DEVELOPMENTS TOWARD A RESIDENTIAL FIT-OUT INDUSTRY

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Abstract

This paper outlines some of the background of and constraints facing the emergence of a new industry, focused not on buildings as such but on residential fit-out – the integrated kit-of-parts "behind your front door." Residential application of the distinction between base building (support) and fit-out (infill), although sharing the same principles as the well-established office building and shopping mall sectors, is particularly important because it affects a very large market whose potential is not yet exploited but is arguably nascent.

It is well understood that industrial manufacturing processes – now becoming "product service systems" in the consumer sector – are most effective and dynamic where individual users are directly served, as seen in the automotive and electronics/communications sectors. Construction of base buildings understood as "infrastructures for living" is capable of stimulating the evolution of a fit-out industry that will itself accelerate innovation and distribution of new domestic fit-out services and systems.

In general, the creation of a genuine fit-out industry is not a technical or industrial design problem. Material subsystems and components like partitioning, bathroom and kitchen equipment, as well as "plug-and-play" piping and wiring are available or are being invented and approved in regulatory regimes internationally. While some smart products are still needed, the problem now is essentially a business proposition. By shifting to the provision of benefits rather than simply manufacturing products, companies may find a competitive advantage in a sector of the building industry now poised for an innovation leap. In the US and other developed countries, this is particularly compelling given the sustainability agenda, smart growth and increased demand for consumer-oriented production. In this perspective, the trend toward base building architecture allows the building industry to effectively come to terms with new and creative modes of industrial production.

Keywords: *Open Building, Fit-out Industry, Product/Service Systems.*

INTRODUCTION

Personalization in housing is not new. Families have always personalized their dwelling places, independent of wealth, climate or culture. In rented flats, people bring in furniture, cabinets and appliances, paint the walls and put flowers on their balconies. In owned flats, families upgrade kitchens and bathrooms and rearrange spaces with new equipment even before the old equipment is obsolete.

Considered in the aggregate, this is a massive economic reality. In a development or building of identical dwelling units, a visit to the same place in 10 – 20 years will reveal customization and personalization – no two dwellings will be the same for long. The evidence for this is ubiquitous, in all countries. In the United States alone, more money is spent each year by families at home project "do-it-yourself" centers and in hiring contractors to upgrade and modify houses, apartments and condominium units than is spent on new housing construction. While cyclical, the fact remains that remodeling market is massive and will not go away as incentives increasingly encourage continuous use of the existing building stock.

Thousands upon thousands of companies offer products and services in response to the demand for personalization. These companies are constantly improving their products and services to maintain a competitive advantage. The national show organized in the United States each year by the National Association of Home Builders is a remarkable display of this phenomenon. The equivalent showcases occur everywhere if not at the same scale.

Since personalization is ubiquitous, and the worldwide building industry is deeply committed to it, investing heavily to develop new products, tools, and methods, what, then, might be the next steps for an industry already deeply involved in personal-

ization and customization?

BALANCE

Because personalization never occurs in a social vacuum, there are important constraints that must be spelled out. Most importantly – especially in the context of multi-family buildings, where the difficulties of personalization are most pronounced - there is always the reality of the other family next door, upstairs or downstairs exercising the same initiative. And there is the larger social system, i.e. the "community" involving building codes and standards, legal and financing regulations, as well as more local constraints such as home owner association or condominium rules.

To be specific, an electrical appliance attaches to an outlet and cable in a wall, which connects to a cable in the building and then to a cable in the street. Similarly, a toilet connects to a drain line in the wall, which connects to the building's drain line, which connects to the city sewage system. When such resource systems cross the boundaries of territories (legal jurisdictions) under the control of various parties, potentially complex and disruptive conditions of entanglement arise. These must be sorted out and resolved, particularly at the building level. Legal disputes and quality-control problems are well known in residential buildings due in large measure to these entanglements.

Because of these physical / technical / territorial issues, consumer electronics and the automobile – both suggested as exemplary models of innovation and all seeing extraordinary advances in mass-customization - are poor models for the building industry. This is because these products are known not by their place in the larger fabric of the built environment but exactly by their fundamental detachment from any place.

Further advances in personalization and customization for the individual in respect to the built environment – and housing in particular - cannot ignore the inevitable territorial and technical dialectic between the individual and the group. Since neither a detached house or a unit in a multifamily building can exist in contemporary society without action by both the individual and the community, it is futile to expect further evolution of mass-customization and personalization in support of physical environment improvement processes without recognizing both forces.

In what follows, trends in the building products and services sectors are discussed, indicating a new understanding of how to release the tensions so often found between the individual and the group in the realization of personal preferences in housing. The release of such tensions will inevitably release new energy to solve the problems that have here-to-fore hampered the full application of mass-customization and personalization to the built field.

TRENDS

To survive in the competitive global market place, manufacturers and suppliers have to develop new ways to sell their products. One trend is to package core products, developing a combination of products and services, which makes the sale more attractive to customers. Consumers no longer look only for physical products, but rather focus on the benefits enabled through a value-adding service. Thus, by shifting into the provision of benefits rather than simply manufacturing products, companies might become more competitive.

Companies are facing the challenge to align their production systems with emergent complex demand patterns (Morelli 2002). The same author also argues that there must be an understanding of costumers' needs to enable the provision of knowledge-intensive systemic solutions, or product service systems (PSS). PSS can be defined as a service-led competitive strategy, which addresses the issues of environmental sustainability, and is the basis to differentiate from competitors who simply offer lower priced products (Baines et al. 2007). According to the same authors, by considering product's life cycle, companies increase value in use for consumers by taking the risks, responsibilities, and costs traditionally associated with ownership, while still retaining asset ownership that can enhance utilization, reliability, design, and protection.

The importance of considering all stages of products' life cycle, as well as the connections with other products and services, has led to the emergence of the concept of "through-life manage-

ment" (Koskela et al., 2008). Through-life management should encompass designing and producing artifacts, producing services through those artifacts, and planning for deconstruction (or disposal) of those artifacts. According to the same authors, the central idea of introducing through-life management is to create an understanding of all those stages as one unit of analysis and as one integral object of management.

PRODUCT BUNDLING

Homebuilders watching service-oriented business trends will undoubtedly notice a development called "product bundling" or "kitting", a version of PPS. This means that product manufacturers and service providers are "adding value" and gaining profit in the supply channels by preparing certain packages of building parts off-site, for easy on-site installation. Sometimes this is called "prefabrication" or "kitting", for example when an electrical contractor pre-wires all the boxes and terminations in his shop, packs all the cable whips and associated parts needed for the entire wiring installation in boxes, and brings them to the site for installation. In these instances, no "new" products are needed, only a new way of organizing the work.

The term product bundling can have several meanings. One is characterized by the legal battle involving Microsoft, charged with monopolistic practices by its "bundling" several discrete pieces of software into a unified package the parts of which cannot be purchased separately. The business literature concentrates on this definition.

In the context of the building industry, bundling refers to bringing together a number of discrete products (made or purchased) into a coordinated (integrated) package by a single company. Normally, this process occurs at a distance from the site of final installation, signifying that value is added both off-site (in preparing the bundle or kit) and on-site (in installing it).

Product bundling is similar to prefabrication, which means assembling elements – ordered by the user rather than initiated by the producer – in an off-site location, to be installed as a whole when it reaches the construction site it was prepared for. But there is a difference. Product bundling or kitting focuses on the delivery of packages of generally small parts ready to assemble, connoting the idea of boxes of parts small enough to get in a pick-up truck and through the front door or window of the house.

This is not particularly new. Examples of "product bundles" include a kitchen from IKEA (Norman, 1993) or even a plastic - wrapped toilet bowl valve-replacement kit. Often, these products are not made entirely by the company doing the bundling (although they can be), but may be products brought together from a variety of manufacturers or suppliers. The "bundler" is an intermediate service company.

It is characteristic of a product bundle or kit that it arrives at the site ready for assembly, rather than pre-assembled. This means that further value must be added at the site, but that the on-site assembly work is facilitated by the bundling together of just the right parts designed for assembly and sometimes also the tools for the job. The on-site work is a form of construction.

KINDS OF BUNDLES

There are two kinds of product bundles. One is project independent. This kind of bundled product is made off-site, but in this case, the product is not made specifically for the project but for ANY project – that is, it is made at the initiative of the producer, for a particular market segment. This kind of product is often called manufactured. Examples of this are a Velux roof window kit; a lighting fixture with all the cables, hangers, fasteners, etc in the box; a passage door hardware kit with a variety of strikes and other parts to fit a variety of door installation conditions; a faucet/ drain/ overflow kit; and so on.

The other kind of product bundle is project dependent. This kind of bundled product is also made at a distance from the building site and is prepared to facilitate on-site assembly with increased speed and quality with reduced dependence on site labor. This is the kind of production that is initiated for the project at hand. Again, the bundle is ready-to-assemble when it reaches the site it is intended for. Such project bound bundles can and usually do use manufactured parts made for the market, and brought together (cut, bent,

Figure 1. One of the Sears Catalog Houses

shaped) for the particular installation. Examples include a sunroom extension from a local window/patio enclosure company; a set of kitchen cabinets the selection of which is specific to the job at hand including the countertop; and so on.

The key distinction is a business distinction - the locus of initiative. In the former case the producer takes the initiative and risk. In the latter case, the user takes initiative and assumes the risk.

BRIEF HISTORY OF WHOLE BUILDING PRODUCT BUNDLES OR KITS

The housing industry in the US has experienced a number of efforts during the past 50 years at whole house kitting. Some have failed because they were out of touch with the market and because they tried to introduce too many product substitutions out of the ordinary.

Sears Catalog Houses

Sears Catalog Homes (sold as Sears Modern Homes) were ready-to-assemble houses sold through mail order by Sears Roebuck and Company, an American retailer. Over 70,000 of these were sold in North America between 1908 and 1940. Shipped via railroad boxcars, these kits included all the materials needed to build a house. Sears offered the latest technology available to house buyers including central heating, indoor plumbing, and electricity. As demand increased, Sears expanded the product line to feature houses that varied in expense to meet the budgets of various buyers. Sears began offering financing plans in the 1920s. However, the company experienced steadily rising payment defaults throughout the Great Depression, resulting in increasing strain for the catalog house program. Over the program's 32-year history, 447 different house models were offered. The mortgage portion of the program was discontinued in 1934; the entire program ceased altogether in 1940. (Stevenson, K.C. and Jandl, H.W. 1986)

Lustron House

Another case is the Lustron House, only several thousands of which were built after massive private

Figure 2. A Lustron house kit spread out on an airport runway to demonstrate the extensive contents of a Lustron House kit of parts. (ca 1950)

and public sector investments in the late '40's and early '50's.

In 1947, the Lustron Corporation received a U.S. government $12.5-million Reconstruction Finance Corporation loan to manufacture "mass-produced prefabricated" homes (a contradiction in terms – author's note) featuring enamel-coated steel panels. The Lustron Corporation set out to construct 15,000 homes in 1947 and 30,000 in 1948. From its plant in Columbus, Ohio the corporation eventually constructed around 3,000 Lustron homes between 1948 and 1950. The Lustron Corporation declared bankruptcy in 1950." (Herbert, 1986)

Techbuilt

Designed by architect Carl Koch, the Techbuilt house was – in the 1950's and 60's - a "prefabricated" house using ordinary wood framing in 4'-0" panel modules for the exterior walls and roof, and a post and beam interior structure with panelized floor elements. Each house was designed for the specific customer on a 4ft-planning grid, but the

Figure 3. Techbuilt panels arriving by truck

house package was not produced until the drawings were done and a purchase contract signed. The entire house package was delivered by truck, including the operable windows and pre-hung exterior doors already installed in their wall panels, kitchen cabinets, heating equipment, radiant heating elements, and the roofing shingles. Exterior siding (consumer choice), fixed glass, electric service and plumbing were obtained locally. A local contractor assembled all parts. A Techbuilt advisor

Figure 4. View of the erection of interior post and beam elements

stayed on-site only until the shell was erected and enclosed. (Koch, 1958)

DEVELOPMENTS IN INTERIOR INFILL SYSTEMS

Matura

Between 1990 - 95, Infill Systems BV in the Netherlands introduced an integrated interior fit-out product for the European market called Matura®. It was based on a decade of research at the Delft University of Technology and was designed for new construction and the renovation of older buildings. It offered fully customized residential interiors just-in-time. Two new products were developed to organize the assembly of off-the-shelf products used commonly in the European market. With newly developed software that provided seamless IT management from design through installation – with pricing, fabrication, packaging and installation information and drawings – the two new products make a proprietary system that had patents in seven countries including Japan, the US and Canada.

It was one of the most advanced product

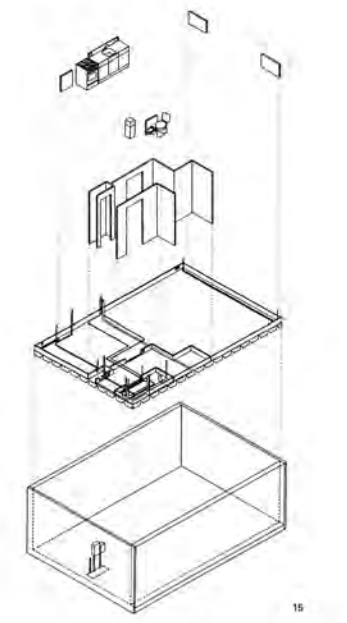

Figure 5. The Matura concept of lower and upper systems

bundling or kitting products for the multi-family (apartment or condominium) residential market. It focused only on the interior. The base building and main service / utility access (shown at the bottom of Figure 5) in which these packages are installed is

the responsibility of a development company. The Matura lower system is shown in the diagram as the more technical layer containing the horizontal pipes, ducts and cables. The upper level contains the more consumer-oriented products such as cabinets, fixtures, finishes, lighting, and so on. That initiative produced a number of completed dwellings but eventually went out of business. (Kendall, 1996)

Matura 2

Now, the developers of Matura are introducing a new set of products, one of which, CABLESTUD, is in the market in Europe introduced by GYPROC.

Whereas in the early Matura Infill System the partition and the matrix tile were technically interdependent, the new products keep them separate, as the drawing at the right shows. (intellectual property rights belong to Infill Systems BV)

Next Infill

Originating in Japan as a product innovation initiative of Sekisui Heim, in response to the emerging demand for efficient and consumer-oriented renovation of obsolete but still useful large housing blocks, Next Infill was a product bundle including a

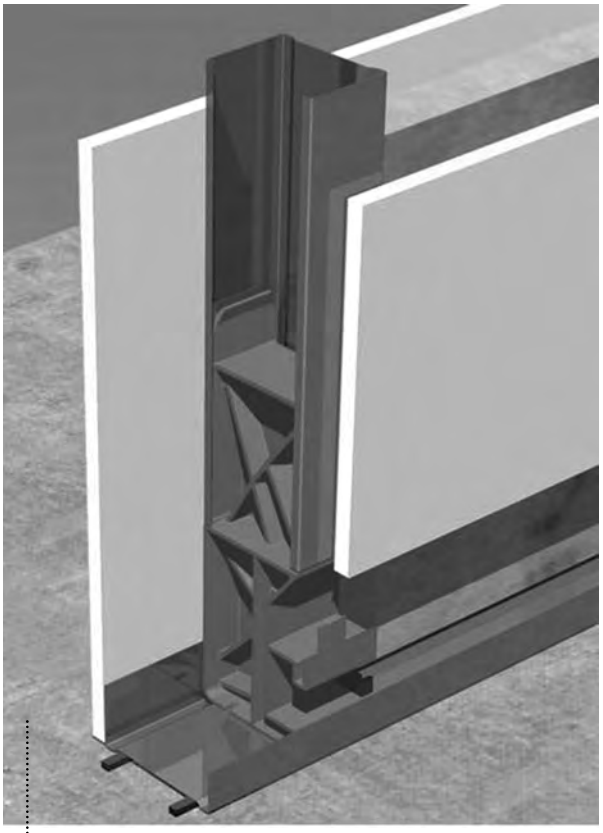

Figure 6. Cable Stud

thin raised floor under which pumped drainage and water supply piping would be placed. It also included a partitioning system within which electrical and data cabling would be placed, and dropped ceilings to accommodate other cabling, light fixtures, air conditioning pipes and the variable beams of many of the concrete buildings needing renewal. Later, the concept was taken outside of Sekisui Heim and now operates as an independent company successfully selling product bundles in the

Figure 8&9. Next Infill Partitions (left) Next Infill raised floor with piping (right)

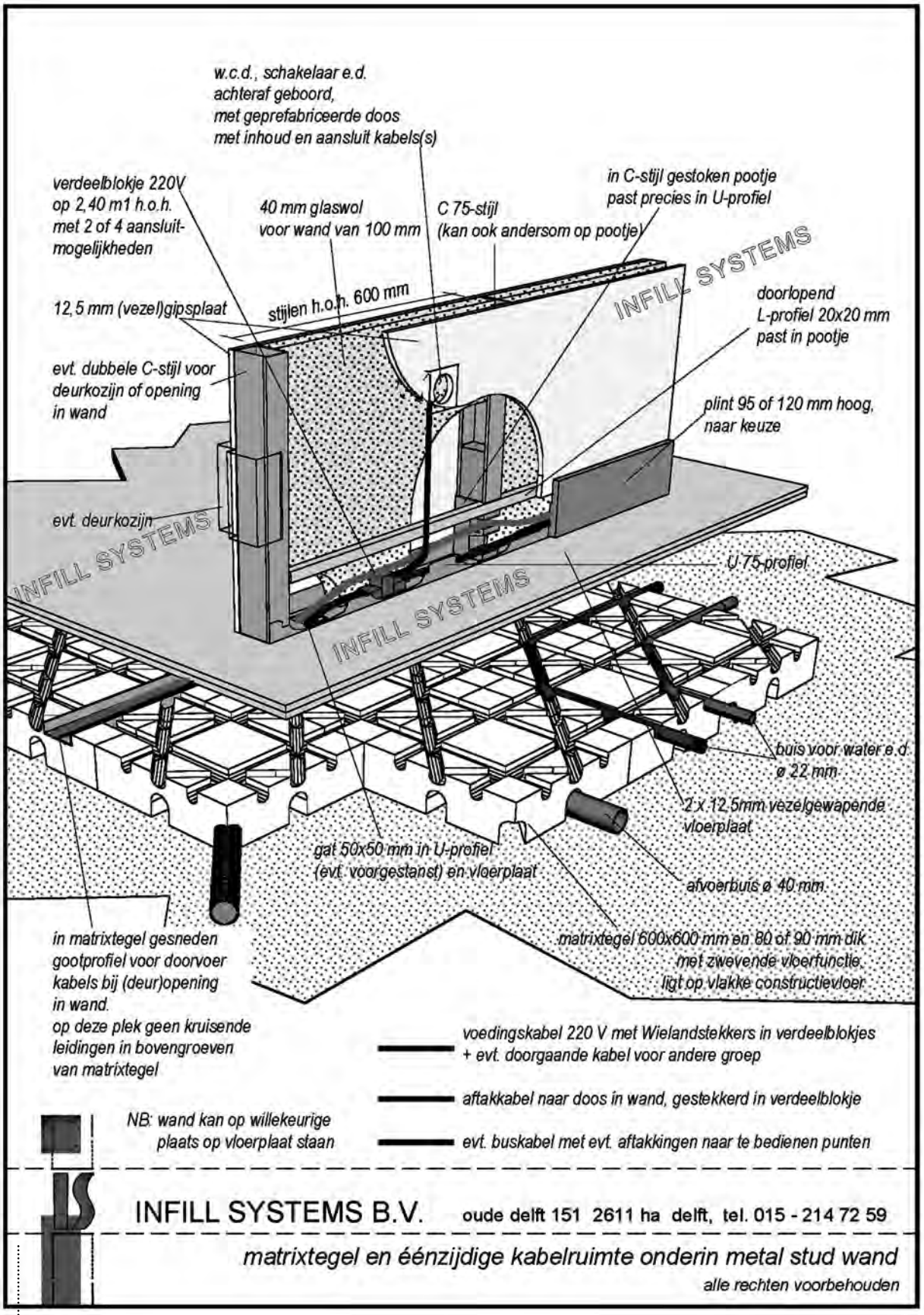

Figure 7. *Matura 2 matrix tile for horizontal pipe routing*

Japanese market. (Next Infill -http://www.next-infill.com/index.html)

The number of newly built private housing units for sale has been decreasing for the last five years in metropolitan areas of Japan. At the same time, the stock of second hand houses is increasing. In this context, the business practice of "buy, refurbish and sell " is growing rapidly. "Intellex" is one company serving this new market. They have already sold 8,000 units over the last few years, with 1,000 -1,500 units sold each year. Their share of the stock renovation market is 5.2% in metropolitan areas. They call their commodity " Renovex Mansion." The period from buy to sell is under 120 days including 20 days of design and 30 days of work. They always remove all existing infill parts (including plumbing and wiring) and fill in with new infill. They call this way of refurbishing "Full Skeleton Reform." They have their own design firm and have developed their original design –build system. Their business practice is completely different from that of apartment building developers, because their work sites are scattered across vast metropolitan areas and each site has only one unit under renovation at one time. Their system is similar to house builders.

The "Next Infill" system is a supplier to Intellex. Two systems are delivered. One is the wooden (under layer) frame system without surface panels, applied to walls, ceilings and floors. The second system is the equipment system of plumbing and wiring. They call this the "infra" of the infill.

Another distinguishing movement of the stock renovation market in Japan is "full body renovation of one building". "Revita" is the leading company. They are one of the subsidiary companies of Tokyo Electric Power Company. They buy company-owned (apartment) houses for employees that are not so old but which the company wishes to sell for economical reasons. They renovate and refurbish the entire common area and associated piping and electrical equipment. Then they sell each unit to the people who want to live there, with each unit having its old, existing infill. Then the inhabitants (to be) order the renovation of their units to a builder of their choice, according to "Revita's" coordination guidelines. Revita is paid a coordination fee. "Intellex" and "Revita" are two typical business styles of the Japanese infill Industry today. (Chikazumi, 2010)

CONCLUSION

With the passage of new laws in Japan encouraging 200-year housing; with the trend in Warsaw, Poland toward open building as the "Warsaw Standard"; with the initiative of the Sato Development Company in Finland; and with the continued "adaptive reuse" of obsolete office and warehouse buildings world-wide into housing, it is only a matter of time before new companies discover the pent-up demand for "product service systems" and enter the market with residential fit-out. A well-developed consumer market is, however, a prerequisite, supported by sensible financial and regulatory reforms.

REFERENCES

BAINES et al. 2007, *State-of-the-art in product-service systems*. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture. Volume 221, Number 10 / 2007, pages 1543-1552. Sage Publications.

CHIKAZUMI, S. 2010, Shu-Koh-Sha Architectural and Urban Design Studio, Tokyo (informal interview)

HERBERT, G. 1984, 1986.: *The Dream of the Factory-Made House: Walter Gropius and Konrad Wachsmann,* Cambridge, Mass., MIT Press,

KENDALL, S. 1996, *Open Building: An Approach to Sustainable Architecture*. Journal of Urban Technology. December.

Ibid. 1996, *Europe's Matura Infill System Quickly Routes Utilities for Custom Remodeling.* Automated Builder, May.

KOCH, C. 1958, *At Home With Tomorrow.* NYC: Rinehart Rinehart and Company, Inc.,

KOSKELA, L.J. & HOWELL, G. 2008, *The Underlying Theory of Project Management is Obsolete,* Engineering Management Review, IEEE, Vol. 36, Issue 2, pp.22-34.

MORELLI, N. 2002, *Designing product/service systems: a methodological exploration.* Design Issues: 3-17.

Next Infill. (http://www.next-infill.com/index.html)

NORMANN, R. & RAMIRAZ, R. 1993, *From Value Chain to Value Constellation,* Harvard Business Review, July-August, pages 65-77.

STEVENSON, K.C. and JANDL, H.W. 1986, *Houses by Mail: A Guide to Houses from Sears, Roebuck and Company.* National Trust for Historic Preservation, Wiley and Sons, Inc.

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