Industrialized Housing: An Inquiry Into Factors Influencing Entry Decisions by Major Manufacturing Corporations (1972)

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INDUSTRIALIZED HOUSING:

An inquiry into factors influencing entry decisions by major manufacturing corporations.

A report prepared by the
COMMITTEE ON INDUSTRIALIZED HOUSING
of the
NATIONAL ACADEMY OF ENGINEERING

NATIONAL ACADEMY OF ENGINEERING
Washington, D. C. 1972

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May 31, 1972

Mr. Clarence H. Linder
President
National Academy of Engineering
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Dear Mr. Linder:

It gives me great pleasure to transmit herein the final report of the Committee on Industrialized Housing. The Committee was established under a grant from the Scaife Family Charitable Trusts for the purposes of (1) assessing the state of the art in industrialized housing, and (2) conducting market and feasibility studies to help determine if America's pre-eminent manufacturing corporations might, through improved production technology, play a greater role in meeting the Nation's housing goals.

It is my feeling the somewhat pessimistic overtones of the report, although disappointing to those of us who undertook the project with high hopes, result from a realistic appraisal of existing conditions in the field. The views presented reflect private rather than public postures of many corporations concerning the uncertainties of future markets, entry costs and the efficacy of hardware solutions to the housing problem. The concensus which emerged in the project suggests industry feels production innovations will not prove cost-effective unless matched by innovations in financing, land-use and other software areas.

The Committee is grateful to all cooperating organizations in and out of government, and is particularly indebted to the industrial firms which lent so generously of their time and personnel. It is our sincere hope this report will clear away some of the misconceptions surrounding industrialized housing and contribute to a more constructive approach to the Nation's housing problem.

Sincerely,

Eric A. Walker
Chairman, Committee on
Industrialized Housing

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TABLE OF CONTENTS

PREFACE

The Industrialized Housing Committee was established in December 1970, to assess the role, if any, large American corporations might play in the provision of housing through the development of a sophisticated new mass production technology.

The Committee's task was seen from the outset as part of a broad-based public and private commitment to providing improved shelter. It viewed the Industrialized Housing Project as an appropriate vehicle for exploring one major, quantifiable element in a complicated social problem and confined its research to the question of whether a privately-based, production-oriented approach could significantly reduce housing costs while at the same time upgrade housing quality.

The Committee found institutional constraints inhibit high-impact technical response to the housing problem. Recent similar findings in such diverse areas as public transportation, shipbuilding, resource allocation, and health care reinforce emerging private and public awareness that exotic technical solutions cannot, by themselves, be expected to resolve socially-based problems.

The dominant conclusion of the Project is that major American corporations would not, at this time, contribute to an improved housing stock by merely adding capacity through expanded mass production methods. That conclusion notwithstanding, the Committee believes there are, and will continue to be, a variety of constructive areas in which industry can

I. ASSUMPTIONS

The Project was conceived in December, 1970, as an analysis and test of economic and social indicators which seemed to support the assumption that cooperation among the Nation's leading industrial corporations in the mass production of housing was essential and would prove sufficiently profitable to attract investment capital on the scale required to launch a new, high-technology industry.

The most significant indicators reinforcing that view while simultaneously attracting corporate interest and influencing public policy were: the magnitude of the housing problem; the role of improved construction methods in a variety of successful European housing programs; the emergence of new housing markets, State actions in the area of code reform; changing attitudes of organized labor; and, increasing confidence in the effectiveness of technological transfer. Throughout 1970 and 1971, those indicators were cited repeatedly as evidence supporting the two major assumptions central to the Project's inquiry.

(1) The Nation's leading manufacturing corporations have experience in cost-saving, mass production techniques and management skills that suggest optimum transferability to an industrialized delivery system for housing; and

they have the required engineering and systems design capability to develop an integrated manufacturing process for adapting innovative housing hardware to high volume production components.

(2) The Nation's leading manufacturing corporations with national and international outreach have, or could command, capital on the order of magnitude necessary to sustain volume production of housing units in the face of market fluctuations; and

they have the ability to deploy on a nation-wide basis sophisticated management, inventory, and distribution systems capable of aggregating markets and delivering housing in sufficient volume to assure profitability.

Those two assumptions dominated housing's conventional wisdom in 1970. This report summarizes the research effort conducted by the Project to establish their validity and applicability as points of departure in a new approach to meeting the Nation's housing needs.

II. CONCLUSIONS

The Industrialized Housing Project of the National Academy of Engineering was commissioned to determine whether a combination of the Nation's leading manufacturers could, through the intensive development of innovative building systems, achieve two goals:

(1) serve the national interest by increasing the quantity of housing, improving the quality of housing, and lowering the cost of housing; while

(2) serving the economic interests of the corporations participating in a "new" housing industry by attaining those objectives within realistic parameters of risk and opportunities for profit.

After eighteen months of inquiry, the Project's findings indicate that an improved technology yielding only increased production can, at best, reduce costs to the consumer by less than ten percent. Thus, with respect to its two primary objectives, the Project finds:

-- a restructured industrialized housing industry, composed of large manufacturing corporations, is not required at this time in order to increase the quanitity of housing;

-- large scale entry of major corporations into industrialized housing would not significantly lower the cost of housing to the consumer;

-- economic advantages, specifically return on investment over an acceptable period of time, would not accrue to large manufacturing corporations entering the factory-built housing industry on a large scale at this time;

-- increased industrialization would offer cost-effective opportunities for improving the quality of housing.

While these conclusions are predominantly negative, it should be recognized that social and technical changes are slowly taking place which could, over the next decade, make it possible for large corporations to enter the housing field on a volume production basis. Among the long-range factors working in favor of a more promising investment climate are: growing consumer acceptance of manufactured housing; erosion of restrictive zoning ordinances, building codes, and labor practices; and the cumulative effect of incremental advances in housing technology.

Despite these favorable long-range trends, however, the Project's findings are that prospects for entry by first-rank manufacturing corporations into the production and marketing of housing on a national scale are extremely discouraging at this time.

III. METHODOLOGY

In preparing its report, Industrialized Housing: An Inquiry Into Factors Influencing Entry Decisions by Major Manufacturing Corporations, the Industrialized Housing Committee relied heavily on technical staff made available to it by several of the Nation's largest industrial organizations. In addition, extensive use was made of experts from government departments and universities as well as consultant-contractors representing a variety of relevant disciplines. In selecting outside assistance, the Committee placed particular emphasis on experience and imaginative approaches to design, construction, planning, market analysis and labor relations in the housing field.

This collaborative method of problem definition and solution, utilizing the in-house capabilities of participating companies combined with outside specialists, offered advantages for both the corporations and the National Academy of Engineering. In the case of the former, the research provided a window on the state of the art in the emerging technology of manufactured housing, while for the Academy, the methodology suggested a new approach to structuring and financing multi-discipline urban research programs.

In the allocation of tasks, the work of the consultant-contractors was focused on providing both the foundation for a third, or implementation phase of the Project if a follow-on were recommended, and a simultaneous test of the validity of the Project's basic assumptions. They prepared technical

papers in five areas -- market research; industrial relations; the development of an information system; systems analysis; and environmental design. While not necessarily leading to, or supporting the conclusions reached by the Project, the papers contributed a range of thoughtful and imaginative insights touching on most of the significant factors influencing entry decisions by major manufacturers.

1. The Outlook for Housing Demand in the 1970's

   This paper presents a reassessment of demand forecasts for housing in the 1970's and identifies growth areas and potential new markets.

2. Report on Labor in the Construction Industry: Current and Emerging Attitudes on Industrialization

   This report describes evolving attitudes found in organized labor concerning innovations in production methods, and outlines alternate strategies for dealing with manpower problems in a restructured housing industry.

3. Information System: An International Catalogue of Industrialized Building Systems

   An information storage and retrieval system, using Litton Keysort card decks, contains product information on over 700 housing systems and sub-systems. Three case studies of representative housing systems were undertaken to provide in-depth analytical source material.

4. A Model for an Industrialized Housing Industry in the U.S.

   A systems analysis of the existing manufactured housing industry produced a process model focusing on constraints that inhibit large corporations from entering the field and strategies for eroding those constraints. This analysis was also used to test hypothetical entry approaches designed to illustrate representative programs for individual corporations or consortia exploring market intervention.

5. Possible Directions for Housing Technology at a New National Scale

This report was prepared as an initial attempt to describe the requirements of a proto-type production system making optimum use of innovations in housing technology.

In parallel with the consultants' research, an extensive series of interviews was conducted with corporation executives and financial underwriters familiar with housing issues. The interviews were in some cases highly structured while others provided general background information and opinion. As a result of assurances that information supplied would be treated on a restricted basis, responses to questions were frank and candid. Thus, the Project had access to privileged points of view and insights that are not generally reflected in data-based research.

From the interviews, industry's perceptions of seven trends in the housing field emerged. Those trends, termed "Indicators" for the purposes of this report, were independently analyzed by Project staff. The results of that analysis constitute the basis of the Project's conclusions.

IV. MAJOR INDICATORS AND PROJECT FINDINGS

Indicator 1: The Housing Problem

In the late 1960's, the housing industry appeared to lack both the productive capacity to meet established national goals and the ability to control rapidly rising costs.

Housing goals set by the Federal Government in 1968 called for the construction of 26 million units over the decade 1969-78. As indicated below, annual levels of production for the preceding nine-year period did not suggest the industry, as constituted, possessed sufficient capacity to meet those goals on either an annual or ten-year basis. 1/

Year	Total (000)
1960	1,400
1961	1,455
1962	1,610
1963	1,793
1964	1,752
1965	1,726
1966	1,413
1967	1,562
1968	1,864

Over the same years, the cost of new housing rose steadily with no promise of relief to the consumer in sight. Increases during the 1960's averaged eleven percent per year and studies by the House Banking and

1/ Housing Starts. Construction Reports, C-20, Bureau of the Census, April, 1972; Construction Statistics: 1889-1964. Published by the Department of Commerce, 1967

Currency Committee in 1969 and 1970 showed spiralling costs were effectively pricing seven of every ten American families out of the new home market.

The second half of the decade also saw large-scale abandonment of structurally sound dwellings spread with devastating impact through the center city neighborhoods of large and medium size cities.

The magnitude and complexity of the housing problem, further complicated by the abandonment phenomenon, clearly called for new and more effective approaches by both government and business.

Finding

The levels of housing production reached in 1970 and 1971 and projections for 1972, make it clear the existing mix -- conventional builders combined with mobile home and other semi-industrialized producers -- can meet or even exceed Federally-mandated production goals.

On that point, government officials in the housing field agree, as shown by this exchange between Representative Edward P. Boland, (D., Mass.) and George Romney, Secretary of Housing and Urban Development. 2/

> "Mr. BOLAND. Your Department is to be complimented on the activity that it had in housing in 1971. You reached the goal. The total number of housing starts for the calendar year 1971, as I understand it, is about 2,270,000. Is that right?
>
> "Secretary ROMNEY. For 1971, Mr. Chairman, there were 2,085,000 conventional units, and on top of that you have to add, we think, the mobile home output, which was about 492,000 units.
>
> "Mr. BOLAND. What is the projection for 1972?
>
> "Secretary ROMNEY. For calendar year 1972, I projected a figure between 2 million and 2.2 million conventional units, and about 500,000 mobile homes.
>
> "Actually, the year has started out much higher than that because the January - February figures were running at another half million mobile home units. So we are up to the 3 million units level."

2/ Testimony of the Secretary of Housing and Urban Development, the Honorable George Romney, April 10, 1972. Reprinted in HUD-Space-Science-Veterans Appropriations for 1973, Hearings before a Subcommittee of the Committee on Appropriations, House of Representatives, Ninety-Second Congress, Second Session, page 36.

As those figures demonstrate, the existing industry has the productive capacity to meet established goals. Accordingly, the Project found 1972 to be an inappropriate time for large scale intervention in the housing field by major corporations.

On the basis of current and projected production levels, "the housing problem" would not benefit, under existing conditions, from a restructured housing industry with greatly expanded capacity.

Indicator 2: The European Experience

In the 1950's and 1960's, a number of European countries made impressive and well-publicized gains in overcoming housing shortages and alleviating social problems by aggressively converting from conventional to highly sophisticated, industrialized housing production systems. In Western Europe, cooperation between public and private sectors played a major role in most of the successful efforts; under government impetus and financial support, local construction industries developed improved building techniques.

Working with the design professions and public planning agencies to establish national housing standards, both for quality and quantity, the European building industry developed highly integrated systems that were particularly effective in increasing the housing supply in high density, urban areas. In several countries, those systems increased production and demonstrated cost superiority over traditional home building techniques. Throughout much of the world they were viewed as the wave of the future in meeting the universal need for shelter.

Finding

The Project finds that the degree to which the European experience in industrialized housing can be applied in this country does not merit major investments in production facilities by American manufacturers at this time.

There is no evidence to suggest large manufacturing corporations have been major participants in the growth of European industrialized housing. Building practices there, as in the United States, have followed traditional patterns moving from conventional stick-building techniques to more rationalized systems methods. As a result of that evolutionary process, telescoped in Europe under the pressures of post-war reconstruction, industrialized building methods are now demonstrating, after a long and agonizing shake-out within the industry, some cost advantages over conventional construction.

The most glaring fallacy in attempts to ascribe total transferability of European technology and building processes to the United States results from literal application of culture-sensitive solutions. Some elements of the European experience in industrialized housing can provide useful benchmarks for improvements in American technology. In general, however, European building processes and practices would have to be modified extensively to fit uniquely American cost, space, code and amenities requirements before they could be successfully applied in the United States.

Indicator 3: New Markets

In the late 1960's, five major housing markets emerged which appeared to be particularly suited to exploitation by large corporations. They were:

1. The Federally-mandated market for low- and moderate-income families.

2. A rising preference among buyers and renters for multi-family housing as opposed to the traditional single-family, detached house;

3. An anticipated boom in the market for so-called "second" or vacation houses;

4. New Towns with increasing appeal as investment opportunities for developers and increasing attraction to consumers as a life style;

5. An expanding military construction program.

In each case, potential demand was great and reassuring forecasts indicated continued growth, both as new and replacement markets. They represented the kind of aggregated buying power needed to support volume production and were assumed to be highly responsive to improvements in a delivery system which promised to reduce costs to the consumer.

Enhancing their appeal was the fact that three of the five markets were tied to expanding Federal programs; low- and moderate-income housing, new communities, and military construction. There was reason to believe the introduction of cost-saving industrialized methods would be encouraged, and where appropriate, underwritten on an experimental basis by the government.

Finding

The Project finds that emerging housing markets do not yet represent a sustained, aggregatable demand for manufactured housing large enough to justify investments in production facilities and other start-up costs on the order of the magnitude required for entry by major corporations.

1. The market for low- and moderate-income housing, plagued with social problems, is difficult to quantify and penetrate. As Secretary Romney stated before the House Committee on Appropriations on April 10, 1972:

> "...These conditions cannot be corrected by the housing or other programs of our Department no matter how well they are administered. Housing needs for the poor in the central city cannot be met without cures for the social conditions..." 3/

2. The growing market for multi-family housing is being adequately met by existing capacity. This category of housing starts has grown from 257,000 in 1960 to 900,000 in 1971. Between 1968 and 1971 alone, starts increased 50 percent demonstrating the capability of the industry, as presently structured, to respond to changes in consumer preference.

3. The market for second or recreation homes is characterized by boom-or-bust conditions and would entail excessive entry risks for large-scale manufacturers.

> "There is definitely a market for second homes, and it should grow as our society becomes more affluent. But it seems that more excitement has been generated about this market than its prospects would justify ... Even if we assume that

3/ Ibid. Part III, page 30

> construction of second homes triples by 1980, surely an optimistic estimate, the number would still be only 150,000 per year. Since the typical second home tends to be minimal housing, this number would be equivalent in dollars to perhaps only one-third as many average conventional units. In short, there will be a market for second homes, but it will hardly revolutionize the demand for construction materials and services." 4/

4. While New Towns hold promise as markets for manufactured housing over the long term, any assessment of them as potential sources of demand should reflect the fact that unlike most foreign countries where their development has been sponsored by government, in this country new communities have been built by private developers with pre-existing vertically integrated systems of finance, land assembly and development, construction and marketing. To date, New Town efforts have produced higher than anticipated costs to the consumer and encountered serious administrative and legal roadblocks at the local level. Thus, on the basis of the still limited experience in the U.S., New Towns must be viewed as riskly investments in themselves, and equally questionable as markets for a high-volume housing industry at this point in time.

5. The future for industrialized production of housing for the military remains unclear pending the outcome of current programs. The scale of that highly specialized market cannot as yet be determined. However, under the most optimistic conditions, the military market is a limited one.

4/ Cline, George Dr., Housing in the Seventies: Realism vs. Euphoria. Real Estate Review. Vol. 1, No. 1, p. 37

Indicator 4: Extensive Federal Support

The emergence and growth of new housing markets was fostered and sustained by unprecedented levels of Federal support. The Federal Government was providing direct subsidies for production, shoring-up the mortgage credit market, and funding the development of new communities, all designed to carry out the commitment by Congress to increase the Nation's housing supply. Experimental efforts such as the Department of Housing and Urban Development's Operation Breakthrough, and the housing programs of the military services were other examples of the Federal Government's determination to find ways of increasing production and, eventually, stabilizing costs.

The steady trend toward higher levels of government support increased Federal subsidies for housing from approximately 50,000 units in the mid-1960's to 500,000 units by 1970. Federal expenditures for housing are scheduled to reach $7.5 billion annually by fiscal 1978; the 1969 commitment totalled only $385 million.

In the recent past, housing volume fluctuated in the absence of policies insulating the mortgage credit markets from the effects of a deflationary monetary policy. The availability of money for construction loans and home buying has always been the most sensitive barometer in the industry and the Nixon Administration made a significant contribution to stabilizing production and restoring confidence by cushioning the mortgage credit market

against the general anti-inflationary policies of the government. In 1970, the Administration committed $13 billion to the housing market through Treasury support of the Federal National Mortgage Association and the Government National Mortgage Association as stimulants to housing production. The continued availability of credit was instrumental in maintaining increased levels of construction through 1971 and into 1972.

The Housing and Urban Development Acts of 1968 (82 Stat. 476) and 1970 (84 Stat. 1971), contained further evidence of expanding Federal support. In that legislation, the government undertook the promotion of New Towns by providing a wide range of direct loans, grants, and guarantees for private investment, supported by a borrowing authority of $500 million. Of particular significance for the growth of industrialized housing were the large, aggregated markets represented by new communities.

Operation Breakthrough, begun in 1969, subsidized the erection of 2,795 housing units by a variety of building systems on nine demonstration sites. In a pioneering effort, Breakthrough sought to employ the Federal Government's leverage to erode institutional and administrative barriers -- zoning, restrictive labor practices, building codes -- which have traditionally discouraged volume production of manufactured housing.

Paralleling Breakthrough, Department of Defense programs, conducted independently by its constituent services, started industrialized housing demonstration projects totalling 3,160 units at 12 sites.

These measures on the part of the Federal Government to meet the country's housing needs were viewed by major corporations as encouraging developments. They were seen as the cutting-edge of vastly expanded markets for manufactured housing and foreshadowed the increasing use of industrialized methods in an improved, highly integrated delivery system.

Finding

The Project finds that Federal support for housing production will continue at expanded levels through the 1970's. The commitment will rise from a current $4 billion per year to nearly $7.5 billion by 1978.

However, the uncertainties inherent in the annual appropriations process make unclear the precise form future Federal support will take. Problems encountered in implementing Federal housing subsidy programs have led to a reassessment of their effectiveness and called into question techniques presently being employed to improve housing. A variety of new approaches are under study by the Office of Management and Budget and the appropriate committees of the Congress. It is impossible at this time to tell whether the current review will lead to a new, consolidated subsidy program, a housing allowance or some form of voucher system.

Experimental programs currently being conducted by the Department of Housing and Urban Development (Operation Breakthrough) and the Department of Defense have yet to be evaluated. Until such evaluation is made, it cannot be assumed that in future efforts to alleviate the housing shortage the Federal Government will give preference to industrialized housing producers.

The uncertainties surrounding the form of future Federal commitments suggest that large manufacturing corporation must carefully assess the wisdom of initiating new ventures or increasing their present roles in the mass production of housing until these commitments are more specifically

described. The composition and scale of that portion of the housing market relying on Federal subsidy will be determined by the programs evolving out of the in-depth evaluation presently in process.

Indicator 5: Emerging State Support

With the launching of Operation Breakthrough, the Department of Housing and Urban Development urged the States to initiate the necessary legislative actions to remove local restrictions inhibiting wider use of factory-built housing. In support of HUD's efforts, the National Conference of States on Building Codes and Standards, in cooperation with the Department, prepared model legislation for consideration by State legislatures. The Factory-Built Housing Law enacted by California in 1969 was one of six similar laws passed that year in response to the need for State-wide code reform. The purpose of the California law, as described by its author, Assemblyman Pete Wilson, was to

> "...[enable] the industry to use its technology to factory-produce housing. [It] is very simply a uniform state building code designed to facilitate and encourage the production of industrialized housing -- housing which is mass produced in a factory rather than on site.
>
> "The California Factory-Built Housing Law establishes a system of state inspection and approval of housing which is produced and assembled in a factory. This system replaces the literally hundreds of different sets of local code requirements which might otherwise be devised by local jurisdictions in California." 5/

Thus, an encouraging trend toward code reform at the local level seemed to assure the necessary legal and administrative actions required to expand the market for manufactured housing.

5/ Automation in Housing, "A Blueprint for Tomorrow," October, 1970

Finding

Increased activity at the State level has resulted in a more favorable climate for manufactured housing and leads the Project to a positive finding with respect to this indicator.

Model legislation prepared by the National Conference of States on Building Codes and Standards, in cooperation with the Department of Housing and Urban Development, has led to widespread interest in code reform. Since enactment of the California Factory-Built Housing Law, nineteen other States have passed comparable bills. At present, fifteen additional States have similar legislation under consideration.

State	Enacted	Proposed	Preempts local codes	Interstate Reciprocity
Ala.	1971			
Ariz.		X		
Calif.	1969		X	X
Colo.	1971		X	X
Conn.	1969	X		
Dela.		X		
Fla.	1971		X	X
Ga.	1971		X	X
Hawaii	1970		X	X
Idaho		X		
Ill.		X		
Ind.	1971		X	X
Iowa		X		
Ma.	1971		X	X
Md.	1971		X	X
Mass.		X		
Mich.		X		
Minn.	1971		X	
Mo.		X		
Neb.		X		
Nev.	1971			
N.Y.	1971		X	X
N.C.	1969		X	X
Ohio	1969		X	
Okla.	1971	*		
Ore.		X		
Pa.		X		
R.I.		X		
S.C.	1970	*		
Tex.		X		
Vermont		X		
Va.	1970		X	
Wash.	1970		X	X
W. Va.	1971			
Wisc.		X		

*Preempts local building regulations if HUD certifies acceptability of housing.

The eventual intra- and inter-state uniformity resulting from wide acceptance of such legislation has far-reaching market implications for large manufacturing corporations.

Action by the States must be considered a significant contribution to a future economic climate that will be more conducive to large corporate intervention in housing production.

Indicator 6: Receptivity of Organized Labor

Historically, craft unions have opposed the introduction of mass production methods into the home building industry on grounds that such methods would have an adverse impact on jobs and wages. Despite that traditional posture, organized labor recognized as early as 1966 the probability that industrialized housing would represent a significant portion of all construction activity in the 1970's. Accordingly, the Building Trades Department of the AFL-CIO commissioned the Battelle Memorial Institute to study developments in prefabrication methods and their implications with respect to future manpower requirements. Since the delivery of the Battelle report in September 1967, both the building trades unions and industrial unions, such as the United Brotherhood of Teamsters and the United Auto Workers, have been active in organizing plants which produce factory-built housing or housing components.

The growing willingness of organized labor to deal pragmatically with increasing industrialization of the building process was underscored by the generally positive response of unions to Operation Breakthrough and their cooperation with the government agencies and private construction firms involved in that program.

Finding

The Project finds that, due to job and wage implications, labor's historical opposition to industrialized housing has not conclusively changed.

The initial willingness on the part of organized labor to accept modifications of traditional work practices for Operation Breakthrough appears to result from labor's view of that program as one of a limited and experimental nature. Major changes in labor's receptivity to large-scale mass production of housing will come only after there is an assured market for the products of a restructured housing industry and evidence of expanding job opportunities resulting from the introduction of improved production technology.

Indicator 7: The Automobile Industry Analogy

In recent years, academic journals, technical bulletins, and the popular press have published articles on the potential advantages of transferring the technology of automobile manufacturing to the production of housing. The thrust of most papers on the subject has been the adaptation of the highly integrated management and technical systems developed to mass produce automobiles to a more efficient delivery system for housing.

The assumed advantages of such technological transfer are manifest: increased production; lower costs to the consumer; quality control; reduced construction time on site; assured delivery schedules; potential gains in productivity with corresponding decreases in labor costs resulting from the replacement of skilled craftsmen with less skilled assembly-line workers, and a wide range of other improvements and cost savings characteristic of time-tested mass production methods.

Seen in the context of a national need, these elements combined to reinforce the persuasiveness of the ethic represented by American success in telecommunications, aerospace and other highly sophisticated technologies.

Finding

The Project finds that comparison of the home building process with the automobile industry is useful only as a theoretical exercise.

The system that produces automobiles on an assembly line delivers, as a final product, a closed environment. Although the production system itself is "open" and allows for the introduction of new components at any stage in the process, the product upon delivery to the consumer is a closed, finished, highly autonomous sub-system free to move about on a vast, publicly-supported infrastructure.

The finished product of the housing production system,on the other hand, is an open environment which can function only if external supporting services are supplied to it at a predetermined fixed location. Although these conditions do not apply generally to mobile homes, increasing regulation of their design and production and, more significantly, their freedom of choice concerning location, will place similar constraints on that industry in the near future.

At this stage of its development, the housing industry is capable of mass producing components and partially or fully assembled houses virtually on demand. The fallacy in comparison with the automobile industry lies in the fact the infrastructure required to support the products of a high capacity housing industry, i.e., aggregated land, prepared sites and services has not been developed on a scale remotely comparable to its capacity to produce hardware or to that supporting the automobile.

V. FACTORS INFLUENCING INVESTMENT DECISIONS

When the validity of the 1970 indicators was challenged, the focus of corporate decision-making shifted, in response to the Project's initiative, to an assessment of opportunities in industrialized housing judged against criteria normally applied in choosing between investment alternatives. Those criteria were:

(1) Start-up costs, tooling (particularly relevant to testing the validity of the automobile production analogy).

(2) Compatibility of existing production, distribution and marketing operations to new product line.

(3) Amortization periods.

(4) The relative profitability of investments in housing production when compared with alternatives.

(5) The relative level of risk in investing in housing production when compared with alternatives.

(6) The problems faced by building materials producers in creating "competitive" situations with their existing markets; in the words of one corporate executive, "if we go into the industrialized housing business, we force our present customers out."

(7) Where large corporations are internally structured to operate with strong divisional or profit center autonomy, in-house competition tends to limit effectiveness in bringing full corporate strength to bear in new ventures. Where the risk is high, as in housing, experience has shown there is little hope for success unless across-the-board support exists within the company. Given the present make-up of a substantial number of leading firms in the building supply industry, this type of internal competition and market fragmentation make the required degree of corporate commitment extremely difficult.

(8) Manufacturing industry as a whole is dividend oriented, and the time lag between investment and return in housing has proved to be an embarrassment to a number of large, national corporations. What is viewed as an exaggerated or unrealistic take-out time has become a road-block to corporate executives planning to lead their companies into industrialized housing. Stockholder sensitivity to long-term yield periods further inhibits executive willingness to commit substantial corporate funds to an area of recognized uncertainty.

Consistently, in interviews with Project staff, executives cited the above factors as significant risks for any large-scale manufacturing corporation considering entering the industrialized housing field at this time.

VI. PROMISING TRENDS

The Project's investigation of the feasibility of capital-intensive mass production of housing by major manufacturing corporations led to six general observations about the future growth of the industrialized housing industry.

(1) Accompanied by a shakeout among existing firms, increasing industrialization of the building process will continue on an evolutionary and incremental basis throughout the 1970's, laying the groundwork for a re-examination of the possibility of large corporate intervention in the housing industry at a later date.

(2) Virtually every school of architecture in the country offers courses in systems building and industrialized construction methods; the State University of New York at Buffalo in a pioneering effort has focused the entire curriculum of its School of Architecture and Enviromental Design on these concepts. Thus, skilled practitioners trained in the techniques of industrialized construction and management will bring expertise and commitment to the industry, regardless of its size or composition.

(3) Further development of more highly sophisticated industrialized building systems will not be limited by technological or design factors. This development process is on-going and will come into wider use as cost savings are demonstrated.

(4) Current efforts by the Department of Housing and Urban Development, the Department of Transportation and the Nation's private carriers -- rail, barge and highway -- are expected to help remedy distribution problems that have plagued housing manufacturers. Reductions in transportation costs will affect the economics of location for production facilities and, in turn, lead to a review of all factors influencing corporate investment decisions.

(5) The enactment of industrialized housing laws in twenty States is extremely encouraging for the small and medium sized producers and should be seen as an emerging line of force creating a more favorable environment for eventual participation by major corporations.

(6) A number of large manufacturing and development corporations have acquired small industrialized housing firms. Although their present level of commitment is limited, this least-risk avenue assures a more rational and experienced approach to more substantial intervention in the industry at some later date.

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