manager				
Japan	DJ1	Architectural Design Office	Communicate construction plans to residents whenever				Introduce techniques of manufacturers.
Japan	DJ2		Communicate construction plans to residents whenever				Introduce techniques of manufacturers.
Japan	DJ3		Communicate construction plans to residents whenever				Introduce techniques of manufacturers.
Japan	DJ4			Safety measures			Introduce techniques of manufacturers.
Germany	PG	Housing Corporation					Engagement of multi-skilled worker.

4. CONCLUSIONS

In the present study, we picked out characteristics and problems of rehabilitation work based on the interview research of agents involved in rehabilitation, and grouped their measures and devices from several aspects of rehabilitation business. All the agents understand the characteristics of rehabilitation work and have devised systematic measures to meet challenges originating from these characteristics (such as organization of a specialized section) according to their respective scales of business. However, there are differences in the level of individual cumulative know-how because organizational training efforts are weak, as evidenced in the repeated answer "do not have an in-house training course for workmen". We found that many of the positions of designer, supervisor and craftsman are filled with experienced and skilled persons.

It is also noticeable, however, that the agents have made efforts to improve industrial efficiency from different approaches including engagement of a multi-skilled worker and utilization of prefabrication member. It will be necessary to establish an overall system in which agents can exchange their know-how and decide their roles (responsibilities) clearly and training could be systematized, in order to ensure that rehabilitation work is improved in both quality and efficiency.

Lastly, we would like to add that this research was planned and carried out with the collaboration

of Ms. Mitsuyo Saito (Denmark), Dr. Mark Bourdier (France), Dr. Thomas Bock (Germany) and Dr. Stephen Kendall (USA) and that analysis of results were performed on joint responsibility of Matsumura and Murakami in Japan.

Table 5. Operating measures taken to sort out problems of rehabilitation -3

		Types of Business	Construction-2 Training: Do you have an in-house training course for workmen? (yes = ●,no=×)		Qualification	Presence of experts
France	SF	Subcontractor	●	There is also group training course, but attendants are	×	●
Japan	SJ1			They learn and deepen knowledge at the site.	×	
Japan	SJ2			They learn and deepen knowledge at the site.	×	
Japan	SJ3			They learn and deepen knowledge at the site.	×	
Japan	SJ4			They learn and deepen knowledge at the site.	×	
Japan	SJ5			They learn and deepen knowledge at the site.	×	
Japan	SJ6		●	They take classes at lecture and learning meetings held by third parties or relevant organizations.	×	
Japan	SJ7		×		×	
Japan	SJ8		●		×	
Japan	SJ9		×	They take classes at lecture and learning meetings held by third parties or relevant organizations.	×	
Japan	SJ10		—		×	
Japan	SJ11		×		×	
Japan	SJ12		—	They take classes at lecture and learning meetings held by third parties or relevant organizations.	×	
Japan	SJ13		●	They take classes at lecture and learning meetings held by third parties or relevant organizations / The workmen involved in new construction are separated.	×	
Netherlands	SN		—	—	×	—
USA	SU1		×	—	×	●
USA	SU2		×	They learn and deepen knowledge at the site.	×	×
USA	SU3		×	They learn and deepen knowledge at the site.	×	×
Denmark	GD1	General Contractor	×	Basic technical training program is available, but the rehabilitation section has not developed specific training program.	×	●
Denmark	GD2		×	Encourage them to attend outside training courses.	×	●
Netherlands	GN		●	Have in-house training course for the management.	×	●
USA	GU1		●	Have product-related training classes. Use outside training service.	Home Improvement License	●
USA	GU2		—	—	×	—
USA	GU3		×	On-the-job training. Encourage them to attend outside training courses	×	●
Denmark	MD	Manufacturer (glass)	×	Encourage worksment to attend outside trainng course	×	●
Japan	MJ	Manufacturer (paint)			×	
Denmark	ED	Engineering Office	—	—	×	×
USA	EU		×	Encourage them to attend outside industrial seminars.	×	●
Denmark	DD	Architectural Design Office	●		×	
Japan	DJ1		×		×	
Japan	DJ2		—		×	
Japan	DJ3		●		×	
Japan	DJ4		×		×	
Japan	DJ5		●	They take classes at lecture and learning meetings held by third parties or relevant organizations.	×	
Netherlands	DN		●		×	
Germany	PG	Housing Corporation	×		×	●

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