Terunobu Fujimori: Working with Japan's Small Production Facilities

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INTRODUCTION

Japanese manufacturing occurs in a dual economy. Much of what has been written focuses on the large-scale; in this article I will illustrate the opportunities for the architect which result from working with the small manufacturers and producers. In her book *The Technological Transformation of Japan: From the Seventeenth to the Twenty-first Century,* Tessa Morris-Suzuki demonstrates how two levels of production systems in Japan work in tandem and supply different segments of the market. These are defined as the "center" (large-scale sophisticated production supported by governmental activities and major corporations) and the "periphery" (small, localized production).' But these terms, while useful to someone who knows Japan, are also misleading: the area she refers to as the periphery actually accounts for a sizable segment of production; about 53.8% of Japan's factory workers are employed in firms of less than 100 workers.[2] Similar duality is found in the construction industry: Japan is represented by five of the world's largest construction companies, but 52% of licensed contractors are one- or two-person operations. In architecture, 35% of all designers are found in independent studios.[3]

Morris-Suzuki argues that Japan's flexible production processes date back to the development of industrialization in the early 17th century—that is, roughly concurrent with industrial development in the West. However, as Japan had closed itself off politically and economically from the rest of the world, it thus developed a different approach to the role and significance of industrial production. There was less concern for labor-saving—governmental edicts of the time established a variety of programs which were explicitly intended to promote labor-intensive activities. Rather, there was an emphasis on value-added production; policies promoted the creation of small manufacturers which engaged in product differentiation.

The *tatami* mat, a symbol of many of the architectural differences between Japan and the West, is a useful illustration of this system: the actual producer *oftatami,* even today, will have a neighborhood workshop where he responds to customer orders by assembling a set of components made by other workshops, often those in other parts of the country.[4] These components include the inner core of the mat, made of layers of straw and varying in size depending on the district in which it is produced; the outer covering, which may be selected for its strength in being rolled around an edge, for a tight weave, or for consistency of color in drying; and the ribbon used to finish the edges of most mats.[5]

The studio where the *tatami* mat is produced is generally found tucked in among single-family houses in residential neighborhoods; business is at least in part a result of community ties. Because of this, customers will often make the decision to purchase from their neighbor (at a higher price) instead of from larger production facilities to which they have no relationship, thus allowing the neighborhood facility to compete on other than economic terms. During the recent economic downturn, I have witnessed that many people who have not been affected will make decisions about purchases as much from the needs of their neighbor's business as from their own—in effect, offering financial support at a time when many small businesses might otherwise fail.

Because the capitalization of small businesses is represented in a single machine or set of machines, there is a demand for equipment which is flexible enough to respond to changing needs. This is considered at least in part to be the result of recent and rapid shifts in industrialization, essentially absorbing 400 years of Western technological development in only 150 years. Machinery used by these small producers is by necessity easier to retool, but these adjustments then become an opportunity for variations and customization which can be exploited by the architect or client.

Today, small producers use customization and product differentiation as a way to segment the market or to offer their customers service which justifies higher costs. However, this differentiation is found not only at the level of the smallest producers, but also at somewhat larger scales of production. In a manner similar to the neighborhood workshop, the small manufacturer of windows, metal screens, or custom-made furniture will also rely on relationships (often

through a keiretsu, local bank support, or even old school ties) as the foundation for business, and will justify higher costs through the higher value of customization or product differentiation.[6] In part, the context for these relationships is unique to Japan, a result of the greater proportion of privately-held stock corporations, a limited and clearly organized set of relationships defined by the business and educational system, and the protection offered by a complex distribution system and import tariffs. Nonetheless, diversification in the market is also natural in an industrialized country where wealth allows large segments of the population to demand greater individual satisfaction or accommodation of the special needs of small groups.'

This customization can and is utilized by architects to appeal to popular taste and to promote innovation. Some architectural modifications are quickly apparent to the outside observer as signature elements: Arata Isozaki's "Marilyn curve" door pulls and furniture, the animal figures found in work by Team Zoo, or the fractal geometries of Kurokawa's more recent work. Less obvious, especially in the photographs which are the sole way many American academics know Japanese buildings, is the manner in which architects may readdress relatively prosaic areas of the building, redesigning the drain pipe, the mullion, or the roof tile. Large corporations often use the small producers, in conjunction with the marketplace, as a developing and testing ground for new materials and products. Thus architects who utilize flexibilities in production influence the products and materials available for a wider market.

PROMOTINGLOCALIZED PRODUCTIONSYSTEMS: TERUNOBU FUJIMORI

Terunobu Fujimori, a professor at the University of Tokyo, has only recently begun designing buildings, although he has beena popular architecturalspokespersonand prolificscholar. He has authored dozens of books, writes regularly for newspapers and architectural journals, has interviewed major architects for a variety of journals and private publications, and is himself interviewed frequently on Japan's public television station, NHK. His decision to design seems to have been an outgrowth of the influence of his mentor Teijiro Muramatsu, who was known for his work on late nineteenth- and early twentieth-century architectures and the technology of production. Through Muramatsu's influence, Fujimori came to a growing awareness that if the opportunities of small-scale manufacturing are not integrated into contemporary design, they may be lost.

In his own research, Fujimori concentrates on Modernist architecture. Today, Modernism is perceived as calling for formal differentiation between buildings which embrace tradition and those which aspire to be contemporary, and in this context the work being produced by Fujimori would be difficult to classify. In Japan, his first building, the Jinchokan Moriyoka Shiryokan, (Shiryokan can be loosely translated as "historical artifact museum"), was initially thought to be "anti-modem"—a label which caused no little confusion since Fujimori frequently utilizes the works of Mies Van der Rohe or Le Corbusier as a standard in assessing the accomplishments of contemporary architects. The perception that his work was "anti-modem" derived from the manner in which Fujimori exploited traditionally manufactured materials, deliberately setting out to use only handmade finishes.

Fujimori describes this approach as not being in opposition to Modernism; it is very much in keeping with the pre-1923 tenets which Gropius proposed at the Bauhaus, calling for a unification of craft with contemporary planning; he defines himself more in terms of the later work of Le Corbusier (such as Ronchamp) and the Japanese architect and theorist Takamasu Yoshizaka, who worked for Le Corbusier from 1950 through 1952. (Yoshizaka later taught at Waseda University in Tokyo and spoke on the importance of uniting contemporary planning with tradition.) Even more striking a parallel to Fujimori's work is the Japanese Mingei movement of the early twentieth century, guided by Soetsu Yanagi. What each of these groups have in common (and others such as the Arts and Crafts movement inspired by William Morris might also be included) is a desire to respond to over-enthusiastic social shifts towards standardization not by rejecting industrialization so much as by attempting to reintegrate and reinforce the importance of traditional production. Many, including those in the early Bauhaus and Yanagi, called for linking industrialized and traditional production in a manner which best exploits the opportunities of each. The influence of these groups on Fujimori probably accounts for the high degree of conscious thought evident at such an early stage of his built work.

The Jinchokan Shiryokan was completed in 1991. It is a small museum and repository for the artifacts collected by the Moriyoka family, which traces its history as supporters of the Suwa Shrine well over 1000 years.[8] The building was published not only in several of the major architectural magazines, often prominently, but was also featured in the inaugural volume of a new series on architecture published by Toto—especially surprising in light of the size of the museum (only 185 square meters) and its relatively isolated location. During design and development, Fujimori relied on his former student Yoshio Uchida, also an architect and a professor at Toyo University, for practical support and advice on detailing and construction. This association continues today. Each of the designers has certain strengths; in my observation, Fujimori has been the person responsible for design decisions relating to opportunities of production, while Uchida seems to take the lead on the construction site, having somewhat longer experience in practice. Because Fujimori is also the chief designer, this discussion will focus primarily on his contributions. In no way do I intend, though, to suggest that Uchida's contributions are unimportant; they simply were less significant in the context I am specifically addressing.

In the Jinchokan Shiryokan, Fujimori first proposed how tradition and regionalism might be united with a Modernist

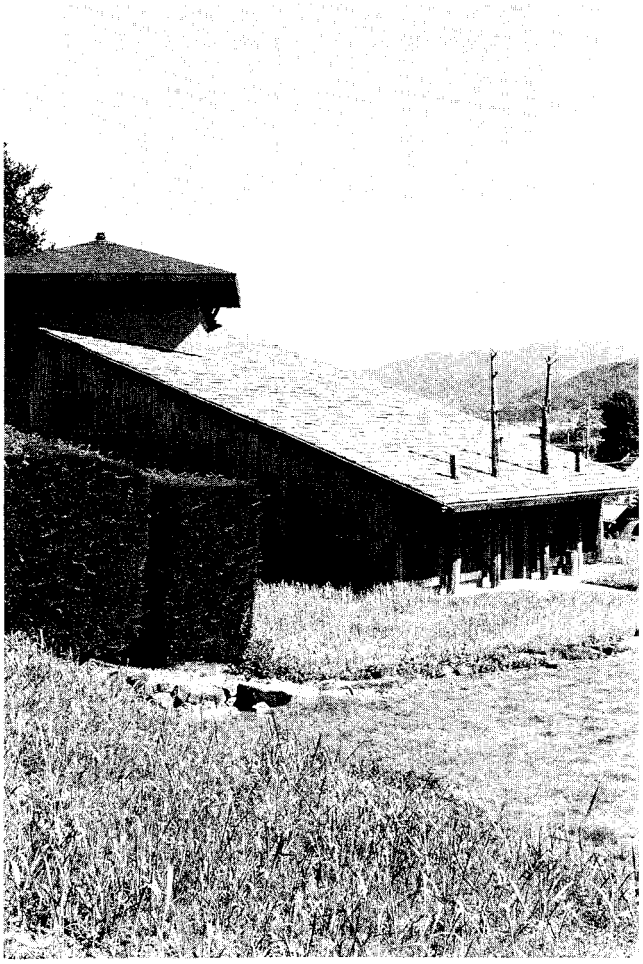

Fig. 1. The Jinchokan Shiryokan, exterior view. All photographs are by the author.

approach to planning and materials. The museum is located in a remote, mountainous area of Japan with a long history, and Fujimori's concern for the region and its past are the basis for his essay on the project, published in *Shinkenchiku*. In his opening, Fujimori describes the cold water running into Lake Suwa and the blue mountains which embrace it. He then turns to the roots of the community, the Moriya family's history, and finally his own childhood in the area. From there, Fujimori goes into a lengthy description of the materials produced for the project, not only naming craftspeople and locations where materials are found, but going so far as to describe his own personal ties to these individual* through a former teacher, one of his students, etc. Surprisingly, he does not address Modernist influences on the building, instead seeming to take it for granted that these would be apparent.[9]

At the time of this building, Fujimori sought to confine himself only to finishes which were refined by hand, including slate and other stone materials, a straw-embedded mortar coat which was applied by hand, wrought iron door pulls and locks, and hand-made glass. (He was not entirely successful; fire-fighting materials are selected and located by local officials in Japan–clearly unsympathetic to the project's intent—and much of the electrical equipment is manufactured.) In one notable example, he utilized boards split in a manner that apparently predates the saw, but wrapped them around the building as a skin in a way which was distinctly Corbusian.[10] Using this material was a far from simple task; the first challenge Fujimori faced was finding someone still capable of splitting the equivalent of 50 ***tsubo*** (about 165 square meters) of board in this fashion, since it is a disappearing art. Ultimately, through personal introductions, Fujimori was able to convince Chuu'ichi Yazawa to participate in the project. In the essay for *Shinkenchiku*, Fujimori describes Yazawa's day (due to his advanced age) as being "...in the morning, on an intravenous drip, and in the afternoon, splitting wood in a way he had not been called on to do for half a century."[11] The use of traditional materials was not intended to be retrogressive; in the internal structure Fujimori utilized steel reinforced concrete, metal decking, and expanded metal. Rather, there was a clear decision to link the advantages of hand-finished and manufactured materials, exploiting each for its benefits.

More recently, Fujimori has shifted away from purely handmade materials and has begun to incorporate production from small manufacturing facilities, in recognition of the challenges this sector also faces. While traditional neighborhood and family ties supported production in the manner I outlined earlier, the Japanese family is increasingly mobile, thus reducing the importance of community ties. Furthermore, the cost differential between locally manufactured goods and goods produced in standardized processes, (especially goods produced overseas), continues to widen. This has led to a slight but continuous erosion of the sector served by small producers, and most likely will continue to do so. As late as 1921, 87% of Japan's manufacturers employed fewer than 10 people; today 46% of the workers employed in manufacturing work for companies of over 100.[12] Fujimori noted that some processes have almost completely been lost and others, while still having a healthy share of the production market, are in need of reintegration and support.

Currently, Fujimori has one project, a house, under construction and two projects in the planning stage. The

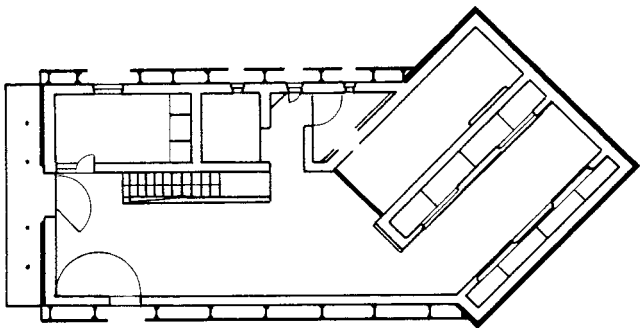

Fig. 2. Plan of the Jinchokan Shiryokan, showing the separation of skin and structure.

house, which is located in one of Tokyo's suburbs, is for Fujimori and his family, and thus refers not to the immediate context of Tokyo, but to the *furusato* (hometown) to which he is tied.[13] Suppliers are located at some distance from the construction site, so the building serves as an illustration not only of the opportunities of the production system, but also the manner in which Fujimori used production to connect the building to his personal history and his community. Two examples which underscore these ties and demonstrate the way in which Fujimori has been able to customize his materials, are his work with the sawmill, *Kakudai Seizai,* and a stone quarry, *Kitazawa Teppeiseki.* Both of these producers were also involved in Fujimori's first project, although perhaps each can be said to have a somewhat increased role in the current building.

In the early part of the twentieth century, most sawmills in Japan were local mills, often close to the forests. (In part this was due to the fact that Japan's more rugged landscape made shipping logs downstream far less feasible than was true, for example, in the American Midwest.) Large mills which operated in urban areas tended to cut primarily imported woods, and the small mills--that is under nine employees — accounted for somewhere around 90% of all sawmills in the country.[14] The importance of the small sawmill actually grew as access to power and small machinery made these facilities more competitive; government surveys show that small mills increased in number 70% between 1919 and 1930, while large mills only increased 30% in the same period.[15] Even today, there are 18,566 lumber yards and mills in Japan, of which roughly two thirds — 12,147 — are staffed by fewer than ten people.[16]

Even by these standards, *Kakudai Seizai* is a very small mill, run by a middle-aged married couple and the husband's father. Fujimori, who grew up not far from the mill, says that he began to spend time there watching wood be cut when he was as young as five years old. This mill is very much in keeping with the scale and capitalization of the small producer or manufacture; machinery is limited to a large bed for the log, which is driven along a track, and a single, stationary bandsaw. Heavy lifting was done by a truck-mounted articulated arm, the truck rented for the occasion, since logs of the size and weight Fujimori worked with were not usually milled at the site. Special saw blades were also rented as this wood was harder than what the mill generally cut. Fujimori and Uchida used simple notes on a letter-size sheet of paper to review how the logs should be cut. With the participation of the Kakudais and two students from the University of Tokyo, the first of two logs was removed from the truck bed and Fujimori directed its setting on the conveyor bed. When it was in place, he marked the narrow end of the log with chalk (primarily as a confirming device; this was not referred to during milling) and told the younger Mr. Kakudai how the wood was to be cut. Fujimori explained later that he did not feel it necessary to discuss his decisions with Kakudai because of his own long experience at the saw mill. This is in marked contrast to the manner in which he consulted with head of *Kitazawa Teppeiseki,* which I will discuss further below.

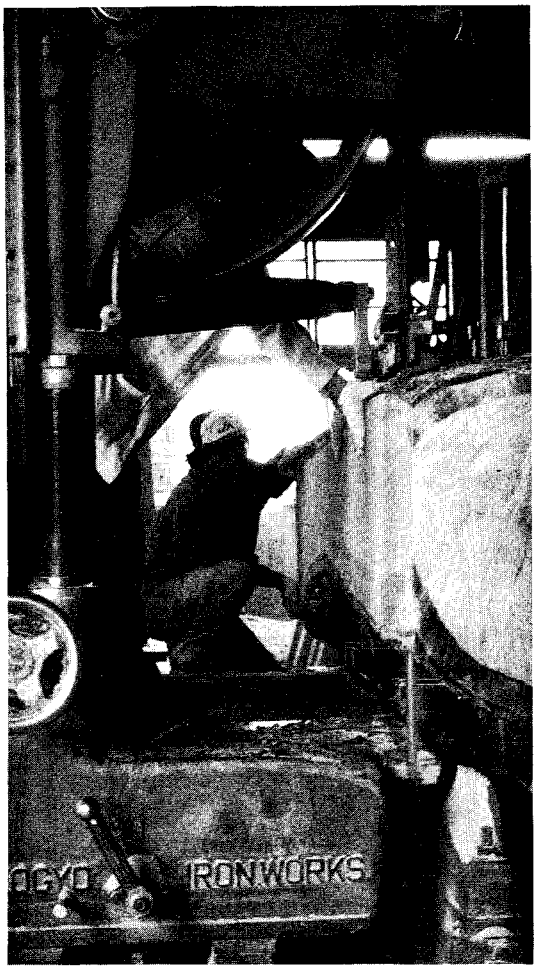

Fig. 3. Cutting logs at *Kakudai Seizai.* Fujimori is pictured getting ready to catch the cut plank.

Altogether, two large logs and one small tree from Fujimori's parents' garden were cut. The smaller tree had been set to dry in a mountain garden owned by his family. As a group, we went up to the garden in a truck and brought the wood back to the mill. This was to be used for window and door frames and was cut to uniform thicknesses." The larger logs were intended for built-in cabinetry and furniture, and were milled to a variety of shapes and thicknesses; because of the way Japanese mill lumber, they retained a ragged bark edge which will be exploited in the finished furniture. At the end of cutting the second log, Fujimori and Uchida were surprised to discover that the rough sketches had been overly conservative and that there was a large piece from the center of the tree of about 5 centimeters in thickness remaining. After some consultation it was decided to keep this piece whole and determine later how they might use it.

In later discussions with the contractor on site, I was told that they preferred to make arrangements for materials themselves as they could control when they were delivered. (Japanese construction sites, being quite small, allow little room for storage.) Also, there is some labor saving to

standardized wood sizes, although this was acknowledged to be more than off-set by the beauty of less uniform materials. Nonetheless, since most contractors do tend to work with a variety of suppliers, there was not a significant resistance to the architect making other arrangements, and indeed, it relieved the contractor of any responsibility for material failure.

Fujimori's visit to the stone quarry around the same time was somewhat different. He has known Kitazawa only since 1991, when Jinchokan Shiryokan was built; at that time he had seriously been considering using French slate or a stone from southern Japan. Seeing an article in the newspaper about the museum, Kitazawa agreed to work with Fujimori to develop a roof shingle from *"teppei* stone," a flat, iron-based stone which splits naturally. (This stone is found only in the hills around Chino city in Nagano Prefecture and in an area of Gunma Prefecture. It is apparently exported to the United States under the name *"teppei* stone;" I have no satisfactory translation.) The shingle was first used on Jinchokan Shiryokan, and is being used as a roof and wall facing on the house. There are actually ten quarries in the area mining this stone, which is commonly used for stepping stones in gardens; many of the quarries which Fujimori approached were not interested in the project. A visit to Kitazawa's site, though, quickly showed him to be more entrepreneurial; there were experiments with stone garden furniture and flower boxes, children's pools, and imported stone from China. This may be due to the challenges of his quarry; he showed us an area where blasting by an earlier owner had damaged some of the stone, making it good only for limited uses.

Fujimori's visit to the quarry had two purposes. First, suppliers seem to more frequently make mistakes on materials requested in Japan, and the architect's visit to the site, prior to shipping, is intended to confirm that the appropriate materials are being cut. In the case of a single quarry, color and stone type are naturally consistent with what was originally selected, but the visit allowed Fujimori to confirm that the thickness and size of the shingles were accurate. In addition, Fujimori wanted to discuss with the supplier how the stone might be further treated by hand to get a rougher edge. (During processing, large stone sheets are cut by a circular saw and then hand split to their desired thickness; this leaves the stone with a flat, cut edge on all sides.) Kitazawa and Fujimori discussed possibilities at some length, with Fujimori experimenting while they spoke. In the end, Kitazawa also lent Fujimori a tool which would be suitable for this work.

Ultimately Fujimori was forced to decide that hammering all the stones by hand would be impractical; the amount of stone made this difficult to do without holding up construction. (Kitazawa estimated that the supply for the house would total between eight and ten tons, and the contractor said it required three four-ton trucks, thus clearly exceeding eight tons of material.) This kind of unresolved experimentation was also found in the Jinchokan Shiryokan, where Fujimori

Fig. 4. Fujimori and Kitazawa experiment with creating a rough edge to ***teppei*** shingles.

spent some time testing plaster finishes before giving up and accepting that he would have to use a mortar finish—although with embedded straw to give a texture similar to plaster.

There are several things to note about the manner in which Fujimori interacted with producers. First, the opportunity to experiment with materials during processing certainly allowed him to control thickness, consistency of color and grain, and size of the materials used to a much larger degree than one can expect with off-the-shelf components. Secondly, when the architect interacts with and tests materials on site, there is a greater understanding of what can be done, especially when one is able to consult with the producers as well. Fujimori seems to have been the first to use *teppei* stone as a shingle material, and during his site visits he was clearly concerned with refining its use. Thirdly, small producers are able accommodate unusual requests because they have the opportunity to rent the necessary equipment and materials, such as harder saw blades.[18] The manner in which Japanese architects are able to exploit flexibilities in the production system thus differs in several key ways from American experiences, and offers architects a distinct set of opportunities.

Fig. 5. Installing *teppei* stone at the Tanpopo House.

Many other major architects in Japan, among them Maki, Kurokawa, and Isozaki, have exploited Japan's flexible production system in their work. The crucial difference between Fujimori and these architects is the manner in which he has created conscious connections between early developments in Modernism and his own investigations, thus redefining what many in Japan perceive as Modem.[19] Fujimori has created a theoretic context for the use of craft and small-scale production which assumes that more highly customized materials are most appropriate as finishes, while standardized materials can best be used for the unseen structure and mechanical components of the building. In this way, differing production systems are rationally united with the areas of the building for which they are most suitable. Because of his importance as a theoretician, his proposals are being addressed seriously by practitioners in Japan.

NOTES

[1] Morris-Suzuki, Tessa. *The Technological Transformation of Japan: From the Seventeenth to the Twenty-first Century.* Cambridge: Cambridge University Press, 1994.

[2] Ministry of Finance. *Chuushou Kigyou Hakusho, 1995.* Tokyo: Ministry of Finance Printing Office, 1995. Table 7 of the appendix.

[3] Matsushita, Fumio. *Design and Construction Practice in Japan: A Practical Guide.* Tokyo: Kaibunsha Ltd., 1994. 175.

[4] I see many women participating in manufacturing and production, but I have yet to see a woman involved in assembling *tatami.* Thus, the use of the male pronoun seems most appropriate.

[5] Haketa, Kumajirou. Personal interview. Tokyo, Japan. 18 June 1995.

[6] The *keiretsu* system is described in any standard text on Japanese business. The following definition is taken from *Japanese Etiquette and Ethics in Business: A Penetrating Analysis of the Morals and Values that Shape the Japanese Business Personality.* Lincolnwood, Illinois: DeMente, Boyle; NTC Business Books, 1991. 163:
"*Keiretsu kaisha* — *Keiretsu* means "affiliated" or "series" and *kaisha* means "company." This term refers to the grouping of companies in Japan, including parent companies, subsidiaries, and subcontract firms, as well as those grouped around a certain bank or trading company. The system is an outgrowth of the economic structure of feudal Japan, when older employees of businesses were allowed to go out and establish their own companies while maintaining close ties with their former employers. Members of specific company groups cooperate with one another in various ways, in what often amounts to an exclusive network."

[7] Although in general manufactured products in the United States are still standardized, "manufactured customization" is emerging in this country as well. American systems of customization tend to rely on modularity or the use of computers, lasers, and other advanced technologies to create adaptable production systems. As a result, architects in the U.S. have access to more variety and lower prices in lighting systems, built-in coolers, window frames, elevator cages, handrails, and a wide variety of other products.

[8] Kengo, Kuma. "Nostalgia Like Nothing You've Ever Seen." *Jinchokan Moriya Historical Museum.* Tokyo: Toto Shuppanl Architecture Riffle 001. N. pag.

[9] Fujimori, Terunobu. Personal conversation. Chino City, Nagano, Japan. 25 July 1994.

[10] Coaldrake dates the saw to at least the 10th century. See Coaldrake, William H. *The Way of the Carpenter.* New York: Weatherhill, 1990. 9.

[11] Fujimori, Terunobu. "*Hajimete no Kenchiku," Shinkenchiku.* Tokyo: Shinkenchikusha, 1991. 267. Translation mine.

[12] Historical data is from Morris-Suzuki, Tessa. *The Technological Transformation of Japan: From the Seventeenth to the Twenty-first Century.* Cambridge: Cambridge University Press, 1994; contemporary data from the Ministry of Finance. *Chuushou Kigyou Hakusho, 1995.* Tokyo: Ministry of Finance Printing Office, 1995. Table 7 of the appendix.

[13] Typically, for example, unmarried children will still be registered as residents of their hometown, or even of the place their parents first lived when married. Eldest sons, such as Fujimori, are assumed to be responsible for the continuation of the family in the community, and it is anticipated that they will eventually return, albeit on retirement. For more on the topic, see Hendry, Joy. Chapter 2, "The House and Family System." *Understanding Japanese Society.* London: Croom Helm, 1987: 21-37.

[14] Minami, Ryoshin. *Power Revolution* in *the Industrialization of Japan: 1885-1940.* Tokyo: Kinokuniya, 1987. 261.

[15] Ibid.

[16] Ministry of Trade. *Heisei 5 nen kougyou Toukei Hyou (1993 Census of Manufacturers).* Tokyo, Research and Statistics Department, Ministry of Trade, 1995. 7.

[17] Although in this case Fujimori was not concerned with

recognizing the original siting of the wood in the way he finally employed it, it is easy to see from my description how an architect or contractor may, for example, orient materials to the compass in the same direction that they originally grew.

[18] The differences in liability laws are also important. This is discussed at more length in a piece written by the author for JAE, forthcoming.

[19] In this regard, Fujimori's efforts can be compared to Kenneth Frampton's attempts to re-establish discussion of Modernist architectures on the basis of tectonics. See, for example, Frampton's recent book *Studies in Tectonic Culture: the Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Chicago: Graham Foundation for Advanced Studies in the Fine Arts and Cambridge: the MIT Press, 1995.

ACKNOWLEDGMENTS

In the summer of 1994, I visited his first project, the Moriya Jinchokan Shiryokan, with Professor Fujimori. While I photographed the project, we spoke about his approach to its design and the perceptions of the project which others held. I was quite fortunate thereafter to be invited by Fujimori to observe the construction of a house for his family during the summer of 1995; he also had two other projects in the design stage at that time. Throughout the course of this experience I have not only had the pleasure of observing an intellectually rigorous approach to design, but I have quite literally been overwhelmed by the generosity shown to me by not only Professor Fujimori, but also by his extended family and by his professional associates.