

SOCIAL CONTROL OF
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The Regulation
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FRANCIS THOMAS VENTRE
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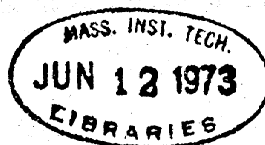
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Certified by

Thesis Supervisor

Accepted by

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Social Control of Technological Innovation:
The Regulation of Building Construction

Francis Thomas Ventre

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A description and analysis of the processes by which the building regulatory system of the Nation responds to technological innovation in the industries under its jurisdiction. The effects of regulation on prospective changes is also assessed. The study is based on findings of two national surveys of municipal building departments (n=1080 and 930) made in 1967 and 1970 as well as on interviews with principals and on documentary research. The study documents the careers of fourteen recent advances in residential construction as they coursed through the building regulatory system. The institutions of government, of private enterprise and of voluntary association that cluster about the building enterprise and the significant relations of those institutions that bear on technological innovation are also identified. The study concludes with specific suggestions for expediting the diffusion of innovation in residential construction technology.

Thesis Supervisor: Bernard J. Frieden
Title: Professor of Urban Studies and Planning

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	9
A Conceptual Model of Collective Decision-making	11
The Clientele and Its Role	14
Three Basic Questions	15
Special Interest Politics of the Building Enterprise	15
 CHAPTER I - REGULATION AND THE ENVIRONMENT FOR INNOVATION IN RESIDENTIAL CONSTRUCTION TECHNOLOGY	 18
Relation to Housing and Urban Problems	18
Relation to the National Political Economy	24
Reputation as a "Backward Non-industry"	29
Complexity of the Construction Enterprise	34
Technological Innovation in Industry	38
Special Case of Regulated Industries	44
How Innovative is the Building Industry: Inter-industry Comparison	48
Intra-industry Comparison Over Time	56
Factors Affecting Technological Innovations in the Building Industry	57
 CHAPTER 2 - ORIGIN, SCOPE AND CHARACTER OF BUILDING REGULATIONS AND STANDARDS: POWERS, PREROGATIVES, PURPOSES, PROCEDURES	 63
Elements of a Regulatory System for the Built Environment	63
Legal and Institutional Framework and Local Building Regulation	65
Inter-governmental Responsibilities for Building Regulation	73
State Government	76
Federal Government	79
 CHAPTER 3 - PROFILE OF THE LOCAL BUILDING OFFICIAL AND HIS DEPARTMENT	 84
The Building Department	86
Job Security and Political Pressures	87
Salaries	89
Age, Background and Qualifications	89
Education Programs	96
Varieties of Local Building Codes	100
Building Codes in Use	106
Technological Currency of the Local Building Code	107
Dissimilarity of Local Building Codes	112

	<u>Page</u>
CHAPTER 4 - MAINTAINING TECHNOLOGICAL CURRENCY IN THE LOCAL BUILDING CODE: PATTERNS OF COMMUNICATION AND INFLUENCE	132
Means of Maintaining Technological Currency	132
The Local Building Department: Its Clientele and Its Reference Groups	144
Reference Groups	149
Building Material Producers or Suppliers Representatives	152
Architects or Engineers	163
Builders	168
The Special Problem of the Speciality Contractor	174
Union Representatives	179
Civic or Voter Groups and Mass Media	185
Prefabricated Home Manufacturers	187
Government Publications	191
Trade or Professional Magazines or Journals	192
Building Products Catalogs	195
Decision-aiding Communication in Local Building Departments	196
Interim Conclusions and Assessment of Hypotheses	216
CHAPTER 5 - PRIVATE SECTOR PRE-EMPTION OF PUBLIC REGULATORY RESPONSIBILITY IN THE BUILDING FIELD	225
Inter-sectoral Activities in Building Regulation	225
The Model Code Associations	234
Operations of Model Code Associations	245
The Trade Associations	265
CHAPTER 6 - DIFFUSION OF INNOVATION IN BUILDING TECHNOLOGY AND THE BATTLE OF PLASTIC PIPE	294
Fourteen Innovations: A Technical and Political Precise of Each	297
Nonmetallic Sheathed Electrical Cable (NMTCBL)	298
Off-site Preassembled Electrical Wiring Harness for Installation at Service Entrance to Dwelling (WRHRNS)	302
Copper Pipe in Drain, Waste and Vent (DWV) Plumbing Systems (COPDRN)	303
ABS or PVC Plastic Pipe in DWV (PLADRN)	303
Off-site Preassembled Combination DWV Plumbing System for Bathroom Installation (PLMTRE)	303
Bathrooms or Toilet Facilities Equipped with Ducts for Natural or Mechanical Ventilation, in Lieu of Operable Windows (or Skylights) (BTHDCT)	312
Prefabricated Metal Chimneys (MTLCHM)	318
Wood Roof Trusses Placed 24" on Center (WDTRUS)	321

	<u>Page</u>
In Wood Frame Construction, Sheathing at Least 1/2" Thick in Lieu of Corner Bracing (WDSHTH)	321
Use of 2" X 3" Studs in Non-Load Bearing Interior Partitions (2X3 STD)	321
Wood Frame Exterior Walls in Multi-Family Structures of Three Stories or Less (WDFRML)	321
Use of Single Top and Bottom Plates in Non-Load Bearing Interior Partitions (SNGLPL)	321
Placement of 2" X 4" Studs on Center in Non-Load Bearing Partitions (2X4 STD)	321
Party Walls Without Continuous Airspace (PRTYWL)	328
A Typology of Building Innovations	328
Changes in Materials	331
Changes in Methods	335
Changes in Design	334
Changes Involving Generic or Proprietary Products	341
Refined Hypothesis on Diffusion of Innovations in Building Technology	348
The Battles of Plastic Pipe	371
Origins of Plastic Pipe	374
The Battle Joined	382
Instructive Pairwise Comparisons	388
 CHAPTER 7 - CONCLUSIONS, ASSESSMENTS AND PROSPECTS	 393
 APPENDIX	 405
Exhibit A: Survey Instrument	406
Exhibit B: Response Table	412
Exhibit C: Biographical Note	414
Exhibit D: Acknowledgements	416

LIST OF FIGURES AND TABLES

<u>Figures</u>		<u>Page</u>
0-1	Linkages in the Code Modernization Process	12
1-1	Kaiser Committee	58
3-1	Effect of Local Education Programs on Prohibitiveness of Local Code	98
3-2	Effect of State Education Program on Prohibitiveness of Local Code	99
3-3	Technological Currency of Local Codes by Percent of Municipalities Using Each Code Type	110
3-4	Technological Currency of Local Codes by Percent of Population Served by Each Code Type	110
3-5	Local Code Obstruction to Innovative Building Technology, by State: 1970 (Grouped Data)	113
3-6	Local Code Obstruction to Innovative Building Technology, by State: 1970 (Ungrouped Data)	114
3-7	Dissimilarity of Local Building Codes, by State: 1970 (Grouped Data)	116
3-8	Dissimilarity of Local Building Codes, by State: 1970 (Ungrouped Data)	117
4-1	Most Difficult Code Item Adoption (Experienced)	139
4-2	Most Difficult Code Item Adoption (Expected)	139
4-3	Frequency of Business Contacts with Local Building Departments	146
4-4a-e	Participation in Collective Decision-making in the Local Building Department, by Actor and by Role	201
4-5a-e	Participation in Collective Decision-making in the Local Building Department by Actor and by Role, Controlling for Type of Local Code in Force	212
4-6	Rosters of Actors in Local Building Department Decisions on Technological Innovation Ranked by Relative Participation in Selected Roles	217

		<u>Page</u>
6-1	Rosters of Actors in Local Building Department Decisions on Innovative Technology Ranked by Relative Participation as Originators, by Type of Innovation	356
6-2	Rosters of Actors in Local Building Department Decisions on Innovative Technology Ranked by Relative Participation as Net Supporters, by Type of Innovation	358
6-3	Cumulative Number of Local Building Codes Accommodating Material Changes, by Year	366
6-4	Cumulative Number of Local Building Codes Accommodating Method Changes, by Year	367
6-5	Cumulative Number of Local Building Codes Accommodating Design Changes, by Year	368
6-6	Cumulative Diffusion Rates (Normalized) for All Changes, by Year	369

<u>Tables</u>	<u>Page</u>	
3-1	Administrative Jurisdiction Over Inspection of Principal Building Components	118
3-2	Building Officials Under State or Municipal Civil Service	119
3-3	Building Officials Represented by a Union	120
3-4	Impact of Civil Service and of Union Representation on Staff Salaries	121
3-5	Chief Building Officials (CBO's) Salary	122
3-6	Beginning Salaries for Building Officials (Other than CBOs)	123
3-7	Maximum Salary for Building Officials (Other than CBOs)	124
3-8	Impact of Union Representation on Staff Salaries	125=
3-9	Ages of Local Building Officials	126
3-10	Years in Building Department for Local Building Officials	126
3-11	Occupational Backgrounds of Building Officials	127
3-12	Most Frequently Reported Minimum Qualifications	127
3-13	Components of Qualifications of Local Building Officials	128
3-14	Formal Education of Local Building Officials	128
3-15	Educational Programs for Building Officials	129
3-16	Basis of Building Code in Force (June 1970)	130
3-17	Changes of Building Code Type: 1964-1970	131
3-18	Percent of Municipalities Prohibiting Selected Construction Innovations	131
4-1	Year of Code Adoption and Revision by Code Types	134
4-2	Estimates of Wholesale Establishments Specializing in Sales to the Construction	155
4-3	Concordance Between Ranks-ordered Rosters of Actors Prominent in Local Building Department Decisions on Innovative Technology	210

		<u>Page</u>
4-4	Local Building Officials' Ranking of Most Trusted Source of Information on Most Difficult Code Item Adoption Decision, by Type of Code	215
5-1	Classification of Building Industry Private Trade Associations	271
6-1	Classification of Elements of the Index of Technological Currency	330
6-2	Concordance Between Rank-ordered Rosters of Actors Prominent in Local Building Department Decisions, by Type of Innovation and Role	355
6-3	Variation of Actor Mobilization with Respect to Material Changes	359
6-4	Variation of Actor Mobilization with Respect to Method Changes	360
6-5	Variation of Actor Mobilization with Respect to Design Changes	361
6-6	Actor Mobilization Invariant with Respect to Type of Change	364
6-7	Percent of Departments Reporting Most Difficult Code Change, by Affected Trade and by Type of Change	389

INTRODUCTION

The subject of this study is the diffusion of innovations in residential construction technology and the social, economic, political and engineering factors that affect the rate of diffusion. The primary focus of the investigation is the building regulatory system, specifically the local building department.

Many factors affect the diffusion of improved housebuilding techniques. The highly diverse, dispersed and discontinuous nature of the housebuilding enterprise itself is one and the conservative tastes of home purchasers is another. Another set of factors are centered on the agencies that regulate most residential construction in the U.S.: municipal building departments. For unless building regulations are amended and enforcement practices are revised to accommodate innovative technology, that technology cannot be employed legitimately by the building industries. It is the local building code that establishes whether any given building technique will be granted or denied to the local construction markets. Building techniques and building products do not occur spontaneously; they are developed and sponsored by constituents of the building enterprise, manufacturers, wholesale and retail suppliers, specialty contractors and building craftsmen, designers, etc. Hence, any change in the competitive status of a building technique will have economic repercussions among these elements. Code changes have the

effect of granting advantaged competitive positions to some while denying them to others. And, this is precisely what makes the modernization of building regulations politically controversial, difficult and time-consuming.

Specifically this study will seek to describe and analyze the political and economic environment out of which emerge decisions that either legitimize or restrict emergent technology. And, these decisions, collectively, constitute the primary, and sometimes the only, social voice in matters of building technology. This is a large responsibility for the building department, a virtually invisible arm of government.

This study extends to the local regulators of building construction the types of political analysis already applied to public regulators of transportation;¹ food and drug industries;² electric power generation and transmission;³ and to general studies of the organization of regulatory agencies and the laws establishing their mandates;⁴ the political environment in

¹Samuel Huntington. "The Marasmus of the ICC," in Francies E. Rourke, Bureaucracy and National Politics, (Boston: Little, Brown, 1963), and The Ralph Nader Study Group, The Interstate Commerce Omission (sic): The Public Interest and the ICC, (New York: Grossman, 1970).

²Charles O. Jackson, Food and Drug Legislation in the New Deal, (Princeton: Princeton University Press, 1970); The Ralph Nader Study Group, The Chemical Feast, (New York: Grossman, 1970); Amitai Etzioni, "Freeing the Food and Drug Administration," Conference Board Record, vol. 7 (October 1970), pp. 37-39.

³Milton Kafoglis and Norman Keig, "New Policies of the Federal Power Commission, "Land Economics" vol. 45 (November 1969), pp. 385-391; [Senator] Lee Metcalf, "The Vested Oracles: how industry regulates government, "Washington Monthly, vol. 3 (July 1971), pp. 45-53.

⁴Roger G. Noll, "Reforming Regulation: an evaluation of the Ash Council proposals," one of a series of staff papers in the Brookings Institution's Studies in the regulation of economic activities. The Institution, Washington, D. C., 1971.

which (and on which) they operate⁵ and the effects of regulation on the technological development of the industry being regulated, and, its the reciprocal, the effect of the technological development on regulation.⁶

A Conceptual Model of Collective Decision-Making

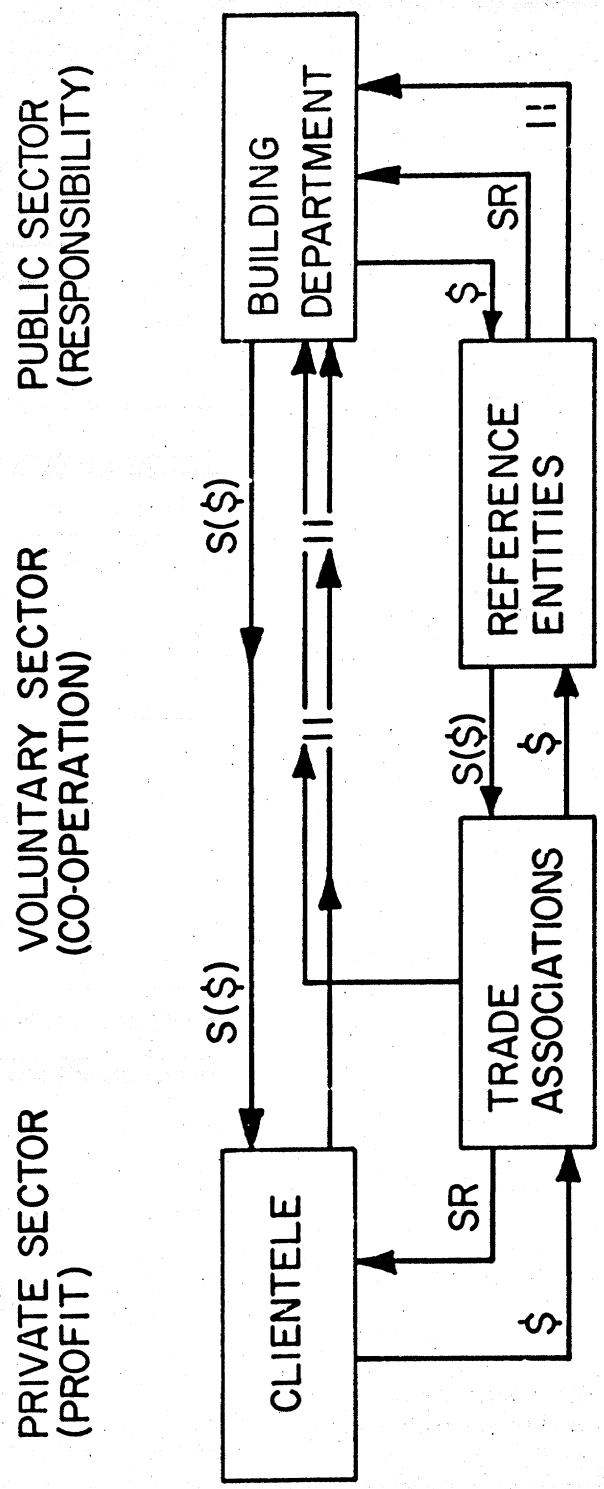
The present analysis bears heavily on the informal or non-statutory influences over local agency decisions to accommodate or not accommodate the building code to innovations in building technology. This analysis posits an informal influence network of four basic nodes and their links, mapped in Figure 0-1. Only one mode's existence is mandated by law. The others, in one way or another, are creatures of the market for construction services.

The four nodes are: (1) the building department, representing its staff and the large, undifferentiated and indifferent public the agency ostensibly serves; (2) the clientele of the agency--the members of local building enterprises--which the agency serves in immediate, tangible and

⁵Theodore J. Lowi, "Distribution, Regulation, Redistribution: the Functions of Government," in Randall B. Ripley (ed.), Public Policies and their Politics, (New York: W.W. Norton, 1966), pp. 27-40. Grant McConnell, Private Power and American Democracy, (New York: Random House-Vintage, 1970); and a somewhat journalistic Louis M. Kohlmeir, Jr., The Regulators, (New York: Harper and Row, 1969). See also Metcalf, fn. 3 above.

⁶Effect of regulation on technology is described in William M. Capron (ed.), Technological Change in Regulated Industries, (Washington: Brookings Institution, 1971). The reverse case, see Kafoglis and Keig in fn. 3 above.

Figure O-1 LINKAGES IN THE CODE MODERNIZATION PROCESS



SOCIO-SPATIAL REFERENCE
 EXTRA-LOCAL SPHERE
 LOCAL SPHERE

- S(\$) = Institutional sanctions (either rewards or penalties) that have economic consequences for the recipients.
- || = Informal (non-statutory) influence over decision-making.
- \$ = Legitimate financial payment (e.g., for services rendered, dues)
- SR = Symbolic reward (such as peer approval); as contrasted with material reward

practical ways; (3) reference entities such as the model code groups that interact with the local agencies at a symbolic level; (4) the so-called "voluntary" trade associations formed to advance the shared interests of firms, organizations and individuals engaged in related business enterprises.

Four basic types of messages are transmitted along the links mapped in Figure 0-1. Briefly identified in the figure, the message types are elaborated at appropriate places in the study. At this point all that requires mention is that this map, like all maps, is a condensation of, and an abstraction from, reality and that only informal, non-statutory and legitimate transactions are mapped. There are allegations of criminal influence in the transactions between the entities mapped. Estimates of the dollar volume of this traffic vary by a factor of five--from two to ten percent of the value of construction put in place⁷--a testament in itself of the lack of reliable data on this phenomenon. Lacking such data, there can be no definitive analysis of criminal activity in building regulation. But the main reason this aspect is not

⁷"City Aids to Lose Approval Power in New Building," New York Times, 27 December, 1972, p. 1+. Cf. Times expose of building industry bribery published in June and July, 1972 and summarized in the issue of 13 August, 1972, Section 4, p. 4.

included in the present analysis is that most of the allegations of criminality apply to the enforcement of codes rather than with their substantive content or technological currency. It is the latter that is the subject of this study.

The Clientele and Its Role

The primary focus of this study is the building department's clientele for, while the public-at-large might view building regulations with rampant indifference punctuated--in the wake of building catastrophes--by occasional outrage, this other, more restricted public--the institutions of the building enterprise--pay rapt attention. And that attention is well rewarded, for it is the argument of this thesis that the clientele and the reference entities of the building department are the prepotent influence on the determination of public policy with regard to innovative building technology. Moreover, that influence is exercised to the point of the virtual exclusion of wider constituencies--such as consumers and users of environments and the public interest generally--constituencies without forceful representation in this regulatory function of governments. The occasion for influence presents itself when the building department seeks to augment its own scant information resources as it determines whether or not to alter the building code to accommodate innovative technologies.

Three Basis Questions

By reconstructing the agency's collective decision process, the present study will attempt to identify the several message channels used by the agency to monitor its technological and political environment. Once identified, channel use will be measured to establish the impacts, jointly and severally, of the individual elements of the agency clientele.

In sum, three basic questions energize this inquiry:

(1) How does innovative technology course the regulatory process and how do the institutions of the building enterprise affect that process?

(2) Which elements of the building enterprise comprise the building department's clientele and how is this influence manifested.

(3) What effect does that influence have on the diffusion of technological innovation in the building industries?

These questions, in their present form, are not serviceable hypotheses. Hypotheses will be developed in the course of this study. Once formulated they will be tested against survey data drawn from about 1,000 building departments--custodians of the local building codes.

Special Interest Politics of the Building Enterprise

The map of transactions offered in Figure 0-1 is partitioned according to the sources of authority and legitimacy of the four model elements (in the horizontal dimension) and their

socio-spatial range (in the vertical). The voluntary sector, based on cooperation and mutual assistance, mediates between the autonomous economic establishments that provide construction services of materials and the public governments in which responsibility for public health, safety, welfare and morals is entrusted. Whereas profit is a dominant consideration and criterion for decision-making in the private enterprises, responsibility for the public welfare is the counterpart in the public sphere. In the vertical dimension, elements of the model are differentiated by the locus of their primary referents in both a social-psychological and geographical sense. The elements mapped in Figure 0-1 interact with one another in the local community--this is what is meant by the term "local building industry or interests"--but they are also tied to organizations outside that community.⁸ This outside stimulus is important to any analysis of local government decision-making.⁹ Even those involving that reputedly most local of industries--homebuilding.

The conceptual model partitioned into a 2X3 matrix leaves three lacunae that require comment. Their occurrence, in fact, make the study of the local building regulation function distinctive among studies of industrial regulation. Take the public sector first. Except in a handful of states there is no

⁸ See Roland L. Warren, The Community in America, (Chicago: Rand McNally, 1963), especially Chapter 8 for a discussion of extra-community ties among American institutions.

⁹ Brett W. Hawkins, Politics and Urban Policies, (Indianapolis: Bobbs-Merrill, 1971), especially Chapter 5.

joint intergovernmental responsibility for general building regulation (this will be documented later); it is by and large a function of local government. The federal role is mostly hortatory and indirect at best. Moving to the voluntary sector we observe that while it is true that local trade associations (e.g., homebuilders groups, contractor groups, labor unions) proliferate, they depend heavily on their national counterparts for intellectual leadership, for organizational advice, for technical assistance: in short, for everything except money. Conversely, as is indicated in the map, national trade associations invariably enter local conferences only at the side of their local counterparts. While "national" might initiate a local involvement in behalf of a technological innovation, that program is executed as if it were a program of local authorship. Finally, in the private sector, there is an apparent lack of an extra-community counterpart for the local building industry. This is probably the distinctive feature of the building enterprise; the term has almost no meaning without a reference to a fixed locale and a building site. Unlike many conventional industries and other business enterprises wherein a relative handful of national firms account for a majority of productive capacity, construction--and homebuilding particularly--is a proliferation of autonomous, atomistic, very small and short-lived establishments. This organization of the building enterprise is distinctive among economic activities, so is the manner in which technological innovation occurs. So much so that the present study must as a first step undertake an analysis of that organization and means of innovation.

Chapter 1

REGULATION AND THE ENVIRONMENT FOR INNOVATION IN RESIDENTIAL CONSTRUCTION TECHNOLOGY

Relation to Housing and Urban Problems

The problem of technological innovation in residential construction is no longer the concern of a small group of industry specialists; the issue is societal and pervasive. This is so because the technology of housing production has direct consequences for the 10 million American families housed in relatively poor conditions at the present time and the 26 million who, under the mandate of the Housing Act of 1968 (42 U.S.C. § 1441a), are to be housed suitably by 1978.¹

Of course the state of technological development in the construction industry is not the sole or even the principle influence on the volume of housing production or on the quality and distribution of housing services. The housing "stock" strategists, for instance, argue that money is the most important building material of all and the supply of money and the costs of borrowing (incorporating interest rates and credit terms) from that supply or money profoundly affect the quality and type of housing produced in a given year (an effect felt especially after World War II)² and on the costs of maintaining

¹ U.S. Department of Commerce, (Report of the) Panel on Housing Technology of the Commerce Technical Advisory Board, The Housing Industry: A Challenge to the Nation, (Washington: USGPO, 1970), p.7.

² George F. Break, "The Sensitivity of Housing Demand to Changes in Mortgage Credit Terms" originally appeared in his The Economic Impact of Federal Loan Insurance, (Washington, D. C.: National Planning Association, 1961), pp. 225-241. Reproduced in Alfred N. Page and Warren R. Seyfried, Urban Analysis: Readings in Housing and Urban Development, (Glenview, Ill.: Scott, Foresman, 1971), pp. 105-122.

adequate housing to the consumer, whether purchaser or tenant.³

Although Grebler and associates adduced powerful evidence to the contrary,⁴ production-oriented housing experts maintain that the historic American reliance on managing the economy by means of monetary policy has cost the nation's housing stock dearly.⁵ But with even a most enlightened monetary policy, defined by most homebuilders as that policy that manifests low interest rates and "easy money,"⁶ the number of houses that can be built or renovated with any given amount of money or credit depends on the costs of construction. The housing "service" strategists, on the other hand, argue that the costs of occupancy, falling to either the owner or rentor, reflect the initial production and financing costs and to a much smaller though growing extent on the level of labor-intensive (e.g., security, maintenance) and neighborhood

³ Miles Colean and Robinson Newcomb, Stabilizing Construction, (New York: McGraw-Hill, 1952), pp. 88-89.

⁴ Leo Grebler, David M. Blank and Louis Winnick, Capital Formation in Residential Real Estate, (Princeton: Princeton University Press for the National Bureau of Economic Research, 1956). This large study (spanning 1890 to 1950) concluded that housing declined relative to other consumer preferences and that this happened despite the trend toward easier financing.

⁵ Most recently articulated by Nathaniel H. Rogg, Executive Vice President of the National Association of Home Builders at the October meeting of the Policy Advisory Board to the MIT-Harvard Joint Center for Urban Studies.

⁶ As, for example, in the statement of John A. Stastny, President, National Association of Home Builders, in Hearings before the Subcommittee on Housing of the Committee on Banking and Currency, Housing and Urban Development Legislation--1971, 92d Congress. First Session, p. 1278:

I think that the problem in the housing market has been generated by a deficiency in the financial structures of this Nation which has created a cyclical seesaw in the provision of money to...the people who need it, at a price they can afford...

services that complement the physical shelter.⁷

The problem of housing production has now achieved the status of what development economist Albert Hirschman, has called a "privileged problem:" that is, a problem that has finally entered the consciousness of the elites that establish the public agendas in their respective societies.⁸ In the United States, national commissions are utilized to focus the public's attention and so it has been with housing production. No less than three national studies ordered into being by President Lyndon B. Johnson during the late 1960s provided clear indication of the enormous unmet housing needs of the nation. The Kerner Commission --clearly not a "housing"-oriented investigation at the outset--provided 15 pages of recommendations on housing the nation's deprived urban population.⁹ Only the area of education received greater attention for reform than did housing. The Douglas Commission charged by the President to

...conduct a penetrating review of zoning, housing and building codes, taxation and development standards... [and to] recommend the solutions...to increase the supply of low-cost decent housing.

⁷ Morton Isler, "The Goals of Housing Subsidy Programs," Papers Submitted to Subcommittee on Housing Panels, Part 2, House Committee on Banking and Currency, 92d Congress, First Session (Washington: USGPO, 1971), p. 423.

⁸ Albert Hirschman, Journeys Toward Progress, Part II, (New York: Twentieth Century Fund, 1968).

⁹ U.S. National Advisory Commission on Civil Disorders, Final Report, (New York: Bantam Books, 1968), pp. 467-482. Hereinafter referred to as the Kerner Commission.

related the housing needs of the population in general to the organization of the local government and the provision of municipal services in such a way that would expedite the rationalization of the building enterprise.¹⁰ Only the Kaiser Committee was charged specifically with examining the obstacles to a greater production and more equitable distribution of housing services to the nation's citizens. And it is this committee which most forthrightly assessed the nation's housing production against the achievement of "a decent home," the title of the committee's final report, for every American family.¹¹

The Kaiser Committee's consultants established the rate and direction of change in the composition of building costs as well as the relative shares of off-site wages and building materials overhead and profit to the total initial and operating cost of a housing unit.¹² Relating these costs to the incomes of American families, the Kaiser Committee found that standard housing was beyond the reach of 7.8 households--one out of eight--assuming that housing absorbed 20%

¹⁰ (Final Report of the) U. S. National Commission, Building the American City, (Washington: USGPO, 1968), p. vii. Hereinafter referred to as the Douglas Commission.

¹¹ (Final Report of the) President's Committee on Urban Housing, A Decent Home, (Washington: USGPO, 1968). Hereinafter referred to as the Kaiser Committee.

The charge: a decent home and a suitable living environment for every American Family, is the basic legislative mandate for U. S. housing policy. This language, a decent home, etc., originated in the Housing Act of 1949 (42 U.S.C. § 1441) and reaffirmed in subsequent revisions and recodification of program elements (42 U.S.C. § 1441a; 12 U.S.C. § 170).

¹² Marketing Research Department, McGraw-Hill, Inc., "A Study of Comparative Time and Cost for Building Five Selected Types of Low-Cost Housing" in Report of the President's Committee on Urban Housing, Technical Studies, Vol. II, (Washington: USGPO, 1968), pp. 1-52. Hereinafter referred to as Kaiser Committee Technical Studies.

of total income. If the then-current policies were extended, the proportion of underhoused--rich and poor alike--would still be one in ten by 1978 according to Committee estimates.¹³

The years since the issuance of the Kaiser report have seen a compounding of the difficulties of the American family in search of housing. Between 1965 and 1971 when the cost of living rose 25% the cost of housing rose at a rate twice as great. During these years the costs of structure alone rose between 10 and 12 percent annually and the cost of land at an even steeper rate.¹⁴ The components of the costs of the structure--materials and labor--are also changing at differing rates,¹⁵ spurring producers to an alternation in the mix of the two, which, as we shall discuss later, is an alteration in the technique of production that must be either preceded by or occur

¹³ Kaiser Committee, A Decent Home, p. 7. In fact, the average ratio of housing costs to gross income for the total population is 15%. Ibid.

¹⁴ House and Home, (September, 1971), p. 67. These differential rates between "above ground" and "below ground" costs are confirmed in a survey of recent empirical work found in Daniel Rubinfeld, Urban Land Prices: Empirical and Theoretical Essays, working paper 13, MIT-Harvard Joint Center for Urban Studies, passim. Unfortunately, this study overlooked lot size as a variable in determining site cost of housing. This oversight is doubly painful because lot sizes have varied greatly in recent years, generally increasing in the late '50's and through the mid-60's (partly as "defensive zoning" into large lots gained favor in those suburban jurisdictions intent on excluding the less affluent) and then a decline in size in recent years in reaction to increased land costs. The Third Annual Report (of the President) on National Housing Goals, reported a 17-1/2% decrease in lot area (from 10,709 sq. ft. to 8,851 sq. ft.) between 1968 and 1970, (Washington: USGPO, 1971), p. 16.

¹⁵ The split within the "above ground" costs between materials and labor and their differential rates of change were documented recently in the report of the Panel on Housing Technology, The Housing Industry: A Challenge to the Nation, pp. 15-21. A more balanced view, incorporating insights to industrial relations in construction that are not widely known, is D. Quinn Mills, "Housing and Manpower in the 1970's," in Subcommittee on Housing Panels: Papers, House Committee on Banking and Currency, 92d Congress, First Session, (Washington: USGPO, 1971), p. 311-312.

concurrently with a change in building regulation. This last process-- the process by which building regulations are altered to accommodate evolving production technology--is the main concern of the present study.

Another way in which housing technology is related to pervasive national problems is the relation of production technology and the potential employment of disadvantaged workers. U. S. construction manpower policy is operating at present under the assumption of shortages among selected crafts in the building trades particularly electricians, iron workers, plumbers and steam fitters.¹⁶ One way to affect this anticipated shortage is the recruitment of minority workers to construction occupations; activities to this end are now underway in a number of cities. The principal obstacle to this flow, holding aside for the moment illegal discrimination, is the difficulty of persuading recruits to endure long periods in apprenticeship (at low pay and under great employment insecurity) while learning traditional practices.¹⁷ Evolving building technology extends the promise of changing both the skill demands of individual tasks as well as the requisite mix of skills in the industry. The former augurs for a reduction in training time

¹⁶ Third Annual Report (of the President) on National Housing Goals, p. 99.

¹⁷ John T. Dunlop and D. Quinn Mills, "Manpower in Construction: A Profile of The Industry and Projections to 1975," in Kaiser Committee Technical Studies, Vol. II, pp. 274-276. Recent empirical evidence is presented by Alex Maurizi, "Minority Membership in Apprenticeship Programs in the Construction Trades," Industrial and Labor Relations Review, Vol. 25, No. 2 (January, 1972), p. 203.

required to prepare the construction workforce. This would be accomplished by the incorporation of new materials and processes which are simpler to fabricate and install;¹⁸ by wider use of industrially produced housing modules;¹⁹ and increased use of components, pre-assembled off-site by less-skilled (and lower-paid) labor.²⁰ These components, incidentally, could be put within the reach of owner-builders or self-help groups as well as to the organized house building enterprises.

Relation to the National Political Economy

Because the building industry in the aggregate is so large and in its geographic deployment virtually ubiquitous, any change in its orientation or in the state of its technology will ramify across the political economy of the entire country. The aggregate impact of construction expenditure on the economy is sizeable and has been thoroughly documented by Colean and Newcomb²¹ and by Rogg.²² In 1971, the latest

¹⁸ Interview with Eddie Kaplan, Journeyman Plumber, Scranton, Pennsylvania, 4 July, 1970. This is a deeply-felt threat to craft-conscious mechanics.

¹⁹ Walter McQuade, "An Assembly Line Answer to the Housing Crisis," Fortune, Vol. LXXIX, No. 5 (May, 1969), pp. 99+.

²⁰ Reavis Cox, et. al., The Supply-Support Requirements of Homebuilders, (Washington: The Producer's Council, Inc., 1962), p. 19.

²¹ See fn.3, above.

²² Nathaniel H. Rogg, et. al., Significance of Homebuilding in the U.S. Economy, (Washington: National Association of Homebuilders, 1965). In The Seven Myths of Housing, Nathan Straus insistently reminded planners anticipating a post-World War II depression that "No other form of public works stimulates--directly or indirectly--so much employment [as a public housing program]." (New York: Knopf, 1944), p. 9.

year for which figures are available, the total construction ran to \$109.3 billion²³ and the impact of this expenditure is felt in labor, land, building materials, and money markets. But increases or decreases in aggregate amounts of construction activity--even holding aside differences in the types of construction--are more sharply felt in some commercial and industrial sectors than in others. To begin with, housing production draws more heavily on wholesale and retail business services than it does from any single goods-producing industry.²⁴ Still, 40.4% of the output of the heating, plumbing and structural metals products industry go into construction as does 69.2% of stone and clay products; 50.4% of paint and allied products; 47.0% of the electric lighting and wiring; and 41.0% of the lumber and wood products (except containers) industry output. In all, a mere 12 industries provide over 80% of the goods and services purchased directly by the construction industry.²⁵ We shall return to the effects of this differential economic impact in subsequent chapters.

About 3.0 million persons are employed in the construction industries. The Panel on Housing Technology estimates that an increase in housing production rates by one million units per year would require an additional one million men.²⁶ And if current ratios held, the

²³ U. S. Bureau of the Census, Statistical Abstract of the United States, 1972 (Washington: USGPO, 1972), p. 671.

²⁴ Allan H. Young and Claiborne M. Ball, "Industrial Impacts of Residential Construction and Mobile Home Production," (U. S. Department of Commerce, Office of Business Economics), Survey of Current Business, Vol. 50, No. 10 (October 1970), p. 16.

²⁵ George R. Kinzie, "Construction's Input-Output Profile," Construction Review, Vol. 16, No. 8 (August, 1970), p. 7.

²⁶ In The Housing Industry: A Challenge to The Nation, p.7.

proportion of skilled craftsmen to lower paid laborers and helpers would be two to one. Ball estimates that an additional expenditure of \$1,000 for public housing and for single family private residences would create a demand for 236 and 204 manhours of work, respectively. And half of those jobs would be in industries other than construction!²⁷ Where Ball has estimated the gross employment effects of construction expenditures, Dunlop and Mills have pinpointed the precise impacts on selected elements of the labor supply, subject to several sets of assumptions.²⁸ Differential impacts are noted here as well.

Only in the conventions of national income and product accounting does it appear that the construction industry is a nationally organized enterprise with centralized units of production serving a mass market. In reality, the construction industry functions as a collection of small, dispersed businesses each showing highly differentiated and geographically self-contained sources of supply and demand. This assertion is substantiated in the following analysis wherein the economic impact of construction in terms of goods and services is disaggregated both in terms of purchases for materials and services and expenditures distributed to employees, owners of businesses, lenders and governments.

²⁷ Claiborne M. Ball, "Employment Effects of Construction Expenditures," Monthly Labor Review, Vol. 88, No. 2, (February, 1965), p. 154.

²⁸ Dunlop and Mills, "Manpower in Construction," pp. 239-286.

Drawing on recent input-output studies of the U. S. economy, Kinzie has estimated that out of every dollar spent out for construction 55 cents goes to the purchase of materials and services and 43 cents is distributed to employees, owners, lenders and governments.²⁹ But it is in the geographical distribution of these expenditures that further distinguishes the construction industry: its localism. Construction expenditures make a disproportionately larger impact on the local economy than on the economy on the nation as a whole. This makes the politics of local building code changes so contentious. Kinzie estimates that 27 cents (almost half) of the 57 cents for materials and services goes into three activities that are highly localized: wholesale and retail services (not goods but services, as measured by trade margins of lumber yards and building materials suppliers for instance), business services (including architectural and engineering services), and transportation and warehousing.³⁰ Given the nature of the construction labor and management workforce and the character of its geographic immobility, one can responsibly estimate that most of the 43 cents going to employees and owners, etc., stays in the immediate locale of the construction.³¹ Thus, one can responsibly estimate that

²⁹ Kinzie, "Construction's Input-Output Profile," p. 4.

³⁰ Ibid.

³¹ Mobility of construction workers is discussed in Arthur L. Stinchcombe, "Bureaucratic and Craft Administration of Production: A Comparative Study," Administrative Science Quarterly, Vol. 4, No. 2 (September, 1959), pp. 168-87; Howard G. Foster, "Non-apprentice Sources of Training in Construction," Monthly Labor Review, Vol. 93, No. 2, (February, 1970), pp. 21-26; R. R. Myers, "Interpersonal Relations in the Building Industry," Human Organization, Vol. 5, No. 2 (Spring, 1946), pp. 1-7; D. Quinn Mills, "Manpower in Construction: New Methods and Measures," Proceedings of the Twentieth Annual Winter

two-thirds of construction expenditures remain in the locality where the building occurs. In 1971, total construction ran to \$109.3 billion and, by the argument just made, \$72.14 billion stayed local.³²

This analysis applies a fortiori to residential construction since the homebuilding industry is even more territorially fixed than is the construction industry as a whole. Most homebuilders confine themselves to a single metropolitan housing market and one quarter build at only one site or subdivision in any given year.³³ Moreover, there are indications that large-volume, multi-location builders (101 units or more) are declining in numbers and in their share of single family sales.³⁴ This may be an aberration, however, for the secular trend in volume per builder is increasing.

The foregoing industry--and geography--specific consequences of construction activity have been elaborated for this reason: local building codes can bestow or withhold tangible benefits from these commercial enterprises. If the local building code were to accommodate innovative technology, displacing traditional methods, the sales of the foregoing industries--including those of their local distributors--would be severely affected and serious economic consequences would

³¹ Meeting of the Industrial Relations Research Association, (Washington, D.C., December 28-29, 1967), pp. 269-76; Lowell F. Gallaway, Geographic Labor Mobility in the United States: 1957 to 1960, (Washington, D. C.: U. S. Social Security Administration, Office of Research and Statistics, Research Report No. 28, 1969), Chapter 4.

³² Computed from the Statistical Abstract of the United States, p. 679.

³³ Michael A. Sumichrast and Sara Frankel, Profile of the Builder and His Industry, (Washington: National Association of Home Builders, 1970), p. 160.

³⁴ Ibid., p. 99.

follow. This is why, as we shall demonstrate later, local building departments have such attentive local clientele.

Reputation as a "Backward Non-industry"

The construction industry, and, particularly, housebuilding, labors under the persistent reputation as a "backward industry" at best or, at worst, as an enterprise that is "not yet" an industry.³⁵ As if competing for the most vivid metaphor, crusading journalists and sympathetic critics alike have characterized the industry as "suicidal,"³⁶ a "headless monster," or an "army of pignies,"³⁷ and "the industry capitalism forgot."³⁸ The popular press draws analogies between the housebuilding industry and pre-steam railroading and pre-Ford automobiles. The thrust of the popular criticism has been that the housebuilding industry has not shared in the science-based technological evolution of the twentieth century and the last two decades particularly. This popular view is one that follows from casual observation of construction projects underway and from the appearance of the finished product, particularly single-family residences. Invariably, the housebuilding industry is unfavorably contrasted with routine manufacturing wherein automobiles, ranges, and refrigerators, flow off assembly lines with glacial inevitability.

³⁵ Donald A. Schon, Technology and Change, (New York: Dell Publishing, 1967), pp. 155-159.

³⁶ L. B. Kromer, "The Industry Heads for Suicide," Engineering News-Record, (22 August, 1968), p. 49.

³⁷ Both epithets appeared in the same article. See Richard W. O'Niell, "Why Technology Innovations Fail," in (Proceedings of a Conference on) Technology Transfer and Innovation, under the auspices of the National Planning Association and the National Science Foundation (Washington: NSF, 1966), p. 69.

³⁸ Fortune, Vol. XXXVI, August, 1947.

One source for this "housebuilding has a technologically stagnant industry" view is a series of post-World War II economic studies which confirmed the casual empiricist's observations by calculating construction efficiency and productivity utilizing measures taken, without adaptation, from the analysis of more conventional industries. These standard measures are, for reasons we shall develop below, wholly out of place in and simply not appropriate to construction activity. Sims--with meticulous scholarship--attributes this technology stagnation consensus to bad data: specifically to studies based on data on the industry from as far back as 1890 and in some cases extending forward only to 1934.³⁹ A few studies since the middle 1950's have confirmed these earlier findings by using more current data, but, unfortunately, the authors of these second-generation studies vitiated that effort by applying measures of productivity which Sims and others, notably the previously cited Dunlop and Mills, have declared to be wholly inappropriate to the nature of the construction enterprise.

The reason this popular misconception persists is that the enormous changes in an industry technique are either not readily apparent to "sidewalk superintendents" and certainly not apparent to the final purchaser or renter of the housing. In fact, housing which too audaciously flaunted its advanced techniques and its technology would encounter serious marketing problems, so atavistic are consumer's feelings when it comes to their own housing. Ralph J. Johnson, after

³⁹ Christopher Sims, "Efficiency in the Construction Industry," in Kaiser Committee Technical Studies, Vol. II, p. 153.

surveying 1,000 homebuilders reported that the threat of adverse consumer reaction is the primary single inhibitor to innovation by builders. (But later in the report he states that the regulatory system--embracing the building code itself and the manner of its administration and enforcement--is, in total impact on the builder's decision to innovate, the prevalently cited constraint.)⁴⁰ Given these problems of consumer acceptance, many housing producers do their best to shield from view changes in technique and changes in technology that they have already absorbed into their production methods.

Sims concedes that up until 1950 one could responsibly report something like technological stagnation in the industry but then shows that since 1950 a veritably "technological explosion" has reverberated through the housebuilding industry.⁴¹ This has escaped other almost contemporaneous students of the use of technology in the industry. For example, Arthur D. Little, Inc., reported to the National Science Foundation and the Department of Commerce that:

during the last thirty years there has been no major technological change of major economic significance for the building industry. ...Technological change has been primarily evolutionary in small increments, significant only in the aggregate...It can hardly be called innovation.⁴²

⁴⁰ O'Niell, "Why Technology Innovations Fail," p. 69; Herbert J. Gans, The Levittowners (New York: Pantheon, 1967), pp. 270-271; Ralph J. Johnson, Constraints to Builders' Use of Cost Saving Innovations and New Products, unpublished report, NAHB Research Foundation, Rockville, Md., pp. 3 and 6. Gans describes how one successful builder who is otherwise technologically progressive accommodates lagging tastes in The Levittowners, pp. 3-14.

⁴¹ Sims, "Efficiency in the Construction Industry," p. 158 and 161.

⁴² Arthur D. Little, Inc., Patterns and Problems of Technical Innovation in American Industry, (September, 1963), p. 133. Cited in Nelkin, The Politics of Housing Innovation, p. 7.

Apparently, innovation--as referred to in this quotation--requires a minimum size or scale (neither of which is further specified in the Little report). It is hard to imagine what analytic or policy purposes are served by defining innovative activity, which is, after all, an indivisible process, by reference to a size standard and a cryptic one at that. Yet there persists, even among technologists, a notion that there is some optimal "scale" or threshold level "size" below which the designation "innovation" or "technological progress" does not apply. Were this merely an index of muddled technological thought (among the professionals) or of technological innocence (on the part of the dilettantes), this misunderstanding would discomfit none but those few academic philosophers and historians who are seriously at work attempting to know the nature and meaning of technology, to apprehend the relation of knowledge to human agency. But, greater mischief lies just beyond those muddled thoughts, for public policy and action are too often based on them. "Operation Breakthrough" is a premier example of a program that, in its conception and its execution, manifests an incomplete (where not erroneous) understanding of the nature of technological change in industry generally and in the building industry particularly.

We have mentioned why to the casual observer there might be no apparent change in building technology. But why have changes in construction technology eluded economists and studies of industrial productivity? The reason is that these analysts assess the housebuilding industry with measures and indices developed for more stable, more conventionally deployed industries. Take, for instance, the criticism of "undercapitalization." Seasonal and annual variation in levels of construction firms invariably show the lower-ratios of gross capital

assets (fixed capital to total assets) than do manufacturing industries. And housebuilding is the most volatile element in the construction industry: Maisel has shown peak to trough amplitudes as great as from 30 to 40% occurring three times between 1950 and 1962.⁴³ Owning and maintaining expensive fixed equipment would be foolhardy on the part of building contractors and homebuilders in this enormous fluctuation of activity. Construction management places more emphasis, therefore, on financial capital and on a well-paid highly skilled, enormously mobile, flexible work force.⁴⁴ These factors lead the construction industry away from conventions of industrial organization common to other durable goods producers in the economy. But, as Sims points out, most of the indicators of efficiency and industry productivity are based on, and thus accurately portray, the realities of relatively stable, fixed, highly capitalized manufacturing enterprises. None of these qualities adhere to the construction enterprise, nor should they, necessarily. Whereas the smallness of size, primary reliance on manual skills, and a high rate of entry-exit that characterize the construction industry, may be viewed as shortcomings and signals of dysfunction

⁴³ Sherman J. Maisel, "A Theory of Fluctuations in Residential Construction Starts," American Economic Review, Vol. 53, no. 3 (June, 1963), p. 359. Reproduced in Page and Seyfried, Urban Analysis, pp. 122-139. The greater volatility of residential construction was recently demonstrated in an unpublished paper by Ken Rosen of the MIT-Harvard Joint Center for Urban Studies, using data from 1953 to 1972.

⁴⁴ John T. Dunlop, "The Industrial Relations System in Construction" in Arnold R. Weber, (ed.) The Structure of Collective Bargaining, (New York: Free Press of Glencoe, 1961), p. 258. Also, interview with Reese Hammond, Director of Research and Education, International Union of Operating Engineers, 28 August 1969.

among manufacturing entities, these qualities are the very genius of the adaptive construction industry.⁴⁵ In short, the industry must be interpreted sui generis and not as a deviant from conventional industrial practice. Unless this concession to reality is acknowledged, conventional industrial economics (including economic indicators) will mislead well-intentioned analysts.

Complexity of the Construction Enterprise

The construction industry is diverse, dispersed, detached, and discontinuous. It is diverse: just over 70% of the 800,000 construction establishments are sub-contracting units engaged in highly specialized work in just one area of building technology.⁴⁶ The range of specialties is sweeping: besides the well-known specialties such as plumbing, electrical, and sheet metal work are the highly specialized trades of underground wire contractors, contractors whose sole work is applying insulation to piping and mechanical appertenances installed by still other specialty contractors. In all, building construction involves 75 specialties organized by 17 craft unions.⁴⁷ Take the case of a door: off-site specialists design, fabricate and assemble hardware such as doorknobs, closers, push plates, hinges, thresholds, astragals; a teamster delivers these to the site; a laborer carries the door and hardware from the storage area to the door opening; next,

⁴⁵ William Haber and Harold M. Levinson, Labor Relations and Productivity in the Building Trades, (Ann Arbor: Bureau of Industrial Relations, University of Michigan, 1956).

⁴⁶ U. S. Bureau of the Census, Census of Construction Industries, 1967, United States Summary, Part A--Statistics of All Construction Establishments, CC67-1-1A (Washington: USGPO, 1970), p. 1A-1. Hereinafter referred to as the Census of Construction, followed by appropriate descriptor.

⁴⁷ Colean and Newcomb, Stabilizing Construction, p. 98.

a carpenter, after final cutting and machining for locks, knobs, hinges, louvers and glass openings (lights), installs the door itself and then adds the just-mentioned hardware; a painter paints it; a glazier installs the lights in it; and a sign-painter places the title on it. Little wonder that doors increasingly arrive at the job-site completely pre-cut, pre-machined and even pre-hung in the doorbuck unit or that this very innovation precipitated the shot-heard-round-the-world of building construction: the Philadelphia Door case.⁴⁸ A sense of the enormous variety of the jobs involved many of which fall under the jurisdiction of one of the 17 constituent unions of the AFL-CIO Building Trades Department.⁴⁹ The Kaiser Committee reported that no fewer than 14 separate contractors--not trades, but contractors--on the average, appear at the typical single family construction site and on apartment work the number of specialty firms averaged 20.⁵⁰ The number of specific occupations is much larger, of course. In recent years, 1.5 million on-site housing starts have been made; most of this housing is built by small firms whose annual output varies between 5 and 25 units per year. Industry logistics routinely coordinate the work of thousands of contracting entities, in these

⁴⁸ Resolved by the U. S. Supreme Court in *National Woodwork Manufacturers Association vs. NLRB*, 386 U.S. 612 (1967). The court found that prohibitions of secondary boycotts (such as those proscribed by the Taft-Hartley Act of 1947) were inapplicable to boycotts of pre-fabricated products. See Arthur B. Smith, Jr., "Boycotts of Prefabricated Building Products and the Regulation of Technological Change on Construction Jobsites," *Industrial and Labor Relations Review*, Vol. 25, No. 2 (January 1972), p. 193.

⁴⁹ For a description of each union and the work under its jurisdiction, see Sydney H. Kasper, *Careers in the Building Trades*, Rev. Ed. (New York: Walk Publishing, 1969).

⁵⁰ Kaiser Committee, *A Decent Home*, p. 151.

millions of atomistic, discrete and autonomous decisions.

The construction industry is also broadly dispersed, not to say ubiquitous. Whereas other durable goods industries have become identified with specific cities or urban regions--an economic geographer thinks of steel when Pittsburgh comes to mind; or of air frame construction when Seattle is mentioned--there is no such geographical concentration in the construction industry. Rather, construction firms are distributed across the nation as the population is distributed,⁵¹ the better to serve local need; only 6% of construction establishments do work beyond the borders of their own state.⁵² And housebuilding is even more spatially limited.

The construction enterprises are detached in that not only does the work move from site to site, job to job, but the combination of possible sub-contractual arrangements among the 10-18 specialty firms likely to be engaged on any single job, makes project planning and systems-oriented management difficult to achieve. This, it turns out, is somewhat less so of housebuilding for, as Cox has shown, the relation of the general contractor to his sub-contractors is very different than that between the homebuilder and his specialty contractors.⁵³ The

⁵¹ G. Alexandersson, The Industrial Structure of American Cities, (Stockholm: Almqvist and Wicksell, 1956), p. 60. Cited in Peter J. Cassimatis, The Economics of Construction, (New York: National Industrial Conference Board, 1969), p. 26.

⁵² Census of Construction, Table B-8, p. 1B-14.

⁵³ Reavis Cox, et. al., The Supply-Support Requirements of Home-builders, p. 7.

latter case teams of builders and sub-contractors often move from job to job with each other and are not ad hoc, temporary consorts. Many specialty contractors, for example, do all of their own work with one homebuilder, often negotiating for new work rather than bidding competitively.

Construction entities are also somewhat detached from their sources of supply of building materials, shifting among vendors of highly differentiated products as consumer tastes and architectural fashions change. This, too, is less often true of homebuilders than it is of general contractors: many homebuilders, Cox showed, are seeking new divisions of duties and responsibilities between themselves and their material suppliers. Builders eager to make use of more efficient financial capital, for instance, attempt to push inventorial functions back into the supply channel, willing to forego some autonomy in the process.⁵⁴ Larger homebuilders are prepared to become distributors of materials themselves in order to increase profits and, especially among general contractors, to assure timely flows of critical materials.⁵⁵ Homebuilders not infrequently buy or arrange for sub-contractor's materials especially when they are costly or items particularly critical to timely completion of the projects. Homebuilders, who often double as merchandisers of their finished housing, are keenly sensitive to consumer wishes with respect to highly visible items like finishes, appliances, and other specialties, and will shift to vendors who offer more complete marketing assistance such as advertising campaigns.

⁵⁴ Ibid., p. 26

⁵⁵ Ibid., p. 33. See also Edward P. Eichler and Marshall Kaplan, The Community Builders (Berkeley: University of California Press, 1969).

The construction industry, and particularly housebuilding, is a highly discontinuous enterprise. The seasonal and annual fluctuation of volume have already been mentioned. Residential construction suffers more because, as Dunlop and Mills have reported, they offer generally lower wages and fringe benefits, offer jobs of shorter duration, frequently work in remote sites, and generally have a more difficult time recruiting skilled manpower than does commercial, industrial, and heavy construction.⁵⁶ The homebuilder is likely to lose the higher quality workers he has recruited just as soon as construction generally picks up in his area. As was mentioned earlier, the discontinuity of residential construction work argues against large amounts of labor saving capital equipment; so too does the casual, transitory nature of the homebuilding work force: housebuilders would be unwise to train a work force to use complex equipment only to see the work force disintegrate when commercial and industrial building activity quickened, or when residential construction slackened. Finally, the discontinuity of construction work is noticeable even from day to day: the vagaries of weather can undercut serious efforts of the close coordination of a building team of specialty contractors and material deliveries.

Technological Innovation in Industry

Technological innovation is the means by which individuals, firms or whole societies adapt new knowledge to the service of human purpose.⁵⁷ Just as every human action, whether individual or collective, employs

⁵⁶ Dunlop and Mills, "Manpower in Construction," p. 244.

⁵⁷ Homer G. Barnett, Innovation: The Basis of Cultural Change, (New York: McGraw-Hill, 1953).

a technique to achieve its ends, any change in that technique-- whether by changing the character of inputs, the outputs, or the means of production--wherever that change of technique incorporates new knowledge we have a change in technology.⁵⁸ At any moment in history the state of technology, to a great extent, determines the kind and quality of possible outputs. The relation between the output for a given amount of inputs at a constant level of technology is known as the production function⁵⁹ and any alteration of that production function, any change in the relation to inputs to outputs, is the resultant of a technological change. If one were to broaden the concept of outputs to the satisfaction of any human need, then the invention of new products would also fall within the definition stipulated.

There are several impetuses to technological change in industry: the costs of inputs may rise and fall relative to one another such that one would, in the interest of conserving resources, then substitute certain inputs or types of inputs for more expensive inputs or types of inputs--labor for capital, financial assets for depreciable physical assets, financial assets for labor, and so forth. During the 1960's several studies of the American Economy identified technological change as the primary engine of economic growth.⁶⁰ But these studies

⁵⁸ Edwin Mansfield, The Economics of Technological Change, (New York: W.W. Norton, 1968), p. 11

⁵⁹ Ibid., p. 12.

⁶⁰ These several studies--by Dennison, by Solow, and by Fabricant-- have been reproduced in abbreviated form in Part Four, "Long Term Consequences of Technological Change," in Nathan Rosenberg (ed.) The Economics of Technological Change: Selected Readings, (Baltimore: Penguin Books, 1971).

of innovation and technological growth in the aggregate have only recently been complemented by investigations of the precise impact of technological change on specific industrial processes; moreover, the industrial conditions that expedite a more rapidly evolved, more accurately targeted technological change have only recently been identified. In this section, we shall briefly review research in industrial innovation and identify some useful generalizations drawn from that research. The purpose for this is to develop hypotheses and insights into the dynamics of technological change in the housebuilding enterprise. We shall focus special attention on regulated industries of the United States who have particular problems of technological innovation, for the present study proposes that the housebuilding industry can usefully be studied as a regulated industry.

Following Barnet, one might refer to the individual innovation as the atom of the technological change, the basic unit. Standing behind the innovation for single action is a chain of events that began with the conception of a new idea, invention of a new device or process or the development of an entirely new market for an existing device or process. While the public imagination is drawn to the significant "breakthrough" sorts of innovations, the reality of industrial innovation is more prosaic. Extensive reviews of the innovative process in industry, such as those conducted recently by the Department of Commerce; Nelson, et. al.; Mansfield, Hamberg, Schmookler, and Jewkes, et. al., reveal that the cumulative effect of the incremental additions to or advances of the state of the art of vastly greater significance to secular progress than is the occasional brilliant, daring

technological tour de force.⁶¹ Retrospective studies of the significant advances in areas as diverse as weaponry,⁶² and of civilian industrial technology reveal similar findings. Myers and Marquis, reviewing over 500 industrial innovations, report that "Technical change is, to a significant extent, based on a cumulative effect of small, incremental innovations."⁶³

There is a pervasive popular belief in the pre-potency of the industrial laboratory as the primary resource of industrial innovation. Galbraith in the New Industrial State suggested that the days of the workbench tinkerer are over; that organized inquiry, in the form of industrial research and development, is the font of virtually all

61 U. S. Department of Commerce, Panel on Invention and Innovations, Technological Innovation: Its Environment and Management, (Washington: USGPO, 1967). Known as the Charpie Report, for Robert A. Charpie, Chairman of the Panel, this report has recently been reissued by the Nixon Administration's Secretary of Commerce, Peter G. Peterson, who was a member of this Panel convened during the Johnson Administration. R. R. Nelson (ed.), The Rate and Direction of Inventive Activity: Economic and Social Factors, (Princeton: Princeton Press, 1962). Edwin Mansfield, The Economics of Technological Change. Daniel Hamberg, R&D: Essays on the Economics of Research and Development, (New York: Random House, 1966); Jacob Schmookler, Invention and Economic Growth, (Cambridge: Harvard U. Press, 1966). John Jewkes, et. al., The Sources of Invention, 2d Ed., (New York: W. W. Norton, 1969).

62 Reported in C. W. Sherwin, et. al., First Interim Report on Project Hindsight (Summary), Office of the Director of Defense Research and Engineering, Washington. Federal Clearinghouse No. AD 642 400.

63 Sumner Myers and Donald G. Marquis, Successful Industrial Innovations: A Study of Factors Underlying Innovation in Selected Firms, (Washington: National Science Foundation, 1969), p. 59. Cf. Arhthur D. Little's dismissal of incremental innovation on p. fn. 42.

significant innovations and technological advances.⁶⁴ But a Commerce Department survey of innovative activity in United States industry, reviewing the work of several students of technology, invention and innovation, reveals that some of the most important inventions of the twentieth century issued from precisely this technological "bush leaguer," the irregular inventor.⁶⁵ Some examples: Xerography, the cyclotron, oxygen steel making, catalytic cracking of petroleum, dacron polyester fiber (this last at a time when the organized petro-chemistry industries were very active pursuing similar products).

Economic studies of organized industrial research and development have revealed a handful of useful generalizations concerning research and development for industrial innovation. After reviewing the literature, Mansfield reports that expected profitability of the research and development being contemplated determined the amount a firm would spend in this activity. Furthermore, the probability of accepting a particular project depends almost entirely on the project's expected returns.⁶⁶ Not surprising behaviour among industries organized for profit: so much could be deduced from the axioms of micro-economics and industrial finance. Of more recent origin however, are the understandings of the influence of particular demand on the rate and direction of inventive activity. Schmookler produced striking evidence that,

⁶⁴ "The Imperatives of Technology," (Boston: Houghton-Mifflin, 1967), pp. 11-21.

⁶⁵ Department of Commerce, Technological Innovation, pp. 16-17.

⁶⁶ Mansfield, The Economics of Technological Change, p. 17.

whether reviewing a single industry over time or taking several industries in cross-section at the same point in time, the pull of demand was far more influential over the extent and type of inventive activity than the push of supply, or the impetus of science and technology itself, ever was.⁶⁷ One last generalization that will serve to illuminate some of the characteristics of innovative activity in housebuilding is the finding that even among industries well endowed with research and development resources, "adopted innovations," innovations originating outside the firm or even the industry under review, contribute enormously to technological advance within that firm or industry. Myers and Marquis'⁶⁸ study of 567 industrial innovations concluded that almost a quarter of these were developed by organizations other than those which finally purveyed the innovated product or process to its final customer. And the cost of bringing adopted innovations to commercial success was about the same as that of those innovations developed within the firm itself. On reflection one suspects that total cost might have been the lower, even adding in the cost of licensing the already partially developed practice, since the uncertainties and high risk that attend initial probes into new areas are not present.

The costs of developing the initial invention or innovation is only the tip of the economic iceberg. Refining an invention, making it commercially feasible, and propagating that innovation consume enormous amounts of time and money. In the Commerce Department's

⁶⁷ Jacob Schmookler, Invention and Economic Growth, p. 204-205.

⁶⁸ Successful Industrial Innovations, p. 60.

review of commercial technological innovation, it was estimated that research, development and creation of the basic invention itself consumes a mere 5-10% of the eventual total costs of a successful product innovation. By far the largest cost involved (40-60%) is that involved in preparing for manufacture of the new item. The report further estimated that 10-25% of the final total cost of an innovative effort accounts for from 10-25% of the overall effort. This, of course, is for the successful product innovations, the report is mute on cost distribution for innovations that have failed.⁶⁹

Special Case of Regulated Industries

The principal tactic of this study is to consider the building enterprise as a regulated industry and then to focus on the factors affecting regulatory policy. This is done for several reasons: First, with an enterprise so vast--800,000 U. S. entities providing contract construction services--and resources so few--those of an impecunious doctoral student--the investigation of the social control of innovation in residential construction technology conforms to a detailed examination of the single filter through which all such innovations, if they are to be legitimately adopted by the industry as a whole, must pass: the local building code. While it is true there are a large number of code-enforcing jurisdictions--the Douglas Commission estimated just over 8,000 such public agencies⁷⁰--by drawing

⁶⁹ Department of Commerce, Technological Innovation, p. 9.

⁷⁰ Marvel, Local Land and Building Regulation, pp. 4 & 12. More precisely, 8,344 or 46.4% of local governments. Of those with 5,000 or more inhabitants: 3,272 or 80.5%.

The second reason is that regulatory methods, although they vary significantly among industries, have serious consequences for the development and diffusion of technological changes in all the regulated industries. The effects of regulation among the electric power, communications, and air and surface transportation enterprises, for example, as described to be significant, if usually off-stage, presences in the bulk of technological decisions in those industries. Further, close regulation of industry can have the apparently contradictory effects of either advancing or retarding technological change within that industry. Summarizing several Brookings Institution studies, Capron⁷¹ reported that licensing can be used to restrict the entry of innovative competition. In the building industry, of course, there are no de jure public controls on entry of firms into the industry⁷² but building codes do act as a de facto licensing of both building material producers to sell and building contractors to incorporate innovative techniques in his work. To analogize: when a building code accommodates a technological change, we have the functional equivalent of a regulator granting a license to market that product or service innovation in a jurisdiction. Complicated, unevenly administered and overly-restrictive local building codes, indecipherable to all but local architects, engineers and contractors, have similarly restricted access to lucrative

⁷¹ Capron, Technological Innovation in Regulated Industries, p. 9.

⁷² Building contractors are often required by law to post surety bonds or letters of credit before undertaking larger and, particularly, publicly-funded projects. This "entry" requirement has set back efforts to encourage minority enterprise in the building business. (Boston Globe, March 9, 1972, p. 1+).

local markets. Another analogy is that suggested by a former research colleague, Charles Field: the local building code functions as a tariff on "foreign" construction competition,⁷³ thus reinforcing the existing parochialism of the industry and cutting off contact with more cosmopolitan firms. But close regulation does not always bring technological stagnation: once innovation occurs within a closely regulated industry--with U. S. airlines being the premiere example--diffusion of the new practice occurs rapidly because of the similarity of conditions imposed on all industry participants by close enforcement of uniform regulations.⁷⁴ We shall elsewhere determine if this is so in building regulation: the more uniformly administered the building regulations, the more technologically progressive is the industry under that enlightened regulation.

Opinion varies within the building industry itself on the extent to which obsolete and fragmented building codes actually inhibit technological progress in the industry. Those that work on the technological "leading edge" do indeed find codes and their highly varied enforcement much of a problem whereas traditional architects, engineers and builders catering to local markets do not. A panel of modular housing producers convened by House and Home, a periodical which addresses itself to managers of housing and light construction firms,

⁷³ Charles G. Field, Home Manufacturing and Building Codes: The Confrontation Between Technology and Institutional Regulation, (unpublished Ph.D. Thesis, Harvard University, 1971).

⁷⁴ Capron, Technological Innovation in Regulated Industries, p. 156.

listed the code problem as the first of six obstacles to achieving technological advance; Johnson, recall, reported essentially the same ranking when he surveyed conventional or "stick-builders" on factors affecting their own technical advances.⁷⁵ In a burst of overstatement, Richard O'Niell, a well-known industry critic, proposed that "contrary to the opinion of many people in the homebuilding industry, these traditional whipping boys (local building codes and labor practices) are not the most serious barriers to technological progress." O'Niell tergiversated, however, when, in the next statement, he declared that "any innovation that really saves money without impairing quality will be accepted by codes and labor--eventually."⁷⁶ Still later, O'Niell admitted a widespread use of code abuses in terms of local administration rather than the quality of the substantive provisions of the code and the use of building codes by local industry and builders as a tariff device.

The Massachusetts Department of Community Affairs provides evidence that, among industrialized housing producers, those who serve low- and moderate-cost markets are hampered more severely by either overstrict or variably-enforced local building codes than are

⁷⁵ The Problem of Codes is Holding Back the Real Modular Breakthrough," House and Home, (October, 1971), Vol. 40, No. 4, pp. 88-89. Ralph J. Johnson, Constraints to Builders Use of Cost Saving Innovations and New Products, pp. 3 and 6.

⁷⁶ O'Niell, "Why Technology Innovations Fail," p. 67. Emphasis added. But, in construction, more so than in most industries, time is money. The New York State Council on Architecture has estimated that, in recent years (1967-70) with annual cost escalations of 12%-18%, delays on \$50-\$60 million jobs may cost up to \$1,000 an hour (John Janssen, personal communication). Sims (on p. 181), citing Dunlop, has also exposed the time-money relation in construction. So the O'Niell qualifier--"eventually"--is significant.

producers marketing more expensive units. Over half the firms producing units in the \$10,000-\$15,000 class reported stricter code standards applying which resulted in higher production costs. But of firms producing for the \$20,000 and over markets, less than 30% so complained.⁷⁷ Clearly, erratic regulation has harsher consequences for home-seeking families with lower income than for higher income home-seeking families.

Lastly, we choose to investigate closely the regulatory effects between industry and government because it is the arena where technological challenges and political resolutions are very vividly drawn. The choice of building regulation as the locus of analysis is reinforced in that study findings can lead to policy recommendations for a reworking of the already functioning building regulatory system. Reassessment of the role of industrial regulation in achieving public purposes has recently been revived. The Ash Council⁷⁸ proposals come to mind as does the work of Nader's Raiders.

How Innovative is the Building Industry: Inter-Industry Comparison

Our purpose here is not to refute definitively the frequently-made assertion that the building industry is a technological laggard. Rather, the intention is to outline the factors that should form the background for assessing industry's technological development.

⁷⁷ Department of Community Affairs, Office of Code Development, Reports Relative to the Development, Administration and Enforcement of Building and Housing Codes, April 1971, p. 84. Hereinafter referred to as the DCA Report.

⁷⁸ Formally: The President's Advisory Council on Executive Organization, A New Regulatory Framework: Report on Selected Independent Regulatory Agencies (Washington: USGPO, 1971).

The building industry invariably suffers in inter-industry comparisons on research and development activities and the consequent of industrial R and D, capital plant. Capital goods investments and associated investment is a frequently adduced indicator of industrial vitality and progress. But persons knowledgeable in construction economics (notably Dunlop)⁷⁹ maintain that, in construction, accumulated resources are in the form of human skills capital rather than in physical plant. Much of the output of industrial research and development and, therefore, much of its economic rationale, is to inform decisions on additions to production capacity. But improvements to physical (and especially, fixed) capital are not suited to the building industry. Hence, studies which rely heavily or exclusively on expenditures for research and development as an indicator of the technological progress are misleading when used to assess progress in the construction industry. Failure to take this into account flaws some recent work in this field.⁸⁰

Schmookler has suggested "value added by manufacture" as a proxy for capital investment.⁸¹ Taking this more comprehensive measure, the building industry comes off poorly; for value added at the building site is among the lowest in all the industries in the United States. General building contractors, "conventional" homebuilders and mobile

⁷⁹ Dunlop, "The Industrial Relations in Construction," p. 57.

⁸⁰ Two examples: Nelkin, The Politics of Housing Innovation, p. 8; and Richard R. Nelson, et. al., Technology, Economic Growth and Public Policy, (Washington: Brookings Institution, 1967), p. 193.

⁸¹ Jacob Schmookler, Invention and Economic Growth, p. 151.

manufacturing in the course of their operations contribute only 28.9, 37.6, and 24.7% respectively, to the final value of the structures they create. In contrast, the prominent construction industry suppliers such as stone and clay products; electrical lighting and wiring equipment; heating, plumbing and structural metal products; paint and allied products; and lumber and wood products all contribute a much larger fraction of the sales value of their products. Respectively: 58.8, 58.1, 49.2, 46.4 and 42.2 percent.⁸² These value-share ratios, incidentally, are a way of quantifying the wide use of pre-assembled and prefinished components in contemporary building. A great deal of value goes into building components before they have ever reached the building site or modular housing plants; builders rarely handle "raw" materials anymore. To a far greater extent than most laymen realize, all homebuilders--not just the "industrialized" ones--are essentially in the business of materials-handling and erection rather than fabrication.

Schmookler found that inter-industry differences in inventive activity (a precursor of innovative activity) are proportionate to

⁸² The mentioned industries sell at least 40% of their output to construction. Value added shares computed from the following sources: General Building Contractors: Census of Construction, General Building Contractors, SIC 1511, CC67-1-2, Table 3, p. 2-5; "Conventional Homebuilders and Mobile Home Manufacturers: Young and Ball, "Industrial Impacts of Residential Construction and Mobile Home Production," Table 1, pp. 14-15; identification of major construction industry suppliers from Kinzie, "Construction's Input-Output Profile," Table 3, p. 7; data on construction supply industries from U. S. Bureau of the Census, Annual Survey of Manufacturers: 1969, General Statistics for Industry Groups and Industries, M69(AS)-1, (Washington: USGPO, 1971), Table 1.

differences in capital sales among industries.⁸³ But the building industry is simply not capital intensive in terms of physical plant; its resources are in the form of financial capital and human capital, categories most frequently slighted, as Usher has argued, in inter-industry comparisons of performance in technological innovation.⁸⁴

Another frequently alleged shortcoming from the building industry is its great reliance on external resources for the innovations that have later found widespread acceptance within the industry. Schon has named this maneuver "innovation by invasion" wherein a technologically retarded, mature, stable, industry is invaded by technologically advanced, developing, expansive industries.⁸⁵ Schon's prize example was the invasion of the textile market by the synthetic fibre manufacturers-usually petro-chemical firms. More than one student of technological innovation in construction has described several instances wherein the housebuilding industry particularly has been the complaisant host to such invaders.⁸⁶ Instances of innovation by invasion are sometimes used as indictments of technological morbidity in the receiving

⁸³ Schmookler, Invention and Economic Growth, p. 205

⁸⁴ Abbot Payson Usher, "Technical Change and Capital Formation" appeared originally in Capital Formation and Economic Growth, (National Bureau of Economic Research, 1955) and is reproduced in Rosenberg, The Economics of Technological Change, pp. 43-72.

⁸⁵ Schon, Technology and Change, pp. 52 ff.

⁸⁶ Jack Ronald Warner, A Proposal for Improvement in Communicating Innovation in the Homebuilding Industry, (unpublished Masters Thesis, George Washington University, 1969), pp. 18-19; an unsigned comment, "Innovations in Construction," Construction Review, Vol. 13, No. 11 (November, 1967), p. 8; and Ralph J. Johnson, "Housing Technology and Housing Costs," (esp. Appendix A), in Kaiser Committee Technical Appendix, Vol. II, pp. 53-64.

industry. But this can be viewed as dysfunctional only by persons ignorant of the history of technological innovation in industry, generally. Myers and Marquis, having reviewed the histories of 567 commercially successful innovations, found that one quarter of them were developed by organizations and firms other than those which finally commercially sold them.⁸⁷ This is typical of the construction industry where most of the research and development dollars and new product development effort is made by the building materials industry, the suppliers to homebuilders the country over. Many--especially among the architectural avant-garde--have criticized this tendency as an index of technological backwardness. Yet, as Capron reports, the electric utilities of the Nation, commonly thought of as innovative and technology-oriented, perform no direct research and development in power technology. Like the building industry, whose research and development needs are met by the suppliers of building products, utilities rely on manufacturers of electric power equipment to do research and development, often to the specifications of the utilities.⁸⁸ Often the supply industry must offer dollar incentives to the user utilities to incorporate newer technology; the utilities require

⁸⁷ Successful Industrial Innovations, p. 60. Myers and Marquis spoke with executives of 121 firms in five industries (railroads, railroad equipment suppliers, computer manufacturers, manufacturers of computer components and ancillary equipment and suppliers of building materials). Each firm identified the "most important" and commercially successful technical innovations of the previous 5-10 years. 53 building material producers nominated 196 nominations.

⁸⁸ Capron, Technological Innovation in Regulated Industries, p. 8. Mansfield notes in The Economics of Technological Change, that producers of consumer goods also draw on R and D performed by suppliers, p. 61.

the incentive inasmuch as they are taking risks on hardware which has not been fully developed or tested. These are precise counterparts to this situation in the building industry.

With scant experience with research, development, and experimentation, the building industry must look to experience in use rather than bench-testing or other formalized evaluations of new materials. This reliance on external sources is much more common to industry as a whole--even technologically progressive industry--than is commonly realized. Myers and Marquis reported vendors or prospective vendors were frequently cited sources of innovations which later became commercial successes.⁸⁹

Industry critics such as O'Niell, Warner, and Bertram and Maisel are quick to point out that the delays in seeing new technology propagated to become standard practice.⁹⁰ Again, these accusations betray an ignorance of the delay of the diffusion process in industry generally, even among relatively concentrated, fixed, capital-intensive industries. Mansfield, after reviewing many studies in diverse industries, was impressed with length of the time involved for a new practice or procedure to diffuse⁹¹ and Denison despaired of reducing this

⁸⁹ Successful Industrial Innovations, p. 60.

⁹⁰ O'Niell, "Why Technology Innovations Fail," passim; Warner, A Proposal for Improvement in Communicating Innovation in the Home-building Industry, passim; and Gordon W. Bertram and Sherman J. Maisel, Industrial Relations in the Construction Industry (Berkeley: Institute of Industrial Relations, 1955), p. 4.

⁹¹ Edwin Mansfield, The Economics of Technological Change, p. 115.

delay by even as much as a few years.⁹² In the accompanying figure, Mansfield demonstrated the length of time required for major innovations to become common practice in the bituminous coal, steel, railroad and brewing industries. Although confining himself to the largest firms in these respective industries, Mansfield discovered that even those innovations which represented significant savings to the industries under review diffusion time ran as long as 30 years. One reason for the delay in capital intensive industries is that sizeable investments in traditional apparatus is not likely overthrown despite the promise of a more productive replacement. The steel industry is paradigmatic in this respect: by the end of 1968 just over a third of the nation's steel making capacity had converted to the basic oxygen furnace although this first came into use in 1954.⁹³ Logically, one would think the less capital intensive or low value-added industries could easily afford to discard aged production facilities because they represented such a small fraction of industry worth. But, as was pointed out earlier, in construction, investment is built into the human skills of the labor force and the building trades unions and their industry allies are duty-bound to prevent the discarding of these investments in human resources.

There are good reasons for delays in the building industry. One was alluded to earlier: an industry that does not have an organized

⁹² Edward Denison, "United States Economic Growth," Journal of Business, (April, 1962) reproduced in Rosenber, The Economics of Technological Change, p. 379.

⁹³ Beatrice N. Vaccara, "An Input-Output Method for Long-Range Economic Projections," Survey of Current Business, Vol. 51, No. 7 (July, 1960), p. 50.

Diffusion Time for Major Innovations in Four Industries

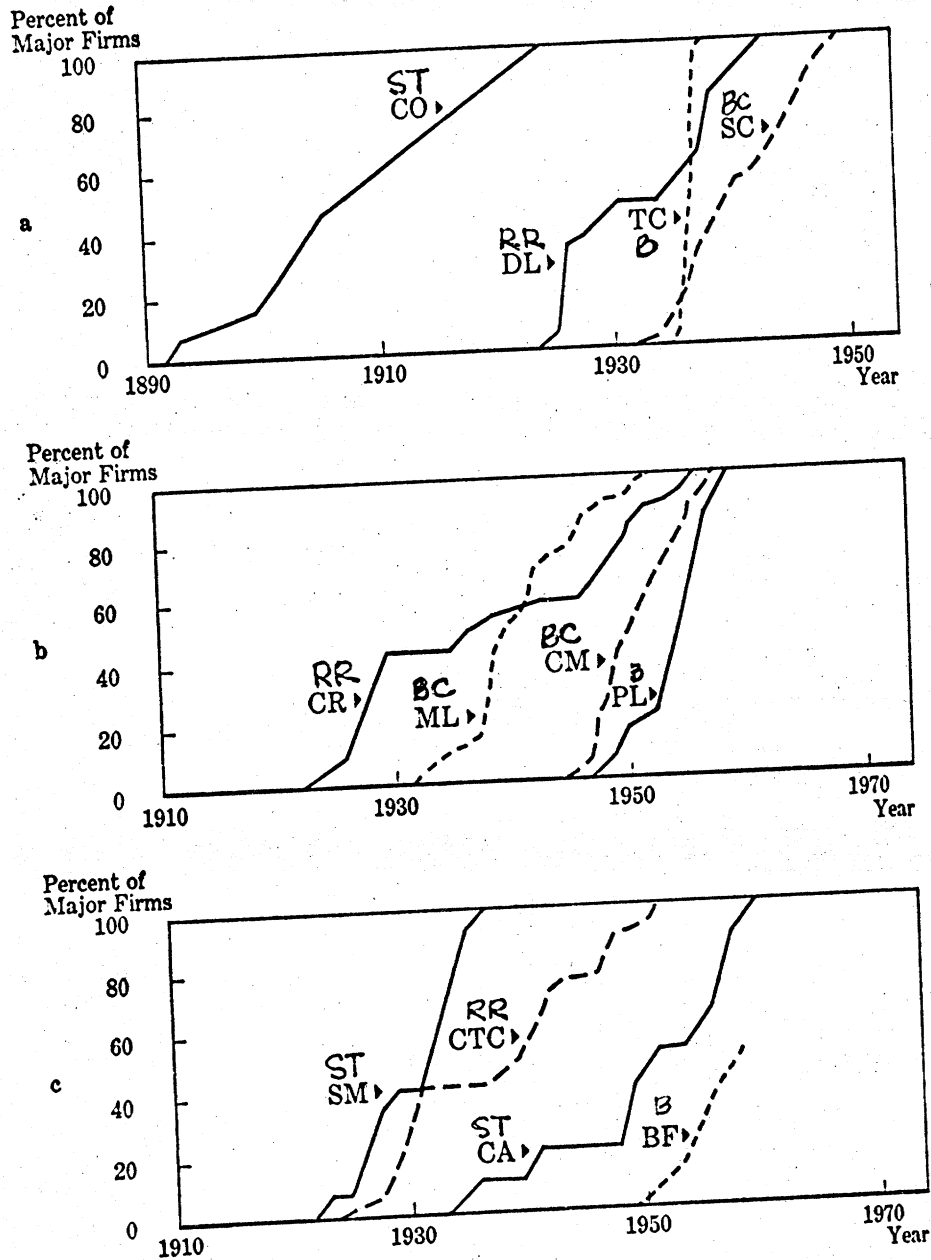


FIGURE 4.1

Growth in the Percentage of Major Firms that Introduced Twelve Innovations, Bituminous Coal, Iron and Steel, Brewing, and Railroad Industries, 1890-1958

- a. By-product coke oven (CO)^{BC}, diesel locomotive (DL)^{RR}, tin container (TC)^{RR}, and shuttle car (SC)^{BC}
- b. Car retarder (CR)^{RR}, trackless mobile loader (ML)^{BC}, continuous-mining machine (CM)^{BC}, and pallet-loading machine (PL)^{BC}
- c. Continuous wide strip mill (SM)^{RR}, centralized traffic control (CTC)^{RR}, continuous annealing (CA)^{RR}, and high-speed bottle filler (BF)^{RR}

Source: Mansfield, Economics of Technological Change, Figure 4-1, p. 116.

research, development, testing and evaluation tradition requires sufficient time to gain experience with the technical and other properties associated with the new materials before a substantial commitment to them can be responsibly made.⁹⁴ Often there is lack of interest or urgency on the part of the supplier of the innovative material. For this reason: many construction materials enjoyed wide use in industries other than building before the building market was broached: pre-stressed concrete, asbestos cement, aluminum, fiberboard, plastic pipe, all enjoyed stable markets in industries other than building. Entrance into the building materials market means dealing with enormous volatility of demand; large problems of inventorying and distributing to a nearly ubiquitous customer with no single one ever accounting for more than the minutest share of total production; and the hassles of obsolete and conflicting building codes and recalcitrant unions (of which, more, later). This may account for Myers and Marquis' finding that suppliers to the housing industry are frequently highly diversified in their line, often devoting less than 10% of their output to the building market.⁹⁵

Part of the delay is no doubt ascribable to the enormous fragmentation of responsibility in the residential construction industry. Combining just a few of the dozens of components and functions might

⁹⁴ Marian Bowley, Innovations in Building Materials: An Economic Study, (London: Gerald Duckworth, 1960), p. 415.

⁹⁵ Successful Industrial Innovations. This finding conflicts with input-output studies of the U. S. economy which have demonstrated that only twelve industries or industry groups supply 80 percent of the construction industry's direct purchases and that in five of these, over 40% of total industry sales go to construction. See Kinzie, "Constructions Input-Output Profile," Tables 1 and 3.

substantially reduce the diffusion time for innovations. Bowley,⁹⁶ has observed that new practices have come into wider use faster on the continent of Europe than in either Great Britain or the United States simply because in many European countries the builders and designers of structures are combined in the same organizational entity.

Intra-Industry Comparison Over Time

As we mentioned earlier, homebuilders, marketing to conservative home purchasers, take pains to mask the sizeable advances they have made in housebuilding technology. A close look at a residential building site reveals much greater use of mechanical devices for materials handling and for fabrication and erection of the building components; the virtually complete mechanization of excavation and landscaping; the much wider use of specialized sub-contractors for things like scaffolding and building site security; the "bundling" of pre-cut and prefinished building materials to each separate homesite, a service now provided by suppliers and local distributors of building materials; the list could go on. Ralph J. Johnson has enumerated 86 innovations in building materials and 39 innovations in building methods in the two decades following World War II.⁹⁷ These innovations have generally been in the form of superior substitutes for existing products and current practices rather than radical departures from tradition, owing

⁹⁶ Marian Bowley, The British Building Industry: Four Studies in Response and Resistance to Change, (Cambridge, England: Cambridge U. Press, 1966), p. 22

⁹⁷ "Housing Technology and Housing Costs." Similar tallies have been made by O'Niell and Warner, previously cited. An enumeration was made about 20 years ago by Haber and Levinson, Labor Relations and Productivity in the Building Trades, pp. 107-151.

to both builder skepticism and the need to integrate into a closely-knit technical structure and social system.⁹⁸

Factors Affecting Technological Innovations in the Building Industry

The building industry is an intricate combination of hundreds of thousands of actors, both individual and institution, private and public and voluntary, some in temporary alliance, ad hoc coalitions maintained only for the duration of a single building project. No single actor asserts enough control over enough of the building process to be decisive. The following diagrams--each a simplification--illustrate the necessary coming together of parts to achieve residential construction.

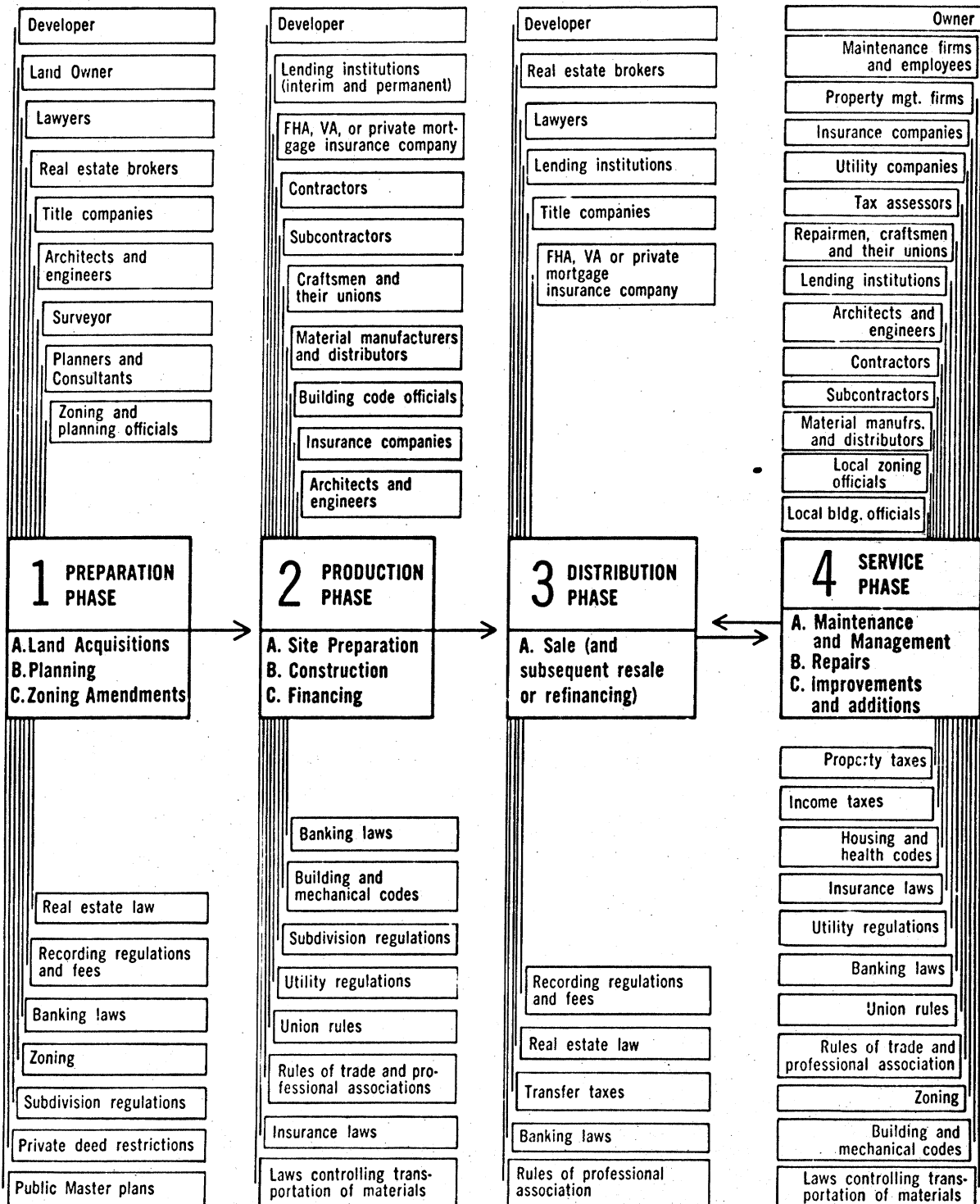
A popular characterization of the reluctance of building industry to show more responsiveness to technological change has been the identification of "obstacles" to innovation. Under this "obstacles" view, a variation of a conspiratorial theory of history, two or three of the hundreds of actors are singled out for indictment as progress retarders. Obsolete building codes and restrictive union practices are more frequently indicted.

Indictment or acquittal of any one of these actors is not the purpose of this study. Nor do we wish to elaborate the conspiratorial model of resistance to technological change. Our studies of the construction industry, and the housebuilding sub-industry, direct us to conclude that two- or three-actor scapegoating betrays an ignorance of the dynamics and the complexities of the construction enterprise.

⁹⁸ Ralph J. Johnson, Constraints in Builders' Use of Cost Saving Innovations and New Products, p. 3.

FIGURE 1-1

The Housing Process Major Participants and Influences *



*From the Final Report of the President's (Kaiser) Committee on Urban Housing, A Decent Home (Washington: USGPO, 1968)

A rather more useful formulation of the dynamic of the industry might be drawn from an analogy with other systems in which a power and responsibility is dispersed among large numbers of actors any one of which bears only a small fraction of the resources or power required to redirect the system as a whole: our analogy is with polyarchic political systems.⁹⁹ The aim of this study is to describe the plurality of interests that--single, but more often in coalition--have a stake in the advance or progress of construction technology. This pluralist approach assumes, further, that there are many "frictions of development" in the evolution of building technology just as there are many frictions in the whole urban development enterprise.

These frictions are more complex than craft union reluctance to dispense with old methods; survey data to be adduced later do not support this simplistic assertion that continues to enjoy wide currency by those who should know better. More complex, too, than the alleged constitutional reluctance of local bureaucrats to accommodate themselves and their building codes to new technology; too many have accommodated. Rather, this hesitation in the face of technological innovation proliferates through the entire social system which accompanies the functional-technological structure of the industry. As Elting Morrison remarked about the turn-of-the-century U. S. Navy undergoing technological change "...the Navy is not only an armed force; it is a society [in which social relationships mirror

⁹⁹ Robert A. Dahl and Charles E. Lindblom, Politics, Economics and Welfare, (New York: Harpeter, 1953), Chapter 10.

technological relationships]"¹⁰⁰ There is no changing one without changing the other. Following this insight, and combining it with insights drawn from the study of polyarchic political systems, we hypothesize that no change will occur in the building industry (and its social system) unless a sufficient number of actors in that system concur.

The research which follows has as its specific objective the identification of those actors or coalitions of actors who have affected progress in the diffusion of a number of specific technological innovations in residential construction. Our attention is drawn to the regulatory arena--the local building department--wherein, sooner or later, the parties of technical-political dispute must enter and reach a resolution. We shall learn that the adjudicators of these disputes: the local building officials, are by origin and loyalty very much a part of the social system that is a residual of the system of technical and functional relations in the building industry.

The effect of building regulations on technological innovations in the industry have been discussed by several investigators.¹⁰¹ But the reciprocal relation, that of the building industry on building regulations themselves, is less well-known. This knowledge gap has been filled with widespread public cynicism most of it directed to building trades unions. Previous investigators of this unions-building code relation do not agree with one another. Slichter reported a great

¹⁰⁰ Men, Machines and Modern Times, (Cambridge, MIT Press, 1966) p. 34.

¹⁰¹ The already cited works of Haber and Levinson (1956); Burns and Mittelbach (1968); the Douglas Commission (1968); Charles G. Field (1971) and the Massachusetts Department of Community Affairs, Office of Code Development (1971).

deal of influence by unions on code-writing decisions on new technology; but he adduced no empirical evidence.¹⁰² Haber and Levinson recorded "little relationship evident between union policy and the severity of building codes."¹⁰³ Mandelstamm, on the basis of interviews with the local building officials, reported no union effects on codes and that opinion was concurred in by contractors with whom Mandelstamm spoke.¹⁰⁴ But these findings are flawed by the relatively unsystematic solicitation of opinions employed both by Haber and Levinson and by Mandelstamm and, worse, the fact that the former study was confined in the central cities of the 52 largest metropolitan areas of the United States and that the latter drew as its empirical base upon two small cities less than 100 miles apart! These studies are still widely-cited as authoritative. This study corrects those defects by employing a uniform survey instrument and drawing on usable returns for almost 1,000 U. S. municipalities of every size class.

Attention is focused on the local building department for several reasons, some merely for operational convenience, others by substantial intent. Operationally, it would be difficult to solicit the opinions of the 800,000 construction establishments in the United States; a thirty year lapse between Censuses of Construction may be partly attributed to the difficult logistics of such a solicitation.

¹⁰² Sumner H. Schlichter, Union Policies and Industrial Management, (Washington: Brookings Institution, 1941), pp. 345-348.

¹⁰³ Labor Relations and Productivity in the Building Trades, p. 181.

¹⁰⁴ Allan B. Mandelstamm, "The Effects of Unions on Efficiency in the Residential Construction Industry: A Case Study," Industrial and Labor Relations Review, Vol. 18, (July, 1965), p. 509, fn. 12.

With much fewer resources than the U. S. Bureau of Census, we drew our interview cordon around the local authorities in the country which have the final say on the acceptance or rejection for local use, innovations of technology: the local building department and its staff; for it is here where the pushes and pulls among industry actors are most readily accessible to the researcher. The other reason for focusing on the building department is that study findings from which can be inferred policy recommendations have an automatic audience. Public purposes are already written into the laws creating local building departments; reforms or suggested improvements of departmental performance can be precisely targeted rather than indiscriminately and piously announced to any public willing to listen. This last, unfortunately, has been the fate of many recommendations for improving performance in the building industry. A similar fate awaits the more general proposals, now enjoying some fashion, advocating the incorporation of social controls into the process of technological change.

Chapter 2

ORIGIN, SCOPE AND CHARACTER OF BUILDING REGULATIONS AND STANDARDS: POWERS, PREROGATIVES, PURPOSES, PROCEDURES

Elements of a Regulatory System for the Built Environment

The opening chapters have described a growing complexity in the construction enterprise and a corresponding need to both regulate that enterprise in the public interest and to permit it to incorporate the most promising of new techniques consistent, of course, with the public safety welfare. One purpose of this section is to identify the several legal instruments and administrative procedures of local building departments that, together, comprise the means of regulation of the built environment. Emphasis is placed on procedures, actions of department personnel in the dispatch of regulatory responsibility for it is only by examining the enforcement and administration of regulations that the realities of a regulatory function can be known and the adequacy of that function assessed.¹

One student of public regulation, the late Merle Fainsod, during the 1940's, called for detailed, case-study examination of the interaction of the regulators, the regulated, and the public. Twenty years later, that call was reissued by, among others, Marver Bernstein

¹ The pertinent texts: Merle Fainsod, "Some Reflection on the Nature of the Regulatory Process," In C. J. Friedrich and E. S. Mason, eds., Public Policy, 1940 (Cambridge: Harvard University Press, 1940), pp. 297-323; Marver H. Bernstein, "The Regulatory Process: A Framework for Analysis," 26 Law and Contemporary Problems (1961), pp. 329-335; Mark S. Massel, "The Regulatory Process," 26 Law and Contemporary Problems (1961), pp. 181-202; Marver H. Bernstein, "Independent Regulatory Agencies: A Perspective on their Reform," in The Annals vol. 400 (March, 1972), p. 21.

who, again in 1972, ten years after his own initial appeal remarked that the "need for empirical research is largely unfulfilled" and the "thinking about the regulatory process...remains impressionistic." The present research is intended to dispell erroneous impressions about building regulations.

Academic and scholarly studies of regulatory activities have traditionally been based on comparisons of written documents, especially those reporting formal decisions, on legislative histories and on events and statutes antecedant to the agency under review.² But the approach falls considerably short in the case of building regulations where, on the one hand, considerable discretionary authority remains with the enforcing officer: the local building official; and on the other, considerable authority in the building standards and regulatory field is preempted by elements of the private sector, acting through "voluntary" associations. Therefore, the present chapter describes the legal and institutional framework of building regulation by public governments; its scope; and the nature of building department operations. Chapter 3 characterizes the personnel responsible for discharging the building regulatory function in local agencies the country over. And Chapter 5 is devoted entirely to an examination of the private institutions that precede and, in a certain sense, preempt public responsibility in this regulatory field.

² Reviewing the work of consultants to the Administrative Conference of the United States, the Chairman of its Committee on Informal Action noted that a dependence on written material and on formal decisions themselves tends to "slight the real life of the regulatory agency, which runs through its correspondence, telephone conversations, and conferences, and only occasionally surfaces in formal decision or regulation. Warner W. Gardner, "The Administrative Conference of the United States," in The Annals vol. 4000 (March, 1972), p. 40. Emphasis added.

Legal and Institutional Framework and Local Building Regulation

The regulation of building construction is imbedded in a matrix of legal, social, technological and political institutions. For instance, to a far greater extent than may generally be realized, private associations and superior levels of governments have pre-empted the standards-setting which predefine and influence the ultimate legislative enactment of local building regulations in the 8,000 jurisdictions which regulate most of the nation's residential construction. The history of local building regulation may be recounted in terms of these chronic assaults on local prerogative. Such a history would reveal that the undeniable dispersion of the industry and the tenacious "grass roots" ideology of its regulators have been persistent enough to allow the first conventional usage: local code, to stand.

Building code specialists ritually respond with the Code of Hammurabi (ca. 1700 B.C.) when a reference is sought for the earliest building code. The provision for building safety conform with the philosophy of retributive justice which the Persian King's code documents and therefore reifies:

229: If a builder has built a house for a man and his work is not strong, and if the house he has built falls in and kills the householder, that builder shall be slain. 230: If the child of the householder be killed, the child of that builder shall be slain. 231: If the slave of the householder be killed, he shall give slave for slave to the householder. 232: If goods have been destroyed, he shall replace all that

has been destroyed; and because the house was not made strong, and it has fallen in, he shall restore the fallen house out of his own material. 233: If a builder has built a house for a man, and his work is not done properly and a wall shifts, then that builder shall make that wall good with his own silver.³

Through the intervening centuries to the present day building regulations, like their Hammurabic predecessors, have been created in response--more accurately, in reaction--to disastrous single episodes of building failure in terms of the then-current juridical and legislative thought (as a Ronan Point, England in 1967 or at 2000 Commonwealth Avenue, Boston, in 1971) or of city-wide conflagrations (as in London in 1666, Chicago and San Francisco in 1906). The earliest codes in the U. S. date from 1626 with the Dutch colony of New Amsterdam, covering types, locations and roof coverings of structures;⁴ emphasis on this last--roofing materials--indicates the prominent fear of propagation of fire from structure to structure. The most common element to early codes was the proscription of wood construction in certain parts of the municipality, but even this modest application of the police power--so routinely invoked at present --met resistance by the courts.⁵ The late eighteenth and early

³ These passages are referred to as a "curious extension" of the law of retaliation in Encyclopedia Britannica, Vol. 2, "Babylonian Law," (Chicago: E. B., 1959), p. 862.

⁴ Cited by Sanderson, Richard L., Code and Code Administration (Chicago: BOCA, 1969), p. 7.

⁵ The precise effect of building codes in turning cities of wood into cities of brick (London after the Great Fire of 1666 being the premier example) may be difficult to assess, for there were other factors contributing to the substitution of one building material for another. For instance, seventeenth and eighteenth century building and rebuilding were forced to do without wood and thatch in large part because the

twentieth century regulatory doctrine of laissez-faire was anticipated by the Pennsylvania Supreme Court that, in striking down just such a "fire limit" ordinance, declared: "It would not be tolerated that the people 'should be absolutely prohibited from using (wood) in the construction of their dwellings and out-buildings' it would be a grievance too intolerable to be borne."⁶ Calamitous fires in the next few decades—wiping out sections of cities—did persuade later courts to relax restraints on structural regulations related to conflagration. The widening of building regulation beyond that required for fire safety, however, came only after the precedent of housing codes regulating occupancy and sanitary conditions. The turn of the century "understanding" of the relation of housing and overcrowding to public health was accepted by local courts as a legitimate ground for the valid exercise of the police powers of states and their creatures, the municipalities. Bosselman argues⁷ that the proliferation of regulations of structural soundness came only after

burgeoning iron industry stripped English and European countryside of these combustibles for fuel, before the days of coal. This argument is suggested by a passage from Robert McHenry with Charles van Doran (eds.), A Documentary History of Conservation in America, (New York: Praeger, 1971), p. 5.

⁶ Kneedler vs. Borough of Norristown (1882), cited by Fred P. Bosselman, The Legal Framework of Building and Housing Ordinances, The Building Official, (March, 1970), p. 10.

⁷ Ibid.

the validity of health-related codes was established.⁸

The police power reserved to the states by the U. S. Constitution, may be delegated by the state to its units of local government. Given the technology of building at the time when building codes proliferated, it was entirely logical to invest localities with regulatory authority. Consider the building enterprise of 70-90 years ago: structures and their principal mechanical components (the few there were at the time) were usually fabricated wholly on the site. The kitchen sink and bathtub, for example, were shaped out of lead (Latin: plumbum) sheets by plumbers.⁹ Most building materials--wood, stone, gypsum, clay products such as brick and tile, were produced or extracted within a days journey of the building site. Except for notorious "boomer gangs,"¹⁰ the construction work force, then as

⁸ "Understanding," indeed. The environmental determinism of the turn of the century, documented by Roy Lubove, The Progressives and the Slums, (Pittsburgh: University of Pittsburgh Press, 1962), has long since been discredited by students of housing and health (See, for an early instance, John P. Dean, "The Myths of Housing Reform," American Sociological Review, XIV (April, 1949), pp. 281-288, portions of which are reproduced in Jewell Bellusch and Murray Hausknecht (eds.), Urban Renewal: People, Politics and Planning, (New York: Anchor-Doubleday, 1967). The notion still has wide appeal, however, among laymen and political leaders.

⁹ Martin Segal, The Rise of the United Association: National Unionism in the Pipe Trades, 1884-1924, (Cambridge: Harvard University, 1970), Introduction.

¹⁰ Clyde Johnson, retired business agent of Millmen's Local 550 (Oakland, Cal.) of the United Brotherhood of Carpenters and Joiners, described boomers in a 4 August 1972 interview as itinerant construction crews (management and labor) that had historically usurped the local fiefdoms of local building contractors by offering cut-rate services. The Associated General Contractors sought relief from this non-local competition and were willing to tolerate union demands as part of the price. The Davis-Bacon Act of 1931, requiring payment of prevailing wages (nearly always union scale) on government-aided construction, drove out the boomers.

now, was recruited from the immediate environs, except for a few highly-skilled craftsmen who ranged somewhat further in search of work (which tradition appears vestigially in the medieval term: journeyman). With the building enterprise so organized, it was thoroughly logical to regulate the activity at the municipal government level. After all, who would know best the quality of climate, of geology, of weather, of local building materials, of local building traditions, of the reputation of local craftsmen and laborers, of accepted practices in the local building trades. Moreover, building practices and building materials, changed only slowly and there was little exotic technology to import. Thus, the "logic of localism" evolved in the regulation of the building industry. But the building process itself, underwent vast change, especially as was shown earlier, since World War II and that process changed from being one of fabrication of a finished product out of raw or semi-finished materials, evolved to become not so much a construction industry as a "materials-handling industry," in the words of Richard O'Niell.¹¹ Building products are now moved to the site in a semi-finished state in sealed units ready for installation and thereby inaccessible to the view of the local official. Moreover, many components, fabricated in ways quite unfamiliar to most of the on-site tradesmen at work, let alone the building official. Whereas thirty and forty years ago a building inspector could mark closely the construction process, today the building inspector stands aside as finished components are unloaded from trucks, stored

¹¹ Editorial, House and Home, October, 1970.

temporarily on the building site, and installed. The work is now effectively removed from the scrutiny of the local building inspector. Increasingly, building products are distributed over a wide area of the country, which makes it difficult for the product designer to decide just which of the local codes should be honored since, as will be shown in Chapter 3, there is a great variance among the technical requirements of individual local codes. In a phrase, technological evolution has outgrown the "logic of localism" in the regulatory philosophy of the building industry. Inspection of installation rather than fabrication techniques are likely to become the primary task of the local building official (as long as structures are fixed to sites, the need for some local inspection remains) and the building regulation statutes must inevitably reflect this.

Not only is the geo-political deployment of building regulatory activities undergoing a shift, the basic substantive purposes of building regulation are widened beyond elemental concerns of the health and safety of the public and its property. Roughly, building and development regulations and judicial interpretation of their effects now embrace broader considerations of public welfare and consumer protection. Addressing the consumerism issue, the Massachusetts Department of Community Affairs reported to the state legislature that:

For the individual family, the outlay for shelter is the largest single outlay ever made at one time and, except for food itself, the largest item of personal consumption. The regulation of the building industry had as its impetus the protection of life and the preservation of physical safety. Today, consumers of housing and users of buildings demand more: a measure of assurance that, in the largest

expenditure of their lives, they are getting their money's worth. Are present regulations adequate to this task?¹²

Public welfare issues are also joined when restrictive development regulations—including zoning and subdivision controls as well as building codes—are demonstrated to be in violation of the equal protection clause of the 14th amendment to the U. S. Constitution or when they represent an unjustifiable use of the police power. Although the most celebrated cases have centered on exclusionary zoning, overly restrictive building regulations have also drawn the attention of public interest advocates in the law.¹³ Nor are 14th amendment cases restricted to issues of race or poverty: any illegal discrimination or unlawful classification of people or buildings may be involved; that is, any classification or discrimination which cannot be justified by the publicly stated goal to be achieved by the regulatory policy.¹⁴ As the regulatory purview has widened, the local building official is under subtle pressure to break traditional organizational and professional isolation. Programs of concentrated code-enforcement have

¹² Massachusetts Department of Community Affairs, Office of Code Development, Reports Relative to the Development, Administration, and Enforcement of Building and Housing Codes, (Boston: April, 1971), p. 1. Hereinafter referred to as DCA Report, April 1971.

¹³ Representative cases are cited in H. William Allen, III, "Restrictions of Building Permits as a Means of Controlling the Rate of Community Development," Urban Law Journal II, 1969, p. 184. A more sanguine view based on experiences in older cities and neighborhoods is found in "Building Codes and Residential Rehabilitation: Tilting at Windmills," Columbia Journal of Law and Social Problems, (August, 1969), pp. 88-97.

¹⁴ Bosselman, "The Legal Framework of Building and Housing Ordinances." Typically, courts have declared that prefabricated buildings, mobile homes and multi-family residences, among others, cannot legally be discriminated against as building types.

prompted the formation of inter-agency task forces between urban renewal, housing inspection and building inspection, for example. In a few cities, Baltimore the largest among them, inspection forces are unified and leasing professionals advocate a closer tie between all agencies that regulate urban development.¹⁵ One impetus for this action is the certification requirements of the HUD Workable Program for Community Improvement; the Workable Program is a prerequisite for most federal-city subventions in housing and urban development. Professional isolation and parochialism are being eroded by the continued growth of four voluntary or proprietary model code associations,¹⁶ each servicing a region of the U. S., and of statewide associations of local building officials. Both these groups will be discussed fully in subsequent sections; at the moment it is sufficient to note that participation in model code groups does not change the basic political fact that building departments effectively function as local departments, national or regional affiliations notwithstanding. Therefore, the discussion returns for the moment to the typical situation in the local building department.

¹⁵ Frederick H. Bair, "Toward a Regulatory System: for Use, Development, Occupancy and Construction," Planning Advisory Service Report No. 243 (February, 1969). Chicago: American Society of Planning Officials. The City of Boston is about to introduce this reform: "(Mayor) White Set to Reorganize Building Inspection Units," Boston, Globe, 21 August 1972, p. 63.

¹⁶ After a sustained immersion in the building code literature, one is led to observe that the writers who favor model code associations refer to them as voluntary groups of likeminded public servants; writers who don't favor them refer to the groups as purveyors of proprietary codes and of professional fee-for-service consultation. Mixed usage is adopted throughout this research report.

Inter-governmental Responsibilities for Building Regulation

As we have stated local regulation of building construction in the U. S. dates to early colonial times. For many years, only the larger cities adopted and enforced building regulations, but, by 1964, as many as 12,000 individual communities were issuing building permits authorizing construction within their boundaries, a rudimentary form of regulation. The Census Bureau now reports its housing information on the basis of 13,000 permit-issuing localities, approximately three-quarters of all local governments.¹⁷ In 1967, the most recent enumeration, 8,344 municipalities, 46.4% of all such governments, reported building codes in effect; municipalities with more than 5,000 inhabitants were more than twice as likely to regulate construction by standing codes: 4,067 or 80.5% of such jurisdictions.¹⁸ This is where the bulk of building regulation occurs: at the local level.

The stated purpose--as distinguished from latent effects---of all these building codes is to protect the public, through reasonable safeguards, from faulty design or construction of buildings, and from health or fire hazards. The form and content of building codes vary widely from municipality to municipality, and from state to state. A code may be limited to new buildings, or may apply as well to repairs and alterations of existing buildings. The substantive

¹⁷ Section 27, "Construction and Housing," Statistical Abstract of the United States: 1972, (Washington: USGPO, 1972), p. 669.

¹⁸ Allen D. Manvel, Local Land and Building Regulation, Research Report No. 6, U. S. National (Douglas) Commission on Urban Problems, (1968), pp. 4 & 11. Hereinafter referred to as Manvel Report.

provisions of these codes often differ, and procedures for inspection, enforcement, and appeals exhibit a high degree of variance, even among municipalities in geographical proximity.¹⁹

Traditionally, local building departments have been concerned with new construction. Their functions have included issuance of building permits, plan inspection and approval, zoning law enforcement, and inspection of the construction. A department may or may not have responsibility for the enforcement of codes regulating plumbing, elevators and other mechanical specialties or housing quality. This varies widely city to city within single states.²⁰ However, as was noted, a trend is emerging to bring other code inspection requirements within the administrative structure of a single local department.²¹

Most local codes provide for appeals from decisions of the local building official. Most commonly, this consists of a board of experts in the field appointed by the municipality's chief executive or legislative body. A code may specify procedures to be followed by the board in reviewing cases on inquiries, and may provide for judicial review from decisions of the building official or appeals board. The local boards of appeals may also be delegated the authority to review proposed changes in the code and to make recommendations concerning them,

¹⁹ Massachusetts Department of Community Affairs, Office of Code Development, Investigations of Operations and Procedures: Housing Inspection Departments, Building Departments and Certain Rehabilitation Activities in Boston, Springfield and Worcester, (Boston: September, 1971). Hereinafter referred to as DCA Report, September 1971.

²⁰ DCA Report, April 1971, p. 43.

²¹ Bair, op. cit.

and it may be granted the authority to approve rules issued by the local building official. This incremental code amendment procedure--the "product approval" process--is given Chapter-length treatment later in this report, for the product approval process is freighted with significance in the diffusion of innovation in residential construction technology.

A few localities have established an arbitration system to serve as the appeals mechanism. Manufacturers and architects may enjoy the same right as the owner and contractor to challenge decisions of the appeals body in the courts.

Typically, county adoption, administration, and enforcement of codes applies the same general types of regulations and procedures to unincorporated areas that municipalities apply to incorporated ones. However, the degree to which counties are authorized to exercise this function, the extent to which they have actually adopted codes, and their geographical jurisdiction over code enforcement vary considerably. Where programs are established, counties frequently undertake significant projects, including the provision of cooperative and contract services for smaller local governments. This is particularly the case in metropolitan areas, where counties may participate in voluntary, cooperative area-wide efforts and sponsor or enter into inter-local agreements for providing inspection and enforcement services, or directly assume powers under various reorganization approaches creating urban counties. Notable examples are the 25 cities in Southeastern Wisconsin, centered around Milwaukee; six cities and six counties centered on the District of Columbia; 12 cities and 4 counties centered on Denver. Similar programs of regional, multi-jurisdiction,

sub-state cooperation are underway in Atlanta and in the San Francisco Bay Area under the auspices of ABAG, the Association of Bay Area Governments.²²

State Government

The primary direct state involvement in regulatory programs governing construction, other than of government buildings, is with mechanical codes (those affecting plumbing, electricity, elevators, and boilers), with regulations dealing with industrialized housing or with special hazards, such as fire and with buildings where public assembly of some form with attendant problems of rapid egress occur. In Massachusetts, at least, the definition "places of public assembly" embraces commercial structures, schools, hospitals and domiciliaries like prisons. Specific provisions vary greatly among the states and responsibilities for promulgating, administering, and enforcing state codes are distributed among state and local government agencies in widely differing patterns.²³

²² Examples are drawn from conferences with Commissioner Edward E. Estkowski, Department of Industry, Labor and Human Relations, State of Wisconsin; and, Advisory Commission on Intergovernmental Relations, Building Codes: Program for Intergovernmental Reform, (Washington: USGPO, 1966). Hereinafter referred to as ACIR Report.

²³ Section IV of the DCA Report, April 1971, contains results of a national survey of states on building code and housing code action. Among the findings: 84% of the states have statewide health and sanitation regulations; 66% plumbing codes; 54% electrical codes; 72% fire safety codes; and 40% have factory housing codes wherein one state certification is obtained and a medallion affixed to the finished unit; that unit is exempt from further local inspection, except for installation. Very few states disallow more restrictive local specialty codes. Much of the remainder of this section draws heavily on Section IV of the DCA Report, April 1971, in which preparation the present author participated.

Some actions in the building code field run from complete control in state hands to complete control in local hands. Statewide mandatory codes are rare. Connecticut is the only state with a general, inclusive code that is mandatory throughout the state for all construction. No community in that state is exempt from this code, and any requests for variances due to special local conditions must be made through an appeals procedure. Connecticut also incorporates a certification procedure which automatically qualifies building systems in every community. A mandatory statewide building code will become effective in Massachusetts after January, 1974 under legislation signed by the Governor on 19 July 1972. This legislation is distinctive in that it requires the establishment of uniform statewide administrative and enforcement procedures to be followed by state-certified, locally paid building officials.²⁴

In keeping with the dispersed federal system of states, the DCA Report cited above identified many different approaches to statewide building regulation that ranged considerably from the rather strict Connecticut Statute. Some representative variations:

Statewide minimum-maximum codes, such as North Carolina's specify minimum requirements that must be used in every community. There is some leeway for local variations, but there is a maximum by which local codes may vary. All variances must be approved by the state code agency, and the success of the code rests with the desire and powers of the agency to impose strict criteria as to what constitutes legitimate variation.

²⁴ Chapter 26 of the General Laws of Massachusetts. Most building regulatory abuses occur in the area of code administration and enforcement, not in the adequacy of the basic code document itself. For a recent illustration see David K. Shipler's intermittent, summer-long expose of construction industry abuses in New York City, particularly the New York Times of 13 August 1972, Section 4, p. 4 and 16 August 1972, p. 1.

Statewide voluntary codes are available on an optional basis for adoption by municipalities. These may be used alone or to supplement statewide mandatory codes for those buildings exempt from coverage. In New York, communities may enact their own local codes, or they may accept the state code. If they decide to use the state code, it becomes mandatory along with all future amendments.

Most states merely suggest statewide minimums which simply require all communities to meet minimum construction requirements while, at the same time, allowing localities to make their codes stricter than the minimum without state approval; "factory" building codes which are special codes that affect only certain industrialized construction processes; and, statewide model codes that function as guidelines after which local codes may model their own codes. This point will be elaborated later. And finally, a large number of states delegate total authority to localities for the promulgation and enforcement of building codes.

General enabling legislation in more than half the states provides for the adoption of recognized national building codes by reference. In some cases, statutory recognition may be given to a particular code; in other cases, authority may extend to the appropriate codes developed by the four proprietary code groups--Building Officials and Code Administrators International, Inc. (BOCA); the Southern Building Code Congress (SBCC); the International Conference of Building Officials (ICBO), and the American Insurance Association (AInsa) as well as to specialized codes for mechanical systems. Some of the state enabling statutes require that subsequent changes approved by the model code group be adopted by local governments in the same manner as initial adoption by reference of the code. Others delegate this responsibility to appropriate administrative officials or, in

in rare instances, provide for the automatic addition of changes as they are formally approved by the promulgating group. A thorough discussion of the model code groups will follow shortly.

Federal Government

Federal interest in the building field has been primarily of four types: support of technical building research, support of standards programs (which underlie code requirements), federal aid program requirements, and federal building construction requirements. These activities are carried out by numerous bureaus, agencies, and departments.

Federal support of technical building research is oriented toward developing knowledge to better enable federal agencies to carry out their program responsibilities. The federal government thus funds private and public agencies, and also directly engages in research that provides the basis for specifications, standards, and testing techniques. Many of these programs are devoted exclusively to dwellings, both in this country and U. S. installations abroad; others are more generally related to building technology; and many federal agency research programs in fields only tangentially connected with building science have developed information useful to the building industry. The thirty-five federal agencies directly or indirectly concerned with construction conducted at least 764 engineering investigations and studies pertinent to building science from 1962 through 1965.²⁵

²⁵ ACIR Report, p. 25.

Although not a federal agency, the Building Research Advisory Board (BRAB) of the National Academy of Sciences was established under a federal charter in 1949 to study and advise on building science and technology. The Board stimulates and correlates building research activities, and may, on specific request, study any scientific or technological subject in its field; BRAB advises on questions submitted by any federal agency, or by private industry when in the public interest. BRAB does no actual laboratory or field research itself, but compiles the findings of engineers, scientists, universities, and research facilities throughout the country. Studies conducted by panels of experts convened by BRAB include some which were undertaken for the Federal Housing Administration (FHA) that may lead to changes in its Minimum Property Standards program. The Board works closely with federal agencies through a standing committee, the Federal Construction Council, which seeks to encourage voluntary cooperation among federal building agencies, and which maintains contact with appropriate state agencies.²⁶

Federal standards programs include the development of standards and testing procedures that may be used in framing and administering building codes. Standards programs in the United States are a complex network of efforts by hundreds of private and public organizations-- governments, trade and technical societies, and private firms--often with some degree of coordination among varying sub-groups. The single

²⁶ The role of BRAB was illuminated for the author by Professor Albert G. H. Dietz of M.I.T., for many years a member and, for three years, Chairman, of BRAB.

most extensive effort is that sponsored by the federal government, principally involving the Department of Defense, the Department of Commerce, and the General Services Administration. The National Bureau of Standards (NBS), the primary research agency of the federal government for building technology, also has four programs in the standards area. Although the Bureau usually does not always prepare standards--its major goal is to facilitate the communication of technological data and to encourage the exchange of technological products and services--the Congress has assigned it the responsibility for developing mandatory standards in selected areas for purposes of safety legislation involving products shipped in interstate commerce. NBS developed the four-volume Operation Breakthrough Guide Criteria for the evaluation of proposed industrialized housing systems designs and supervised that evaluation procedure for HUD.

Several major federal aid programs affect both the private sector, notably building construction, and the public sector, particularly building code adoption, administration and enforcement. The Federal Housing Administration was empowered by the National Housing Act of 1934 to establish Minimum Property Standards (MPS's).²⁷ These establish acceptable practices in residential building technology essential for mortgage insurance determinations. However, they are not a substitute for local building codes, since the FHA requires compliance with all local codes for properties under insured mortgages

²⁷ U. S. Department of Housing and Urban Development, HUD Challenge, "Evolution of HUD's Minimum Property Standards," pp. 8-9.

although in localities without codes for one- and two-family residences, however, MPS's are de facto codes.²⁸ The Farmers Home Administration of the Department of Agriculture administers the Rural Housing Loan Program for use to construct, improve, or repair rural homes and related facilities; or to provide water for farmstead and household use. These loans are made only if other financing is not available to the prospective borrower, and compliance with local law is required. And the Department of Housing and Urban Development provides grants to municipalities to assist in the development and adoption of building codes. It is the stated policy of the Department, in its Workable Program for Community Improvement activities, to urge that local codes be comparable to standards contained in the most recent editions of nationally recognized standards-setting organizations. The Department also makes low-interest loans and grants available for local code compliance. A municipality or county must have adopted a comprehensive system of building and land development ordinances and codes in order to be eligible for financial assistance; local adoption of codes based on national models is required for "workable program" certification as a prerequisite to receiving federal aid for urban renewal project cost.²⁹

28 Ibid.

29 U. S. Department of Housing and Urban Development, A Workable Program for Community Improvement: Handbook, (September, 1970), MPD 7100.la.

In the design and construction of new federal buildings, the General Services Administration follows as minimum requirements standards contained in nationally recognized model construction codes, and follows or exceeds the standards of the national plumbing and electric codes. Policy is to relate construction projects closely to local code requirements, and local plumbing codes are directly applicable to plumbing beyond the property line of the public building. The Housing Assistance Administration of the Department of Housing and Urban Development has established construction specifications for public housing dwelling units built under its program. And construction of federally-owned housing, exclusive of military barracks, for federal personnel and for employees of government contractors is based upon a single set of standards developed by the Department of Housing and Urban Development (HUD) upon the request of the Bureau of the Budget.

In an attempt to stimulate and encourage the application of new construction ideas, Section 417 of the Housing and Urban Development Act of 1969 directs the Secretary of Housing and Urban Development to assure to the maximum extent feasible, in housing assisted under the Demonstration Cities and Metropolitan Development Act of 1966, that there is no unnecessary restraint by building codes upon the employment of innovative methods and materials.

Chapter 3

PROFILE OF THE LOCAL BUILDING OFFICIAL AND HIS DEPARTMENT¹

To understand the relationship between regulation and the diffusion of innovative technology, the central objective of this research, we must understand the factors and forces that shape the policies of the local building department for it is in this arena that determinative action occurs. Who are the people who draft and enforce local building codes? What are their responsibilities? Do their backgrounds and qualifications adequately prepare them for the task of dealing with new technologies or must agencies look elsewhere for technical assistance; if so, where? Must the agencies develop supplemental educational programs? Are existing educational programs, both at the local and state levels productive? Does civil service protection or union representation have any effect upon the performance of the building departments? What types of codes are used and what are the trends in type of code used?

Just as there are forces operating within the department, there are significant forces impinging from without. Code development and code enforcement do not occur in a political vacuum. Building codes have important economic meaning to those favored or not favored by the

¹ The first half of this Chapter draws heavily on a previous publication by Charles G. Field and Francis T. Ventre, "Local Regulation of Building: Agencies, Codes, Politics," 1971 Municipal Yearbook, (Washington: ICMA, 1971), pp. 139-165. The second half draws heavily on a previous publication by the present author, Francis T. Ventre, "Technological Currency in the Local Building Code: Patterns of Communication and Influence," ICMA Urban Data Service Series, Vol. 3, No. 4 (April, 1971).

specified standards. Technical adequacy of the codes aside for the moment, the efficiency and dispatch of code enforcement has important economic meaning to the builder for whom delays are costly. To view codes and new technology on purely technical or legalistic grounds, therefore, is to ignore that they are drafted and enforced in a political and economic environment and that they cannot escape its influence. Chapters 4, 5, and 6 identify the elements of this environment--the local building department's constituency and clientele--and describe the nature of the exchange between the agency and its environment. The present chapter focuses on the department itself, its organization and personnel.

We shall identify here the organizational characteristics and personnel attributes of local building departments the country over drawing on the results of a national survey developed by the author and an associate and administered by the International City Management Association (ICMA). The survey drew useable responses from 929 U. S. municipalities of every size class.²

² The survey, conducted during the summer of 1970, was administered to the building departments of all U. S. municipalities over 10,000 population and a small sample of cities and towns of less than 10,000. Resource limitations denied the ICMA a more extensive sampling of the smaller jurisdictions. Second mailings went to all cities over 25,000. Of 2,072 cities over 10,000 surveyed, 857 (41.4%) responded in time for analysis; only 72 towns under 10,000 (20.6% of those sampled) responded. The returns at each city size class above 10,000 were sufficiently large to be representative of cities in their respective size classes. Most generalizations appear valid for cities over 10,000, but should be extended places under 10,000 with reservation.

The survey instrument and a response table appear as Exhibits 1 and 2, respectively, in the Appendix.

The Building Department

Although the typical building department is small, it is responsible for an astonishing variety of inspection tasks from elevators to boilers, from fire protection to refrigeration. The size of the department is directly related to the size of the city. In 1969, building departments in most cities with populations over 500,000 employed about 100 full-time people, while most departments in cities under 25,000 employed only one or two. One department in four had only a single professional/technical person. Many cities adapt to this situation of small staffs but major responsibilities, either by sharing inspection responsibilities with other local or state agencies or by allowing other departments to assume sole jurisdiction over particular inspection functions. Inspection of building structure, plumbing, and electrical systems is primarily the responsibility of the building department, but fire protection, boilers, and specialty areas such as mobile homes and pollution control are regulated by others (See Table 1).³

Building officials are called on to pass judgments on technical building plans, perform field inspections while construction is in progress, and keep the building code regulations up-to-date. In an age of changing building technology, it is difficult to imagine how the smaller offices can competently discharge their duties which require considerable technical understanding in a diversity of specialties.

³ Tables referred to are located at the end of this chapter.

Job Security and Political Pressures

Most local building officials lack basic job security. Officials apparently, serve at the pleasure of those who appoint them. Therefore, they are very sensitive to political pressure. Given the great uncertainty of their job status, the spirit of complaisance and the philosophy of "don't rock the boat" are entirely rational. Thus it is that building departments, by and large, have acquired reputations for being unduly cautious and conservative and for being responsive to the needs of their immediate clients, the members of the local building community. Despite the tenuous hold that building officials have on their positions, their official actions have powerful economic consequences for a sizable portion of the local economy and, particularly, for individual entrepreneurs. For instance, the issuance, or threat of issuance, of stop-work orders is a field-level decision in many agencies;⁴ such stop-orders invariably delay job progress, and builders are extremely sensitive to the costs of delay. On the other hand, builders are widely known for their aggressiveness and political sophistication, especially when approaching local planning, zoning, and other regulatory bodies. One can readily visualize both the kinds of pressure that converge on the local building officials in these circumstances and the public cynicism which follows.

How well is the local official insulated from the pressures of agency clients? Not very. The survey data lead to this conclusion. Seven out of eight building chiefs serve without a fixed term of office; they serve at the pleasure of those who appoint them. Even those with

⁴ See "Municipal Building Inspection Practices," 1964 Municipal Yearbook, (Washington, ICMA, 1964).

fixed terms do not enjoy a great advantage, for over half of all fixed terms are annual only.⁵ Traditional means of achieving job protection, Civil Service and union representation, are not widespread among the agencies. Only 40% of local building departments are covered by Civil Service regulations (Table 2) and most of these departments are found in the larger cities. Fewer yet, one in fifteen, are represented by unions (Table 3). Thus the normal avenues for job severance and grievance resolution⁶ are notably absent. Despite these perils, many local building officials survive this politically sensitive environment, attesting to their political adaptiveness.

The foregoing analysis has placed great stress on job security, but this objective is not equally valued by all chief building officials. The desire for Civil Service coverage depends upon the particular political-administrative environment. Seventy percent of the chief building officials (CBO's) under a mayor form of government whose departments were not covered by Civil Service regulations want such coverage. In sharp contrast, only 39% of those CBO's similarly situated but under a manager form of government expressed a preference for Civil Service coverage (Table 2). Seemingly, the threats to job security are stronger under the mayor than manager form of government. The response may well have been different had the staff, not the chief building official, been asked to answer this question.

⁵ Field and Ventre, "Local Regulation of Building," Table 1/22, pp. 151 ff.

⁶ Derek C. Bok and John T. Dunlop, Labor and the American Community, (New York: Simon and Shuster, 1970), p. 79.

Salaries

Building officials covered by Civil Service regulations or represented by unions enjoy the tangible benefits of higher salaries. The average salary differential is on the order of 13% to 16% (Table 4). The impact of unions is greater on the lower, starting salaries, whereas the impact of Civil Service coverage is greater at the upper levels. This latter is the result of the mandated merit increases that are a part of many Civil Service programs.

The size of the city also affects salary levels. Generally, larger cities pay more (Tables 5, 6, 7). The advantage of union representation for both beginning and maximum salaries is more pronounced in larger cities, for it is here that organized labor speaks with a stronger bargaining and political voice. The salary advantages associated with the Civil Service, on the other hand, show no such relationship to city size (Table 8).

Age, Background, and Qualifications

Given the ages of officials upon entering the agency, the local building department appears to be a place where careers end rather than begin. Table 9 suggests that most building officials are in the twilight of their careers: one chief building official in seven is over 60, and over half of all chiefs are past 50. Similarly, of the senior building officials, 18.7% are past 60, and 55.2% are past 50. By subtracting the number of years they had spent with the department (Table 10) the entry ages were calculated of the chief, senior, and most recently appointed building officials. They typical chief and senior official were in their forties and the most recent official in

his thirties when they began work in their present department. These findings support the widely held belief that positions in the local building department are sinecures for construction craftsmen too old or infirm to climb a scaffold or, in the case of professionals, as a respite from a practice in decline.⁷

Local agencies draw heavily upon the construction trades and professions for their personnel: the chances are greater than three out of four that the technical staff have either architectural, engineering, or construction experience. This ratio holds for the oldest as well as the most recently recruited building officials (Table 11). But, a sizable portion of the agency's task load is comprised of duties for which no counterparts exist in the conventional construction trades. For instance, as Table 1 indicates, local offices have inspection responsibilities for building components as diverse as boilers and elevators, fire safety, and refrigeration. General construction experience offers little insight into these specialties yet they comprise a large fraction of departmental responsibility.

The heavy dependence on a background of construction experience may be a factor contributing to an agency's tardiness in accommodating new technology. When there is no adequate educational program to provide the building official with the necessary technical tools and information to evaluate new methods and products, he must call upon his own experience in construction, and this, as we have noted, typically

⁷ Richard L. Sanderson, Executive Director of BOCA and one of the foremost proponents of professionalism in code administration, concedes that this channel of agency recruitment is "not unusual," in Codes and Code Administration, p. 128.

dates back almost ten years (Table 10) assuming his immediately previous employment was in construction, something not necessarily the case. During those ten years, however, a number of significant changes will have occurred in the ways in which building activity is organized and operated, with literally thousands of new components, materials, and procedures. The local official is thrust into the position of determining the technical adequacy of a new building practice which is in all probability at variance with the practices he knew and used when he was active in construction himself. It is understandable, therefore, that officials in these positions hesitate to approve of practices that they are not familiar with or which are outside their own personal experience. Moreover, the manner of his early training not only did not positively address the prospect of technological change, the apprenticeship he experienced--one would almost say endured--is an exercise in the orthodox wherein deviations from the received "right way" of "buttering" a brick or parging a wall are early disciplined.⁸

The discipline of apprenticeship can engender a dogmatism with regard to work skills that spread into other than work situations. As

⁸ Although the fraction varies by craft, apprenticeship is the largest single source of training in construction work. The craft-by-craft variation is large. Reporting on a study of 10 years experience in Wisconsin--a leading state in terms of apprenticeship activity--former registered apprentices accounted for 22% of painters and 83% of bricklayers. See Alan C. Filley and Karl O. Magnuson, "A Study of Registered Joint Apprenticeship Committees in Wisconsin Building Trades," Research in Apprenticeship Training, Center for Studies in Vocational and Technical Education, University of Wisconsin, Madison, 1967, p. 76. Also Harold G. Foster, "Non-apprentice Sources of Training in Construction," Monthly Labor Review, Vol. 93, No. 2 (February, 1970), pp. 21-26. Dunlop notes that half of all registered apprentices are in construction. In "The Industrial Relations System in Construction," p. 257.

Veblen observed of craft-oriented workers:

[T] the instinct of workmanship again came into a dominant position among the factors that made up the discipline of daily life and so gave their characteristic bent to men's habits of thought.⁹

"Habits of thought," or in contemporary social-psychological terms, attitude, is defined by Rokeach as a sustained organization of an individual's beliefs about an object that predisposes his actions.¹⁰ If that "characteristic bent" is dogmatic--as well it might be given the apprenticeship conditioning--the consequences for openness to innovative practices are dismal: dogmatism as a personality attribute has been shown to be antithetical to innovativeness.¹¹

What empirical evidence can be adduced for the tentative assertion relating apprentice training with latent dogmatism. The apprenticeship literature reveals little on this question, or any other question for that matter, for the literature is sparse and tends to history.¹² The broader category, vocational education, has been subjected to some analysis, the conclusions of which support the contention made here about apprenticeship: that it is technologically static and above all, particularistic in its methods. For example:

⁹ Thorstein Veblen, The Instinct of Workmanship, (New York: W. W. Norton, 1964), p. 234. This work was first published in 1914.

¹⁰ Milton Rokeach, "The Nature of Attitudes," The International Encyclopedia of the Social Sciences, Vol. 1, (New York: Macmillan, 1966), p. 450.

¹¹ Everett M. Rogers with F. Floyd Shoemaker, Communication of Innovations, 2d edition (New York: Free Press-Macmillan, 1971), p. 187, generalizing from 17 studies by social psychologists.

¹² The subject catalog of the Harvard Graduate School of Education yielded three items under the heading "apprentices:" one of these was dated 1926 and another was the Wisconsin study just cited.

(V)ocational schools have concentrated on the most common occupations and have often standardized them while changing technologies demanded revision.¹³

Familism, particularism and technological stasis are, of course, among the characteristics that serve to distinguish advanced from primitive development among cultures generally as well as among industries in the advanced economies. The implications for emerging building technology are clear: those officials empowered to accept or reject for local use advances in building technique are persons whose own technological intelligence--primarily in terms of skill but also in attitude toward liberality of thought with regard to technique--is particularistic rather than universalistic and not disposed to change. One might say, colloquially, that they were brought up that way. This figure of speech is quite literally true when applied to construction, which is unique among the large industries in the extent to which recruits are "to the occupation born" as it were. A strong orientation to family is evidenced in the way construction craftsmen are recruited and then trained in their construction occupation. Kinship ties and ethnic solidarity account for the racial, ethnic and class make-up of the several construction occupations and the apprentice system operates in a demonically efficient way to intensify this parochialism.¹⁴

¹³ Franklin J. Keller, Principles of Vocational Education, (Boston: D. C. Heath, 1948), p. 281-2. The problem of particularism identified at the conclusion of an international comparative study of the subject reported by Roger Gregoire, Vocational Education, (Paris: OECD, 1968), p. 137.

¹⁴ Center for Studies in Vocational and Technical Education, University of Wisconsin, Research in Apprenticeship Training, (Madison, 1967), passim. On ethnic solidarity, see Richard P. Myers, "Inter-Personal Relations in the Building Industry," Human Organization, Vol. 5, No. 2 (Spring, 1946), pp. 1-7. On racial intolerance in the building trades

As a sociological aggregate, the construction workers in an era of rapid social and technical evolution share attributes usually found in tradition-oriented cultures: familism, particularism and technological stasis. Little wonder then that construction workers have lent themselves as symbols of cultural repression, racial intolerance and political "know-nothingism" in the late 1960's and early 1970's. Why else is the authoritarian personality in this era symbolized by the "hard hat?"

To return to the original reason for this digression: LBO's responsible for acceptance or rejection for local use of innovations in residential construction technology are, as a group, culturally conditioned to the durability of traditional methods and to view changes in those methods with skepticism and a tincture of paranoia.

This, of course, is a manifestation of another Veblenism, "trained incapacity"¹⁵ wherein earlier training, experiences and allegiances become dysfunctional to the perception and execution of new tasks. A response on the part of leaders in the building regulatory field has been a call for professionalism in which is seen a means of "reject(ing) the values and allegiances required of their previous calling and accept(ing) those of the present."¹⁶ The author of the statement just

see C. L. Franklin, The Negro Unionist in New York, (New York: Columbia University Press, 1936), cited by Myers. For a contemporary view, see F. Ray Marshall and Vernon M. Briggs, Jr., The Negro and Apprenticeship, (Baltimore: Johns Hopkins, 1967).

¹⁵ Cited by Robert K. Merton, "Bureaucratic Structure and Personality," in Amitai Etzioni (ed.), A Sociological Reader on Complex Organizations, (New York: Holt, Rinehart and Winston, 1969), p. 50

¹⁶ Sanderson, Codes and Code Administration, p. 184.

quoted has since successfully led an effort resulting in the founding of the National Academy of Code Administration, established in 1972, to advance professionalism in the several code-related occupations.

But the national pattern of qualification requirements for incoming building inspectors reflects the difficulty of those local regulatory officials who seek a more professional image. Little agreement exists on the qualifications currently suitable for local building officials. And when one asks what those qualifications should be in the future, there is even less agreement. The single criterion most widely mentioned, when agencies were asked how their staffs were qualified for their jobs, was construction related experience; but this was listed by only one agency out of five (Table 12).

Two trends are clear: agencies are moving away from single qualification criteria toward multiple criteria; and formal schooling is the most frequently mentioned addition to the traditional criteria such as construction related experience (Table 13). Today's local officials--reasonably well educated (Table 14)--apparently value formal education at higher levels. These trends may indicate a desire to move in the direction of a professionalized, technical class of building officials and may also reflect a realization that regulation of today's, as well as tomorrow's, building technology requires a deliberate change to a fuller set of background credentials. Yet, the continuing lack of agreement among cities on staff qualifications is one of the impediments to systematic career preparation, which is a prerequisite of

professionalism.¹⁷ Such parochialism and lack of consensus is indicative of the highly localized and fragmented nature of the building regulation function.

Education Programs

We have noted that there is no single-channel entry to the position of local building official. Agency personnel are drawn from a variety of fields. This burdens the local agency with the need to orient the new official to his multiple inspection responsibilities. Moreover, continually evolving construction practices and a burgeoning choice among new building products place a further burden on even those agencies which draw heavily on the construction industry for their recruits. Even those men with construction experience must be kept abreast of current technology once they are away from direct involvement in the field, and in addition need to be taught about those areas of inspection responsibility outside their individual experience. There is some "unlearning" to be done, too, for the building tradesman under the apprentice system has learned how to perform a particular task in a particular way; as a building official he must be open to different methods of performing the same task. One of the functions of an educational program is to expose the official to the means of evaluating these different approaches, some of which may appear unorthodox and even contradictory to his tradesman's training. Finally, there is a need to ground the new official in points of regulatory law and administrative practice.

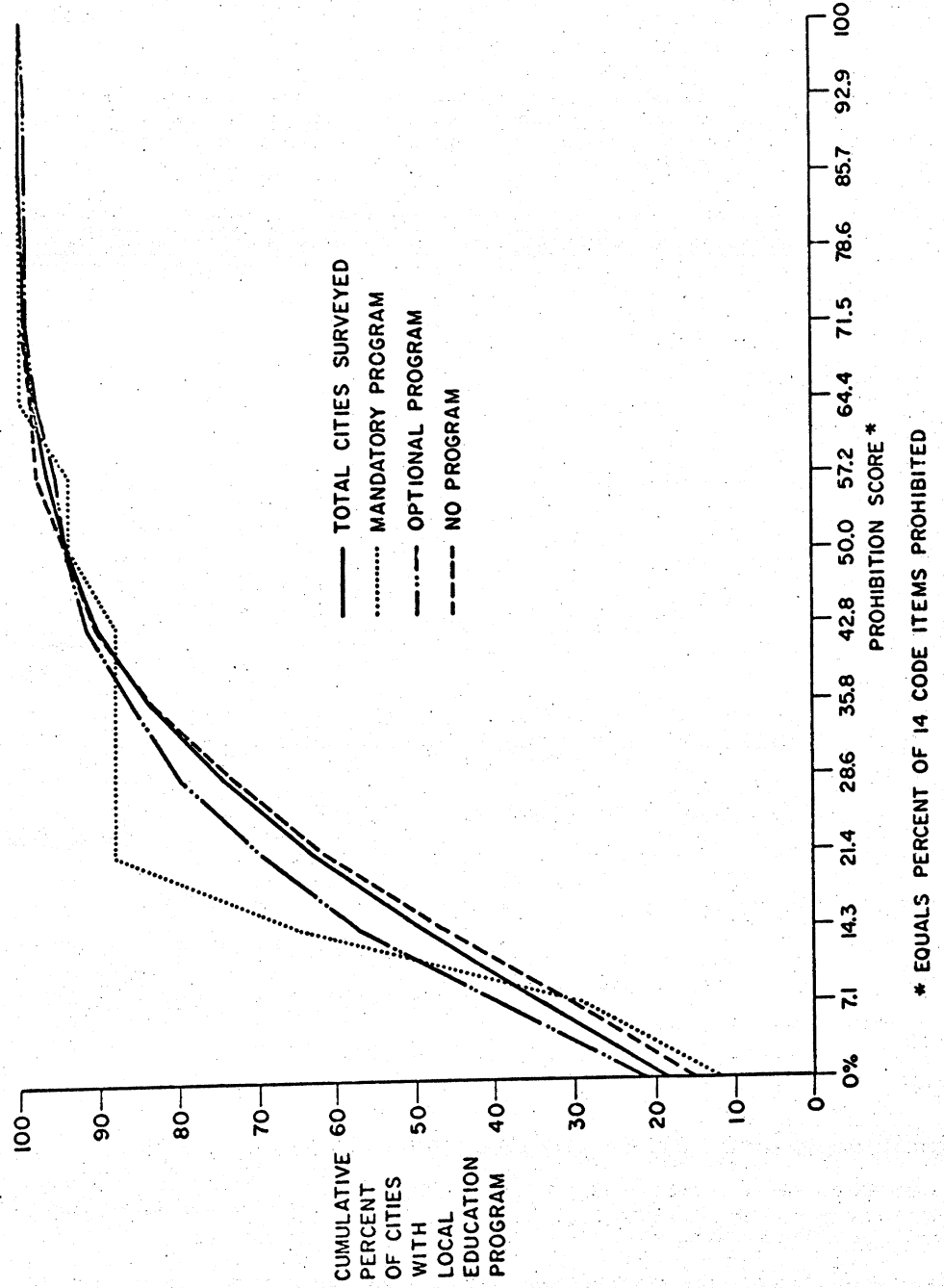
¹⁷ Talcott Parsons, "Professions," International Encyclopedia of the Social Sciences, Vol. 12, pp. 536-547.

All this notwithstanding, only one-third of the cities which were surveyed reported a local education program that was either required of or available to agency members (Table 15). Generally, local programs--where they do exist--tend to be optional. Only about one out of fifteen is mandatory. These mandatory programs occur in the larger cities where the building departments have large staffs and the need for coordination and uniformity of code interpretation is presumably greater. Nonetheless, the optional programs are not strictly associated with city size.

The likelihood of finding a local education program, usually a voluntary one, is higher in the suburbs than in the central cities. This development may have had its origin in the need for local agencies to gear up quickly to accommodate the burgeoning suburban growth of the 1960's. On the other hand, there is still a greater tendency to find the mandatory programs in the central city. Smaller cities and towns--those with populations below 100,000--are likely to rely on state programs: smaller agencies, though they have the need for a program, usually have neither the fiscal nor manpower resources to mount their own programs: hence, their reliance on the state (Table 15).

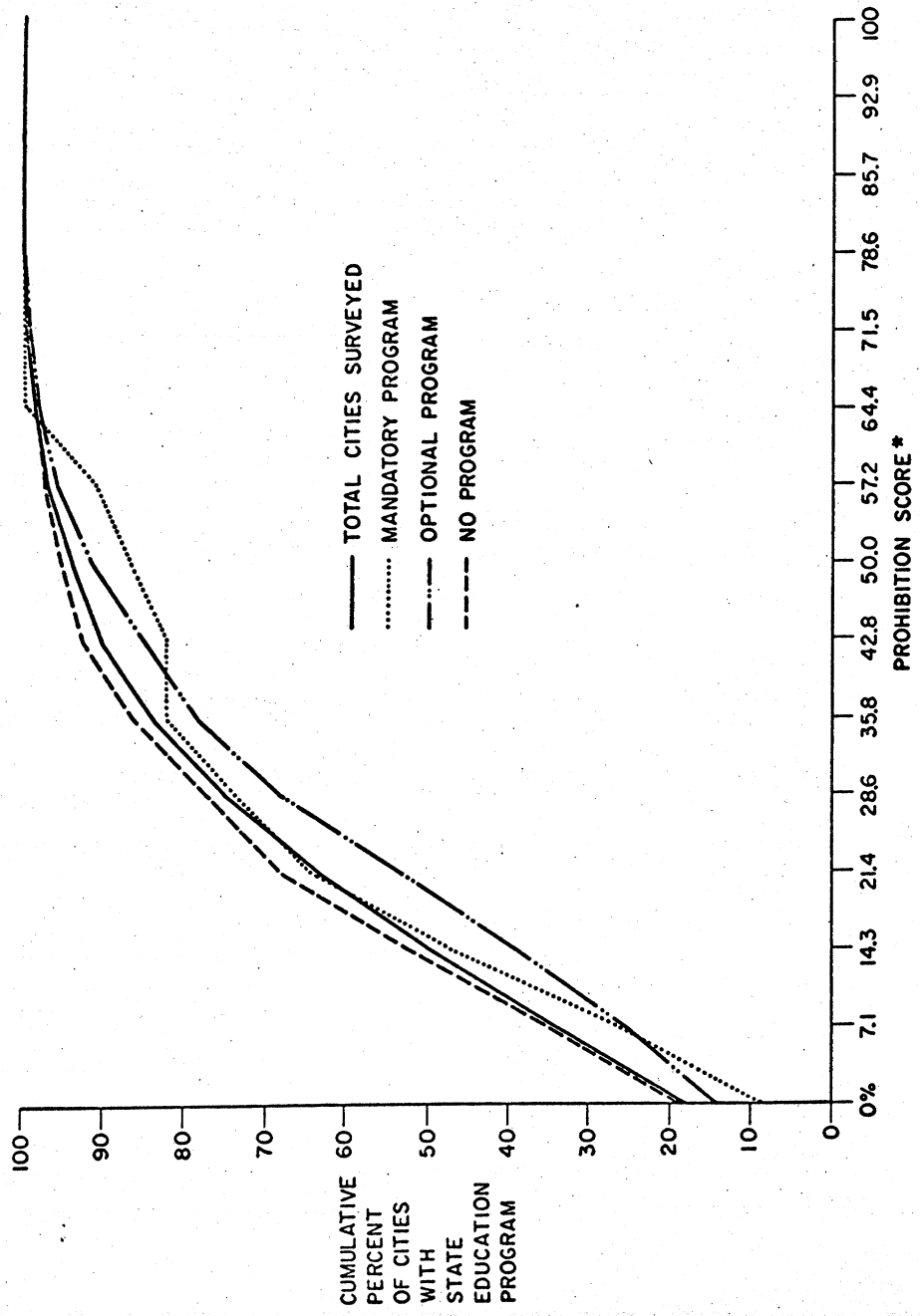
The existence of a state or local educational program for building officials, however, does not guarantee currency of codes. Education programs produce results but they are not panaceas. To gauge the effectiveness of training programs, city codes were scored on the extent to which they prohibited local use of fourteen different tested construction advances. A completely restrictive code, one which prohibited all items, scored 100%, while a completely receptive code scored 0%. Figures 1 and 2 chart the cumulative distribution of cities

Figure 3-1 EFFECT OF LOCAL EDUCATION PROGRAM ON PROHIBITIVENESS OF LOCAL CODE



* EQUALS PERCENT OF 14 CODE ITEMS PROHIBITED

FIGURE 3-2 EFFECT OF STATE EDUCATION PROGRAM ON PROHIBITIVENESS OF LOCAL CODE



* EQUALS PERCENT OF 14 CODE ITEMS PROHIBITED

using state and local education programs. As seen, the impact of local programs has been to improve the currency of codes by spurring the lagging agencies rather than perfecting the performance of the progressive ones. Indications are that state programs, alone, do not strongly affect local agency acceptance of new technology.

Without a deliberate technology updating program or an independent source of information, the local agency is hard pressed to maintain an adequate awareness of new techniques. One common expedient is to rely on the recommendations of the advocates of particular new techniques. So pervasive is this practice that the chapter that follows this is devoted to an examination of the process and an assessment of its effects on the process of technological innovation in the building industry.

Varieties of Local Building Codes

Building codes can be classified in terms of either of two qualities: First, the technical merits of the standards they incorporate, and second, the locus of control over their design, drafting, and enforcement. The ICMA survey revealed that the basic pattern among local building departments is the retention of local control but with a growing use of technically superior codes.

Although all municipal building codes are local ordinances, they are generated from one of or, more often, some combination of three sources: the locality, some proprietary model, or state/county codes. As Chapter 2 indicated the dominant approach to building regulation up to the turn of the twentieth century had been through the locally-based code, a code drafted by local technicians and administered and enforced by local inspectors. The quality of the technical standards incorporated

in the code has depended on the competence of the local technicians and the amount of public revenues devoted to standards research. Few cities used to spend the necessary funds to either monitor advances in building technology or to design codes that accommodate innovative practices. This fact, and the means taken to ameliorate it, are the substance of Chapter 4. Moreover, local officials--having only their personal experience to rely on are likely, ceteris paribus, to incorporate traditional building practices into the code rather than the recent advances in building technology.

These local governments are faced with one of two choices: they may either devise their own building code, relying on their staff resources or on those resources that can be recruited from the locality or the hard-pressed local building official can adapt for local use building regulations developed elsewhere. Sources for these externally developed building codes are three: either municipalities that have approximately the same developmental characteristics as the city searching for a code; or state building codes that are offered for voluntary adoption by the state's localities; or they may subscribe to one of the proprietary model codes. These last are developed for voluntary adoption by private groups whose stated objective is to advance the state of the art and science of building regulations or who have sought to reduce the risk of catastrophe for building owners. The model code groups, which wield large influence on the local regulation of building are examined in great detail in Chapter 5. At this point we mention them only briefly, by way of identification and introduction. The four principal model construction codes and affiliated special codes, the geographical distribution of these groups,

and the means and periods of updating are:

National Building Code of the American Insurance Association (AInsa) was organized in 1904, its staff revised and reissued triennially, and is the only model code with a national subscription. The "National" Electrical Code and the "National" Plumbing Code are not related to the National Building Code and are under the auspices of the National Fire Protection Association and the American Society of Mechanical Engineers, respectively.

Uniform Building Code of the International Conference of Building Officials (ICBO) is widely used in the West and Southwest and was first published in 1927. ICBO publishes a volume of standards (not code requirements) and special codes for mechanical systems, housing, signs, dangerous buildings, resident structures, and for buildings not over two stories in height or more than 6,000 square feet in total floor space.

Southern Standard Building Code, published by the Southern Building Code Congress (SBCC) first in 1945, is supplemented by a separate plumbing code and a separate gas code. The membership is drawn from the states of the South.

Basic Building Code of the Building Officials and Code Administrators International, Inc. (BOCA), draws most of its members from the Northeast and Midwest; the Basic Building Code first appeared in 1950; in addition, BOCA publishes a housing, a plumbing and a fire prevention code; a mechanical code is being prepared.

BOCA, ICBO and SBCC review their codes annually and changes are made by vote of the membership (voting privileges extend only to building officials, though representatives of the industry may become affiliated). (In contrast, the National Building Code is revised by the American Insurance Association staff.) BOCA, ICBO, and SBCC, besides being code publishers, also serve as regional associations of local building officials. All provide plan review and advisory services to members.

The four model codes have brought about a degree of regional code similarity. Additionally, the four groups have provided for communication and coordination among themselves by means of the Model Code Standardization Council (MCSC). The MCSC has recently standardized definitions of terms used in building codes, an important step in the creation of national standards of building regulation. The model code groups have recently produced a single one- and two-family residential construction code.

The code choice alternatives before the local building department bring different combinations of advantages and disadvantages. The voluntary choice of the state code is generally the least expensive option: it provides a measure of compatibility with other jurisdictions within the state, a comparability in code organization, code definitions, code standards cited, and the basis of uniform administrative and enforcement practices; it establishes a precedent for subsequent state-local collaboration in such areas as staff training and organizational development; and for the 80% of U. S. states which have mandatory statewide codes for mechanical systems and life safety, there is a

reduced likelihood of conflict in the future between the general code covering structures and the specialty codes.

The local adoption of one of the model codes promises an even wider area of compatibility, an area crossing state lines. The voluntary nature of model code associations is ideologically compatible with the persistent municipal argument for home rule; identification with the model code group brings with it a measure of professional pride also since many model code groups double as professional associations; and model code groups have comprehensive programs of advisory and publication services which are a welcome addition to the typically very small local building department.

The appeal of the local code, or, more precisely, the locally developed code, needs no explanation given the "grass roots" ideology that permeates so much political thought in the U. S. The cornerstone of American legal and political philosophy is, or rather has been, that the immediate responsibility for the protection of the citizenry under the doctrine of the police power lies with the unit of legal authority closest to that citizenry. There is some question whether this concept is as serviceable now as it was 100 years ago, particularly in the regulation of industries which are undergoing a technological evolution at a rapid rate.

Disadvantages adhere to each of the types of code which a locality might select. The model codes are remote from direct accountability to the local building department and that department's clientele; smaller towns can effectively dominate model code association proceedings except in those cases where strictly proportional voting is allowed; as private associations, although composed of public officials, the

proceedings of model code groups whose decisions will later attain the force of law are sometimes considered to be exempt from the due process requirements which accompany decisions of public bodies. These observations are developed further in Chapter 5. Moreover, the promised uniformity among cities subscribing to model codes often fails to be achieved because many cities are erratic in the effectiveness of their updating procedures. Only 58% of the model code cities annually review their codes for conformance to model code standards, only half of those so reviewing incorporate as much as 90% of the model code changes, while 25% of those who annually review incorporate fewer than half the changes made annually by the model code association.¹⁸

Model codes may provide the aura of the technological currency and the illusion of the removal of technical decisions from the arena of local politics, but more often than not the politics of national trade associations are played just as heavily at the model code meetings as at the local city hall. One could argue, as does Chapter 5, that with more at stake, the pressures and blandishments brought to the model code meetings are likely to be more elaborate and persuasive. Finally, the technological currency of a model code is no guarantee that local codes based on that model code will also be technologically current, as this chapter will later demonstrate.

The difficulty with the locally drafted code is that local resources either in terms of staff or of advisory committees drawn from the local groups, are likely to be overwhelmed by the proliferation of innovative

¹⁸ Manvel, Local Land and Building Regulation, p. 12.

technologies supported by arcane, technologically-couched arguments, without technological support, and often too little time. It is precisely these difficulties which brought about the 65-year-old model code movement in the first place.

The difficulty with the voluntary state code is exactly the difficulty that adheres to all types of voluntary codes: that is, that all voluntary codes are de facto local codes subject to all the abuses attributed to the locally drafted code itself. This is so because voluntary codes are merely advisory until adopted, and maintained in a state of currency, by the local building departments. How will the local departments dispatch this responsibility is the subject of the following section.

Building Codes in Use

The 1970 ICMA survey of local building departments revealed the extent to which each of the code types discussed above was used. At the time of the survey no state required local adoption of a uniform statewide code. In the intervening months since the summer of 1970, when the survey was taken, the state of Connecticut has adopted a mandatory, uniformly administered statewide building code and Massachusetts's statewide code becomes effective in 1975. Table 16 reports the extent of use of the code types discussed thus far; it is readily seen that model codes are widely referred to when local codes are being developed. The question then remains, however, to what extent are all the provisions of the model code adopted by the member cities and towns. Table 17 traces the pattern of code type change for 140 U. S. cities which underwent a change in code type between 1964 and 1970. For this subset of 140 cities, we note the following: model code groups increased their

share by over 40%, and local codes there were purely locally drafted lost over 80% of their share of the 140 cities. But certainly the most dramatic gains were made by the state codes, which drew 42% of their 1970 converts from model code cities and 58% of their 1970 converts from local code cities. The purely voluntary relationship between the local community and the model code group is dramatically demonstrated by the observation that between 1964 and 1970 58% of the model code cities that underwent change dropped one model code and adopted another. What might account for the shifts illustrated in Table 17? The growth of model code use is spurred both by aggressive marketing by the code groups and by the encouragement given local governments by the Department of Housing and Urban Development to bring local codes up to model codes' standards.¹⁹

Technological Currency of the Local Building Code

To measure the technological currency of local building codes in use--not as written or promulgated by the various voluntary groups but as used--local building departments across the U. S. were asked to indicate which of 14 construction materials, methods, assemblies, or design standards were permitted in local residential construction under that department's jurisdiction. The 14-item list is identical to that used in the 1967 Douglas Commission survey of a national sample of local

¹⁹ Strictly speaking, HUD is not requiring localities to adopt model codes; it is requiring--under penalty of loss of Workable Program Certification or recertification--only that local codes that are not unrevised model codes must incorporate "nationally recognized standards governing the use of materials and methods of installation and construction." U. S. Department of Housing and Urban Development, A Workable Program for Community Improvement: Handbook, (September, 1970), MPD 7100.1a.

building departments as reported in Local Land and Building Regulations. None of the items can be considered as exotic technology or beyond the reach of competent building tradesmen. At the time, the Commission's staff stated:

Of the 14 items, 9 involve features that are specifically dealt with and accepted by each of the four national or regional model construction codes. Two items involve building features specifically covered and accepted by the model National Electrical Code. Three items involve plumbing practices, including two that are acceptable under the National Plumbing Code and the various regional model plumbing codes; the remaining item -- use of plastic pipe in residential drainage installations -- involves a practice that had been extensively tested and found acceptable by some model code groups but at the time of the survey was not yet explicitly approved by the National Plumbing Code or some other "model" codes.²⁰

Since then, at least one model code association (BOCA) has adopted plastic pipe in both its building code and companion plumbing code.

Table 18 indicates the extent to which the 14 items have diffused through the nation's building regulatory "system," the relative impact of the type of local code on the extent of adoption of these innovations for local use, and an indication of the change between 1967 and 1970.²¹

At first impression there appears to be a marked tendency for local building codes based on advisory model codes to be more technologically current. On the whole, model code cities prohibited fewer of the fourteen construction advances than did state/county or local code cities. But considering that all items except one are accepted by all of the

²⁰ Marvel, Local Land and Building Regulations, p. 13.

²¹ The Douglas Commission and ICMA analyzed samples of about the same size, 1,050 and 930, respectively; the ICMA survey drew a higher response from cities of the West and from those with city manager governments. Given the characteristics of the over-represented groups, the ICMA findings create a slightly more optimistic picture than actually exists in the nation as a whole.

model building codes or pertinent model mechanical codes, the substantial deviation from perfect scores underlines the purely advisory and voluntary nature of the model code.

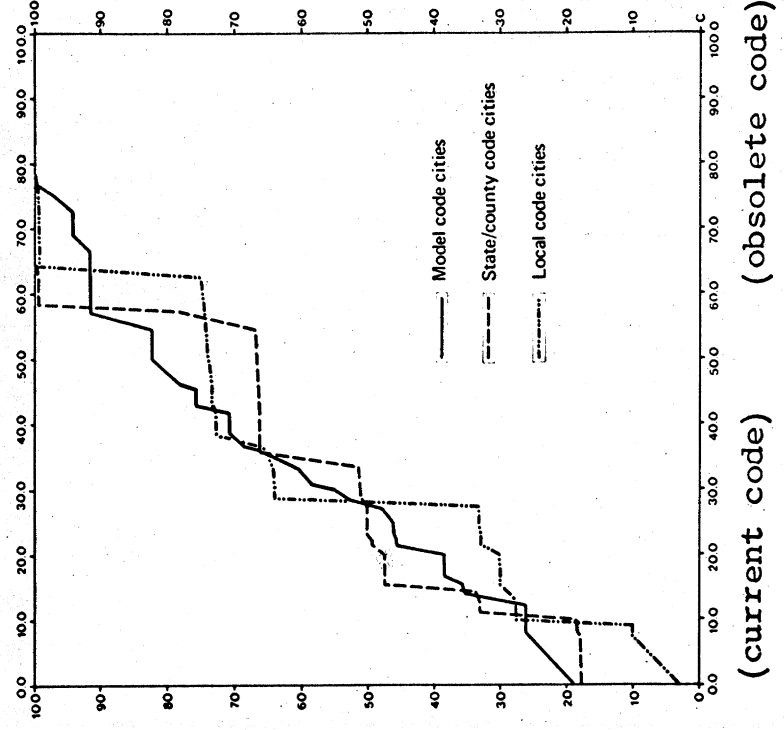
The building codes of the 930 cities in the ICMA survey were rated for technological obsolescence with respect to the panel of 14 items. A technologically current code scored 0.0, and a technologically obsolete code scored 100.0.²²

With such a measure, it is now possible to compare the currency of the local code among the code types and gauge also the coverage of each code type at any level of technological currency. Thus, Figure 3-3 gives a quick summary of the effectiveness of the code types with respect to technological currency: the curves that bulge upward and to the left represent the more current code types; a higher proportion of their client-cities have more current codes now in force. For example, half of the model code cities have prohibition scores of less than 20.00--only one item in five was prohibited--whereas half of the local code cities have prohibition scores of less than 33.33--one item in three was rejected. Model codes are, by this demonstration, superior.

Figure 3-4 reports coverage by code type in a more significant way, in terms of the percent of population served at any level of code currency

²² This revised prohibition score differs from that used in an earlier analysis of the 1970 survey reported in Field and Ventre, "Local Regulation of Building." In the present analysis cities are rated only on those items for which they indicated a positive or negative response: no city was penalized for not responding to a given item. This revised prohibition score is calculated by dividing the number of items prohibited by the total number of items for which either a definite yes or no response was recorded. Further, the revised score is a continuous variable rather than a discrete 14-level variable as in the original (Field and Ventre) prohibition score.

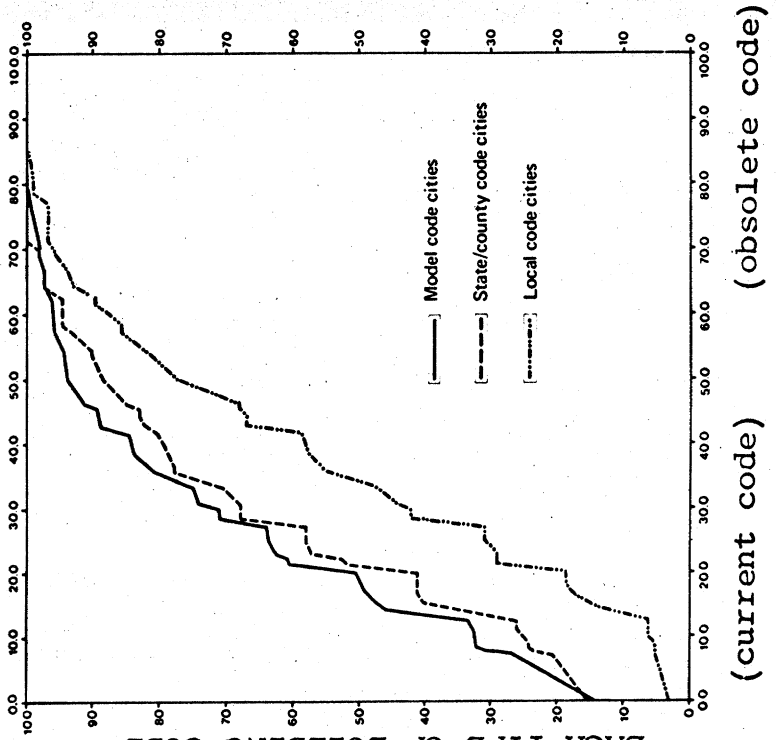
CUMULATIVE % OF POPULATION SERVED BY EACH CODE TYPE



REVISED PROHIBITION SCORE

Figure 3-4 TECHNOLOGICAL CURRENCY OF LOCAL CODES BY PERCENT OF POPULATION SERVED BY EACH CODE TYPE

CUMULATIVE % OF CITIES ADOPTING EACH TYPE OF BUILDING CODE



REVISED PROHIBITION SCORE

Figure 3-3 TECHNOLOGICAL CURRENCY OF LOCAL CODES BY PERCENT OF MUNICIPALITIES USING EACH CODE TYPE

under each code type rather than the percent of municipal agencies served at any level of code currency: again, the curves that bulge upward and to the left represent the more current code types; a higher proportion of the populations served by these codes enjoy the benefits of more current codes. Viewed from this perspective, the often-asserted technical supremacy of the model code-based local code can be questioned. In certain ranges of code currency, state-county codes and occasionally, even locally-drafted codes emerge superior. The point to be made here is that depending on which criteria are chosen, either local codes or model codes, or state/county codes can be associated with lower prohibition scores or greater technological currency: if the proportion of cities served by technically current codes is the measure of code effectiveness, then model codes are clearly superior; if, in contrast, the proportion of the consuming public served by technically current codes is the measure of code effectiveness, then any of the three code types can be found to deliver "better" service. These figures make clear that the relationship of code type to code effectiveness is more complicated than it first appears. One reason for this ambiguity is that model codes are simply not as effective in larger cities as they are in smaller ones. This follows from a comparison of Figures 3-3 and 3-4: 20 percent of cities using model codes have prohibition scores of 0.35 or more; but 20 percent of the population served by model codes have prohibition scores greater than 0.50.²³

²³ The question remains: which code types at what levels of currency are in effect in areas of greater residential construction activity. Since World War II, this has been in the suburbs of the great urban centers of the nation; there are indications, however, that this phenomenon may be at an end. Data now available do not permit an examination of this question.

A mean prohibition score for each state in the U. S. was computed from the prohibition scores of the cities of that state reporting in the 1970 survey. These data are displayed in grouped form in Figure 3-5 and in ungrouped form in Figure 3-6. The darker tones and the higher peaks designated states whose local codes are more obstructive to innovative building technology. A comparison with Table 16 indicates the relative effectiveness of the regional model code groups in bringing about more technologically responsive building codes. But as we shall point out in the following chapter, many factors other than the availability of a model code influence the decision of a local agency to accommodate innovative building technology.

Dissimilarity of Local Building Codes

Fragmentation and the proliferation of responsibility for regulating the building enterprise are two issues that innovators in the building industry find particularly frustrating if they attempt to market their construction products or services in more than one municipality. This applies even with regions of climatic, geologic and even social similarity. The Douglas Commission and the Advisory Commission on Intergovernmental Relations have already documented the difficulties which beset certain kinds of innovation such as industrialized building and material manufacturing innovations which require large market aggregations to achieve financial feasibility, code fragmentation (and its consequences, code dissimilarity), is a greater hindrance than is the obsolescence of the individual municipal codes. Code obsolescence, it can be argued, is a constraint that can be met through engineering design; thus even obsolete codes can be dealt with by materials manufacturers and producers of industrialized buildings so long as they are uniformly obsolete.

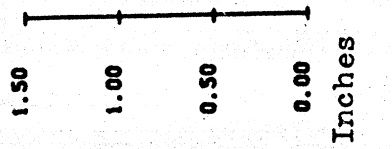
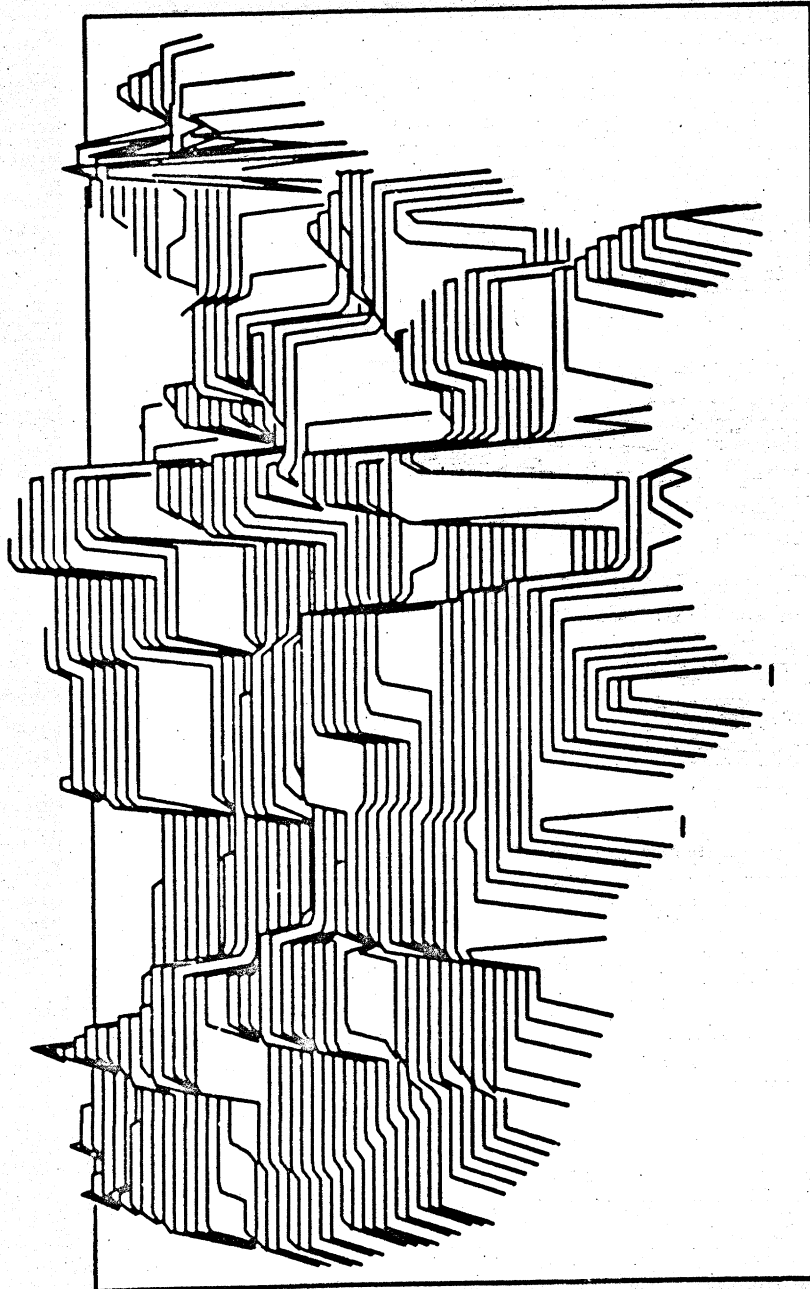


Figure 3-6 --Local Code Obstruction to Innovative Building Technology, by State: 1970

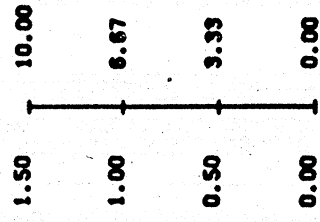
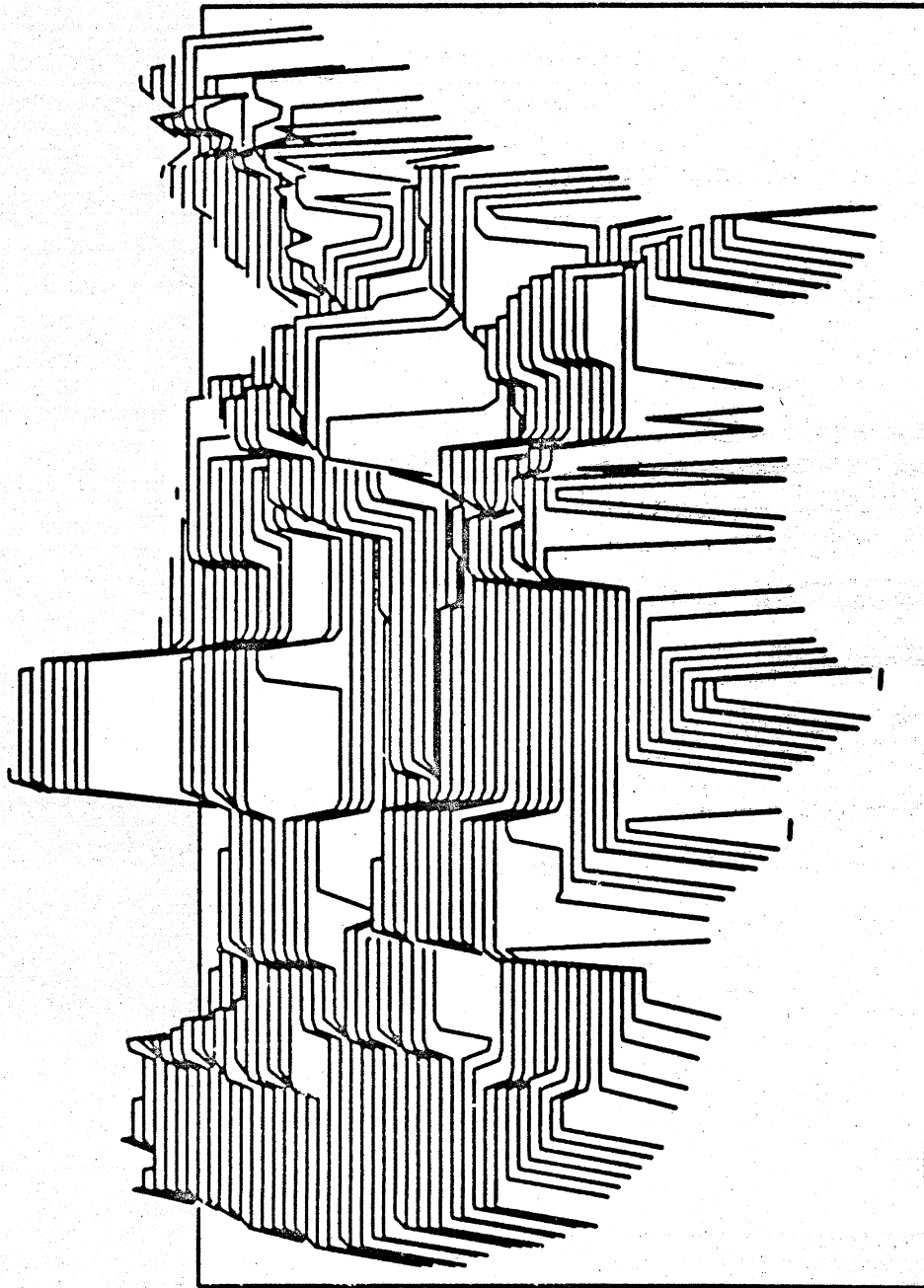
(Source: 1970 ICMIA Survey)

Prepared by Mass. Department of Community Affairs
Office of Code Development

To gauge the extent and consequences of code fragmentation, a dissimilarity score was computed for each state. The score is displayed in grouped form in Figure 3-7 and as ungrouped data in Figures 2-8.²⁴

The darker tones and the higher peaks occur in those states whose local codes are most dissimilar in their choices of code types and in the items prohibited from their codes. Here again, a comparison with Table 3-16 indicates crudely the relative effectiveness of the regional code groups in bringing about uniformity. But we emphasize: the occurrence of the model code has an effect not altogether determined. Data introduced later will show what difference model code groups make on the decision process of local building departments to accept or reject innovative technology. They dynamics of that process--the participation of the agency's clientele, the informational and political force-field in which decisions evolve--is the substance of the following chapter, to which we now turn.

²⁴ The dissimilarity score was computed by comparing each survey municipality in each state with every other survey municipality in that state for concurrence on the acceptance or rejection of each of the fourteen elements of construction technology (see Table 3-18) and then comparing these municipalities on the type of code (model, state or local) in use.



Inches Dissimilarity Score

Figure 3-8 --Dissimilarity of Local Building Codes, by State: 1970

(Source: 1970 ICMA Survey)

Prepared by Mass. Dept. of Community Affairs
Office of Code Development

TABLE 3-1

ADMINISTRATIVE JURISDICTION OVER INSPECTION OF PRINCIPAL BUILDING COMPONENTS

Component	% of cities reporting	Agency with sole jurisdiction				Agency with shared jurisdiction			
		Building department (%)	Other local department (%)	County (%)	State (%)	Building and other local department (%)	Building department and county (%)	Building department and state (%)	Other (%)
Building	97.5	84.6	0.6	0.3	0.2	2.4	0.6	6.3	2.4
Boiler	93.2	25.4	6.2	0.6	34.6	1.7	0.2	19.4	5.8
Elevators	91.1	28.7	1.9	0.3	42.9	1.2	0.3	13.8	1.9
Electrical	96.7	67.8	11.9	1.3	5.5	3.1	0.5	4.6	1.9
Fire safety	95.7	19.2	26.8	1.1	0.9	22.0	0.6	4.0	11.1
Plumbing	97.4	75.6	10.5	1.7	2.2	1.8	1.0	3.3	1.3
Refrigeration	78.9	58.9	8.1	1.7	5.7	1.4	0.9	1.9	0.3
Air pollution	86.3	5.5	17.7	18.3	23.5	1.3	1.8	2.6	15.6
Water pollution	89.4	4.3	19.4	13.3	24.0	1.4	1.6	2.0	23.4
Mobile homes	76.7	41.2	2.9	2.8	15.9	3.5	2.3	3.7	4.4
Mobile home parks	79.7	41.7	4.3	3.8	8.8	4.9	3.8	5.5	6.9

TABLE 3-2
BUILDING OFFICIALS UNDER STATE OR MUNICIPAL CIVIL SERVICE

Classification	No. of cities reporting (A)		Building officials are covered by state or municipal civil service		No. of cities reporting (B)		If not covered would you favor coverage?		% of (B)
	Yes	% of (A)	Yes	No	Yes	No	Yes	No	
Total, all cities	898	37.1	333	565	62.9	492	233	259	52.6
Population group ¹									
Over 500,000	13	92.3	12	1	7.7	1	0	1	100.0
250,000-500,000	12	83.3	10	2	16.7	3	1	2	66.7
100,000-250,000	61	60.7	37	24	39.3	21	13	8	38.1
50,000-100,000	113	57.5	65	48	42.5	38	17	21	55.3
25,000-50,000	223	48.9	109	114	51.1	91	47	44	48.4
10,000-25,000	415	22.4	93	322	77.6	291	113	158	54.3
Geographic region									
Northeast	172	40.7	70	102	59.3	83	62	21	25.3
North Central	245	34.3	84	161	65.7	145	77	68	46.9
South	238	26.1	62	176	73.9	149	53	96	64.4
West	243	48.1	117	126	51.9	115	41	74	64.3
City type									
Central	154	57.1	88	66	42.9	56	31	25	44.6
Suburban	410	42.0	172	238	58.0	208	98	110	52.9
Independent	320	20.9	67	253	79.1	220	101	119	54.1
Form of government									
Mayor-council	235	41.7	98	137	58.3	119	84	35	29.4
Council-manager	614	35.3	217	397	64.7	349	135	214	61.3
Other ²	49	36.7	18	31	63.3	24	14	10	3.9

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-3

BUILDING OFFICIALS REPRESENTED BY A UNION

Classification	No. of cities reporting	Building officials represented by union		%
		Yes	No	
Total, all cities	896	58	838	93.5
Population group ¹				
Over 500,000	13	4	9	69.2
250,000-500,000	12	4	8	66.7
100,000-250,000	60	9	51	85.0
50,000-100,000	113	13	100	88.5
25,000-50,000	220	15	205	93.2
10,000-25,000	417	12	405	97.1
Geographic region				
Northeast	170	18	152	89.4
North Central	245	15	230	93.9
South	239	4	235	98.3
West	242	21	221	91.3
City type				
Central	153	21	132	86.3
Suburban	409	25	384	93.9
Independent	320	10	310	96.9
Form of government				
Mayor-council	236	24	212	89.8
Council-manager	611	32	579	94.8
Other ²	49	2	47	95.9

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting

TABLE 3-4

IMPACT OF CIVIL SERVICE AND OF UNION REPRESENTATION ON STAFF SALARIES

Classification	No. of cities reporting	% of total cities surveyed	Lower quartile (\$)	Median (\$)	Upper quartile (\$)	Mean (\$)
Beginning salary						
Under civil service	258	27.7	6,986	8,082	9,292	8,257
No civil service	340	36.5	6,000	7,001	8,250	7,145
% difference	-	-	16.4	15.4	12.6	15.5
Union representation	51	5.4	7,244	8,551	9,090	8,677
No union representation	544	58.4	6,200	7,396	8,665	7,525
% difference	-	-	16.8	15.6	4.9	15.3
Maximum salary						
Under civil service	254	27.3	8,985	10,241	11,506	10,564
No civil service	321	34.5	7,550	9,068	10,350	9,136
% difference	-	-	19.0	13.0	11.1	15.6
Union representation	51	5.4	9,024	10,414	11,320	10,947
No union representation	523	56.2	8,052	9,501	10,870	9,652
% difference	-	-	12.0	9.6	4.1	1.3

TABLE 3-5
CHIEF BUILDING OFFICIAL'S (CBO'S) SALARY

Classification	No. of cities reporting	Lower quartile (\$)	Median (\$)	Upper quartile (\$)	Mean (\$)
Total, all cities	782	8,595	10,588	13,500	11,311
Population group¹					
Over 500,000	13	18,819	21,712	23,492	22,158
250,000-500,000	11	13,967	16,650	18,802	17,157
100,000-250,000	57	11,379	14,017	16,834	14,421
50,000-100,000	100	10,500	12,750	15,948	13,120
25,000-50,000	201	9,680	11,693	13,566	11,746
10,000-25,000	374	7,738	9,387	11,443	9,786
Geographic region					
Northeast	142	8,314	10,005	12,300	10,493
North Central	209	9,156	11,221	13,361	11,486
South	207	7,200	8,999	10,880	9,418
West	224	10,164	13,176	15,981	13,415
City type					
Central	143	10,240	12,900	15,360	13,548
Suburban	351	9,621	11,996	14,394	12,183
Independent	278	7,287	8,757	10,266	8,983
Form of government					
Mayor-council	192	8,400	10,404	12,750	11,126
Council-manager	552	8,580	10,910	13,800	11,433
Other ²	28	9,000	10,010	12,000	10,703

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-6

BEGINNING SALFARY FOR BUILDING OFFICIALS (OTHER THAN COB'S)

Classification	No. cities reporting	Lower quartile (\$)	Median (\$)	Upper quartile (\$)	Mean (\$)
Total, all cities	598	6,290	7,496	8,752	7,625
Population group¹					
Over 500,000	12	7,392	10,002	12,000	10,238
250,000-500,000	11	6,346	7,818	9,590	8,680
100,000-250,000	52	6,777	7,869	8,964	8,187
50,000-100,000	95	6,978	7,993	9,305	8,142
25,000-50,000	179	6,490	7,636	8,769	7,670
10,000-25,000	220	5,998	7,134	8,341	7,157
Geographic region					
Northeast	85	6,285	7,361	8,190	7,384
North Central	158	6,558	7,490	8,510	7,685
South	157	5,360	6,266	7,230	6,430
West	198	7,548	8,728	9,579	8,627
City type					
Central	127	6,530	7,455	8,660	7,867
Suburban	270	7,198	8,331	9,292	8,236
Independent	191	5,695	6,370	7,370	6,498
Form of government					
Mayor-council	127	6,129	7,158	8,355	7,616
Council-manager	445	6,388	7,557	8,792	7,634
Other ²	20	6,080	7,143	7,650	7,152

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-7
MAXIMUM SALARY FOR BUILDING OFFICIALS (OTHER THAN CBO'S)

Classification	No. of cities reporting	Lower quartile (\$)	Median (\$)	Upper quartile (\$)	Mean (\$)
Total, all cities	575	8,160	9,601	11,000	9,766
Population group¹					
Over 500,000	12	9,720	15,833	18,300	15,784
250,000-500,000	11	8,992	10,683	13,560	12,201
100,000-250,000	53	8,650	9,956	11,468	10,446
50,000-100,000	95	8,488	9,995	11,367	10,159
25,000-50,000	173	8,505	9,653	10,870	9,772
10,000-25,000	206	7,497	9,085	10,429	9,064
Geographic region					
Northeast	78	7,988	9,222	10,255	9,329
North Central	151	8,391	9,802	10,796	9,631
South	152	7,030	8,352	9,469	8,344
West	194	9,376	10,836	11,968	11,030
City type					
Central	127	8,276	9,684	10,948	10,346
Suburban	263	9,222	10,445	11,409	10,387
Independent	175	7,088	8,163	9,386	8,304
Form of government					
Mayor-council	125	7,990	9,155	10,593	9,840
Council-manager	429	8,298	9,758	11,064	9,787
Other ²	17	7,371	8,681	9,735	8,611

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-8
IMPACT OF UNION REPRESENTATION ON STAFF SALARIES,
BY CITY SIZE

Population group	With union representation				No union representation				% difference = (A ÷ B) - 100%
	No. of cities reporting	% of total sample	Median salary (A)	No. of cities reporting	% of total sample	Median salary (B)			
Median beginning salary									
Over 500,000	3	0.3	\$14,432	9	1.0	\$8,280	74.3		
250,000-500,000	4	0.4	9,425	7	0.8	7,486	25.9		
100,000-250,000	8	0.9	8,650	43	4.6	7,703	12.3		
50,000-100,000	11	1.2	8,908	84	9.0	7,904	12.7		
25,000-50,000	13	1.4	7,942	164	17.7	7,614	4.3		
10,000-25,000	11	1.2	7,981	209	22.5	7,004	13.9		
Median maximum salary									
Over 500,000	3	0.3	17,005	9	1.0	14,459	17.6		
250,000-500,000	4	0.4	13,546	7	0.8	10,500	29.0		
100,000-250,000	8	0.9	10,250	44	4.7	9,860	4.0		
50,000-100,000	11	1.2	10,757	84	9.0	9,951	8.1		
25,000-50,000	12	1.3	9,599	159	17.1	9,653	0.6		
10,000-25,000	10	1.1	10,426	196	21.1	9,024	15.5		

TABLE 3-9
AGES OF LOCAL BUILDING OFFICIALS

Classification	Chief building official		Senior building official		Most recently appointed building official	
	No.	%	No.	%	No.	%
Years of schooling completed						
Grades 1-8	18	2.1	15	2.9	12	2.8
Grades 9-12	254	30.3	288	55.8	229	53.4
Some college	335	39.9	184	35.7	136	31.7
College graduate	232	27.7	29	5.6	52	12.1
Ages of local officials						
20-29 years	13	1.6	7	1.5	35	8.7
30-39 years	123	15.6	60	12.7	110	27.4
40-49 years	243	30.8	144	30.6	113	28.2
50-59 years	299	37.8	172	36.5	113	28.2
60 years and over	112	14.2	88	18.7	30	7.5

TABLE 3-10
YEARS IN BUILDING DEPARTMENT FOR LOCAL BUILDING OFFICIALS

Official	Lower quartile	Median	Upper quartile	Maximum	Mean
Chief building official	2.7	6.7	12.5	41	8.6
Senior building official	3.7	7.9	13.6	44	9.9
Most recently appointed building official	1.0	1.8	3.0	36	2.7

TABLE 3-11

OCCUPATIONAL BACKGROUNDS OF LOCAL BUILDING OFFICIALS

Official	No. of cities reporting	Union building trades (%)	Nonunion building trades (%)	General contractor (%)	Engineer (%)	Architect (%)	Other govt. (%)	Other (%)
Chief building official	815	28.8	21.4	42.4	26.8	8.6	24.8	14.1
Senior building official	522	39.0	29.3	28.8	6.7	2.3	20.9	14.8
Most recently appointed building official	433	33.1	25.2	29.8	9.9	2.5	20.3	17.5

¹ Row totals do not equal 100% since some checked more than one background component.

TABLE 3-12

MOST FREQUENTLY REPORTED MINIMUM QUALIFICATIONS

Qualifications ¹	Cities using as a current qualification		Cities suggesting as a future qualification		Net % chang
	No.	%	No.	%	
CRE	166	17.8	65	7.0	-60.
OJT & CRE	110	11.8	79	8.5	--28.
OJT, FS, & CRE	77	8.3	100	10.8	29.
CRE & LE	59	6.3	(38)	4.1) ³	-35.
LE	57	6.1	65	7.0	14.
OTH	55	5.9	54	5.5	-1.
OJT	53	5.7	(15)	1.6) ³	-71.
OJT, FS, CRE & LE	52	5.6	114	12.3	119.
FS, CRE, & LE	(30)	3.2) ²	55	5.9	83.
OJT, CRE, & LE	(30)	3.2) ²	49	5.3	63
FS & CRE	(51)	5.5) ²	51	5.5	..

¹ Key: CRE - Construction related experience; OJT - On the job training; FS - Formal schooling; LE - Local exam; OTH - Other; SE - State exam.

² Not in original listing of leading current qualifications; noted here to facilitate comparison.

³ Not in original listing of leading future qualifications; noted here to facilitate comparison.

TABLE 3-13
COMPONENTS OF QUALIFICATIONS OF LOCAL BUILDING OFFICIALS

Qualification component	Cities reporting as a current qualification component		Cities suggesting as a component for future qualification		Net % change
	No.	%	No.	%	
On the job training	403	43.3	532	57.2	32.0
Formal schooling	277	29.8	507	54.5	183.0
Construction related experience	661	71.1	739	79.5	11.7
Local exam	287	30.9	367	39.5	27.8
State exam	97	10.4	197	20.9	100.0
Other	65	7.0	55	5.9	-15.7

TABLE 3-14
Formal Education of Local Building Officials
(Contained in Table 3-9)

TABLE 3-15

EDUCATIONAL PROGRAMS FOR BUILDING OFFICIALS

Classification	Local education program						State education program						
	Yes, mandatory		Yes, optional		No program		Yes, mandatory		Yes, optional		No program		
	No.	% of (A)	No.	% of (A)	No.	% of (A)	No.	% of (B)	No.	% of (B)	No.	% of (B)	
Total, all cities	17	2.4	236	33.1	460	64.5	696	23	3.3	341	49.0	332	47.7
Population group ¹													
Over 500,000	12	3.3	7	58.4	4	33.3	9	0	0.0	3	33.3	6	66.7
250,000-500,000	11	18.2	2	18.2	7	63.6	9	0	0.0	1	11.1	8	88.9
100,000-250,000	51	7.8	13	25.5	34	66.7	48	0	0.0	24	50.0	24	50.0
50,000-100,000	93	3.2	40	43.0	50	53.8	86	2	2.3	37	43.0	47	54.7
25,000-50,000	172	2.9	66	38.4	101	58.7	170	11	6.5	89	52.4	70	41.2
10,000-25,000	325	0.6	97	29.8	226	69.5	328	9	2.7	161	49.1	158	48.2
Geographic region													
Northeast	120	2.5	32	26.7	85	70.8	147	8	5.4	93	63.3	46	31.3
North Central	200	3.0	44	22.0	150	75.0	201	9	4.5	94	46.8	98	48.8
South	171	3.5	33	19.3	132	77.2	191	4	2.1	92	48.2	95	49.7
West	222	2.9	127	57.2	93	41.9	157	2	1.3	62	39.5	93	59.2
City type													
Central	129	7.0	34	26.4	86	66.7	122	2	1.6	53	43.4	67	54.9
Suburban	326	1.5	149	45.7	172	52.8	308	12	3.9	165	53.6	131	42.5
Independent	246	1.2	44	17.9	199	80.9	261	9	3.4	120	46.0	132	50.6
Form of government													
Mayor-council	182	2.2	39	21.4	139	76.4	188	9	4.8	94	50.0	85	45.2
Council-manager	496	2.4	185	37.3	299	60.3	475	11	2.3	231	48.6	233	49.1
Other ²	35	2.9	12	34.3	22	62.9	33	3	9.1	16	48.5	14	42.4

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-16
BASIS OF BUILDING CODE
ENFORCE (JUNE 1970)

Classification	No. of cities reporting	AIA (%)	ICBO (%)	SSBC (%)	BOCA (%)	State or county (%)	Locally drafted code (%)	No code in effect (%)
Total, all cities	919	12.2	31.3	14.9	15.1	13.5	10.8	2.2
Population group¹								
Over 500,000	12	0.0	33.3	0.0	25.0	0.0	41.7	0.0
250,000-500,000	12	8.3	50.0	25.0	0.0	8.3	8.3	0.0
100,000-250,000	59	3.4	27.1	25.4	15.3	13.6	15.3	0.0
50,000-100,000	111	8.1	39.6	15.3	16.2	16.2	4.5	0.0
25,000-50,000	225	9.3	34.2	11.6	16.9	13.8	13.8	0.4
10,000-25,000	429	16.6	29.8	15.6	13.1	12.6	10.0	2.3
Geographic region								
Northeast	185	22.2	1.1	0.0	32.4	21.6	17.3	5.4
North Central	249	10.8	22.9	0.4	27.7	14.9	20.5	2.8
South	241	18.3	2.1	56.4	4.1	14.1	3.7	1.2
West	244	0.0	91.8	0.0	0.0	5.3	2.9	0.0
City type								
Central	149	6.7	29.5	24.8	14.8	12.8	11.4	0.0
Suburban	414	11.1	33.6	7.2	20.0	12.8	14.0	1.2
Independent	340	16.5	28.5	20.6	9.7	13.8	6.5	4.4
Form of government								
Mayor-council	240	17.1	15.0	6.7	20.4	19.6	18.8	2.5
Council-manager	625	10.2	38.9	17.6	12.8	11.5	7.4	1.6
Other ²	54	13.0	16.7	20.4	18.5	9.3	14.8	7.4

¹ "Population group" subtotals do not include cities under 10,000; a small sample of cities under 10,000 is included in balance of table.

² Includes cities with commission government, town meeting, and representative town meeting.

TABLE 3-17

CHANGES OF BUILDING CODE TYPE:

Type code used 1964	Type code used 1970			Total
	Model	State	Local	
Model	37	15	12	64
State	1	0	1	2
Local	53	21	0	74
Total	91	36	13	140

TABLE 3-18

PERCENT OF MUNICIPALITIES PROHIBITING SELECTED CONSTRUCTION INNOVATIONS

Code changes	No. of cities reporting	% all governments reporting	By type of code				1967 Douglas survey ¹ (E)	A - E
			Model (B)	State (C)	Local (D)			
Nonmetallic sheathed electrical cable	771	14.7	13.1	9.1	32.5	13.0	+1.7	
Prefabricated metal chimneys	832	11.1	9.1	14.0	20.8	19.1	-8.0	
Off-site preassembled combination drain, waste, and vent plumbing system for bathroom installation	805	38.5	34.3	47.6	56.5	42.2	-3.7	
Off-site preassembled electrical wiring harness for installation at electrical service entrance to dwelling	751	51.7	36.6	59.6	67.1	45.7	+6.0	
Wood roof trusses, placed 24" on center	840	5.2	3.8	7.2	12.8	10.0	-4.8	
Copper pipe in drain, waste, and vent plumbing systems	818	4.9	4.2	3.8	10.6	8.6	-3.7	
ABS (acrylonitrile-butadiene-styrene) or PVS (polyvinylchloride) plastic pipe in drain, waste, and vent plumbing systems	876	47.0	42.9	49.5	71.3	62.6	-15.6	
Bathrooms or toilet facilities equipped with ducts for natural or mechanical ventilation, in lieu of operable windows (or skylights)	836	2.6	2.5	2.8	3.1	6.0	-3.4	
Party walls without continuous air space	750	26.4	25.8	19.6	38.6	26.8	-0.4	
Use of single top and bottom plates in non-load-bearing interior partitions	836	20.9	20.2	20.4	26.3	24.5	-3.6	
Use of 2" x 3" studs in non-load-bearing interior partitions	833	32.3	29.7	33.3	48.4	35.8	-3.5	
Placement of 2" x 4" studs 24" on center in non-load-bearing interior partitions	841	42.6	39.7	38.2	66.7	47.3	-4.7	
In wood frame construction, sheathing at least 1/2" thick, in lieu of corner bracing	834	14.9	13.7	14.7	23.2	20.4	-5.5	
Wood frame exterior walls in multi-family structures of three stories or less	819	25.0	19.7	39.0	44.7	24.1	+0.9	

¹ See Allen Marvel, *Local Land and Building Regulation*, Research Report No. 6. Prepared for the National Commission on Urban Problems (Washington, D.C., U.S. Government Printing Office, 1968), p. 33.

Chapter 4

MAINTAINING TECHNOLOGICAL CURRENCY IN THE LOCAL BUILDING CODE: PATTERNS OF COMMUNICATION AND INFLUENCE

This chapter distinguishes among the local building department's several publics and identifies its effective constituency the agency's clientele. The functions of that clientele are enumerated and the most important one for present purposes, that of technological advocate, is elaborated. The participation of that clientele in the agency's determination of technological issues is described in detail and as a function of economic interests. A roster of participants (e.g. building materials producers and suppliers, architects and engineers) and impersonal resources (mass media, trade publications) is developed and the variety of roles they play (as originators, supporters or resisters of change) in the techno-political deliberations of the agency are discussed. The pervasive influence of this clientele is established but its orientation, however, appears not to be explainable purely in terms of economic rationality, at least as hypothesized in the analogy of the local building code as tariff.

Means of Maintaining Technological Currency

Maintenance of the local building code in a state of technological readiness is a primary responsibility of the local building department. There are many different protocols

and procedures to be followed. These differences flow primarily from differences in the state enabling legislation that empowers municipalities to police building construction.¹ Comprehensive review and revision of the local building code--even among model code cities--occurs at intervals too long and too irregular to permit scheduled incorporation of innovative technology. For instance, only one-third of local building departments had comprehensively revised their codes in the 30 months prior to the 1970 ICMA survey (Table 4-1).² Yet most indicated some technical revision to their codes within that time. Proponents of changes who cannot await the occasional comprehensive revision of local codes have another course of action, product approval, now described.

Any building code--local, state, or model--which purports to be a "performance" code must permit the substitution of alternate materials, methods, assemblies and engineering designs for those specified in the code provided that basic performance objectives of the code are met.³ The performance

¹Useful summaries of various procedures are given in Charles Rhyne, Survey of the Law of Building Codes (Washington: American Institute of Architects--National Association of Home Builders, 1960). Ambrose M. Richardson, "Building Codes: Reducing Diversity and Facilitating the Amending Process", Harvard Journal on Legislation, Vol. 5, No. 4 (May 1968), pp. 587-611. Advisory Commission on Intergovernmental Relations; ACIR State Legislative Program: 1970 Cumulative (August 1969), Publication M-48. The Rhyne book--now out of print--is reportedly being revised for future publication.

²Manvel, Local Land and Building Regulation, Table 9, reports a similar lag found in the 1967 Douglas Commission Survey.

³Richard L. Sanderson, Codes and Code Administration (Chicago: Building Officials Conference of America, 1969), p. 15.

TABLE 4-1 YEAR OF CODE ADOPTION AND REVISION BY TYPE OF CODE

Classification	No. of cities reporting	1970 (%)	1969 (%)	1968 (%)	1967 (%)	1966 (%)	1960-69 (%)	1950-69 (%)	1940-49 (%)	Pre 1940 (%)	Total (%)
Year adopted											
Model	651	4.5	8.9	11.4	14.6	3.8	23.9	24.1	6.5	2.8	100
State	115	1.7	2.6	8.7	8.7	3.5	31.3	36.5	2.6	4.3	100
Local	90	1.1	3.3	5.6	3.3	6.7	17.8	32.2	10.0	20.0	100
All	856	3.7	7.5	10.4	12.6	4.1	23.9	26.6	6.3	4.8	100
Year last revised											
Model	554	16.6	22.0	15.7	24.0	4.2	13.0	4.0	0.4	0.2	100
State	89	15.7	13.5	21.3	14.6	7.9	20.2	6.7	0.0	0.0	100
Local	75	12.0	22.7	9.3	6.7	10.7	20.0	14.7	2.7	1.3	100
All	718	16.0	21.0	15.7	21.0	5.3	14.6	5.4	0.6	0.3	100

concept--whether in building codes or engineering design is:

An organized procedure or framework within which it is possible to state the desired attributes of a material, component or system in order to fulfill the requirements of the user without regard to the specific means to be employed in achieving the (objective).⁴

The performance concept appears--although in a vulgar form--wherever the phrase "or equal" (or its variants) follows a specification.

The sponsor of the innovation presents data showing compliance with applicable code standards and, if required by the local building department, evidence of further testing by independent laboratories.⁵ Once the local official approves, the material, method, assembly or engineering standard under review becomes a part of the local code.⁶

This is the bare-bones outlines of the procedure by which local codes undergo piecemeal or incremental modernization, a process repeated thousands of times--recall there are over 8,000 local building codes in force in the U.S.--with a slightly different cast of characters in each municipality. The prior approval of a model code group does not guarantee

⁴ John P. Eberhard, Project Director, The Performance Concept: A Study of Its Application to Housing, Vol. 1, (U.S. National Bureau of Standards, Institute for Applied Technology, 1969), p. 3.

⁵ William Demarest, Building Codes: Product Approval (New Haven: Ludlow-Bookman, 1964), pp. 1-2.

⁶ Richardson, "Building Codes", p. 607.

acceptance of the innovative material, method, assembly, or engineering standard by the localities which have final say. Table 18 of Chapter 3 makes this abundantly clear. Not only is the process of product approval or local code acceptance long, repetitive, and expensive, it is often controversial, since any alteration in the "status quo" of the local building code is bound to penalize some and indulge other elements of the local building department's clientele. But the burdens of decision rest with the local building officials who are, in the words of a prominent builder,

. . .really scared to death to introduce any new products because they are all concerned if it does not work or if it does not hold up, their position is in jeopardy, they can be criticized.⁷

The fear that this witness describes is a real concern for persons whose job tenure is precarious, as we have seen documented in Chapter 3, and whose appointment to office rests with elected officials with ties to the building and

⁷Testimony of Richard M. Wasserman, President, Levitt and Sons, Inc., in Subcommittee on Housing and Urban Affairs of the Senate Committee on Banking and Currency, Housing and Urban Development Legislation of 1969, 91st Congress, First Session (Washington: USGPO, 1969), p. 391. Hereinafter referred to as 1969 HUD Hearings.

development community.⁸ This concern is so prevalent and powerful that it affects the local official's very judgement of prospective building code amendments.

Controversy is the bane of a bureaucrat's existence, particularly an official whose job tenure is uncertain and who lacks a professional's ethos and mobility to sustain him in times of trial. Both these conditions--uncertainty and lack of professionalism--characterize the local building official. He is on the lookout for controversy and is confronted by it whenever a code change is made. The mere prospect of an upcoming code change is viewed with great apprehension, so pervasive is the "climate of fear" attending the local building official's decision to bring the local code into technological currency. Contrary to the widely-held industry opinion that one or two pivotal code changes have been the locus of controversy--the introduction of plastic pipe being the premier example--almost every code change precipitates some controversy. Moreover, local officials expect to encounter controversy over a greater number of technical innovations than their collective experience shows were in reality controversial. This is a manifestation of the

⁸Field and Ventre, Local Regulation of Building, Table 1/22. In the course of a lobbying effort in behalf of state-wide building code reform legislation in Massachusetts this author met several local officials who expressed just such apprehensions. Concerns about "political interference" and job security were so prevalent that the state association of local building officials endorsed the reform legislation that severely limited their own descretionary authority but placed qualified local inspectors under Civil Service protection.

climate of fear with respect to technical advance engendered and sustained by the agency's clientele.

Evidence for these statements follows. Figure 4-1 illustrates the extent to which local building departments encountered controversy in their decisions to adjust their building codes to accommodate innovative techniques. This applies to changes already made prior to the 1970 survey. Figure 4-2 provides data on prospective changes and the expectation, by agencies that have not yet adopted the change of attendant controversy.

Interestingly, each of the fourteen items was named by at least one local agency as the most difficult of recent code changes, although the distribution was highly skewed and over half the jurisdictions agreed on the same item as the single most difficult code change to bring about. This last was the change to permit the use of plastic pipe in residential drain, waste and vent installations (PLADRN). The runners-up for the single most difficult code change ran so far behind plastic pipe that there was no contest.⁹ Figure 4-1 reveals that model code cities--which comprised about 70% of the survey cities--tended to distribute their votes for "most difficult change" among fewer items, whereas state/county and

⁹So widely did plastic pipe outdistance the field that data in Figures 4-1 and 4-2 are plotted on a semi-logarithmic chart. The scales should not be read off directly; instead the data values indicated in the margins should be used.

FIGURE 4-1 MOST DIFFICULT CODE ITEM ADOPTION (EXPERIENCED)

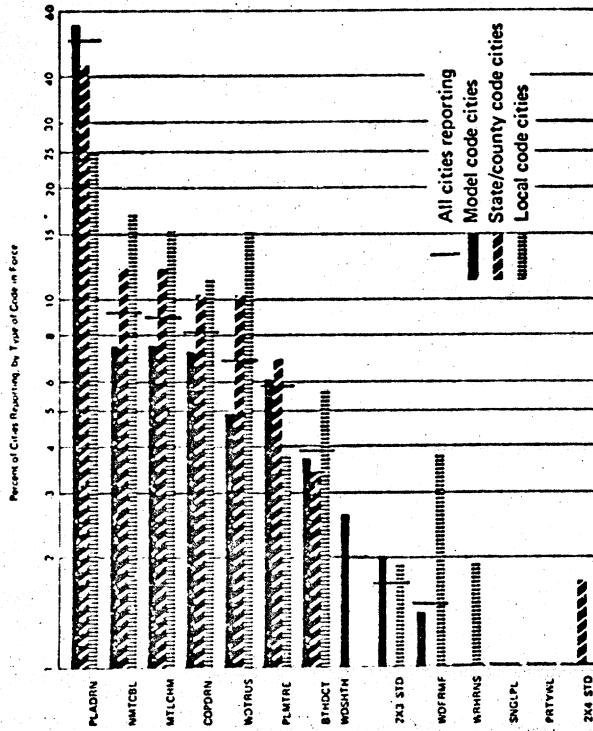
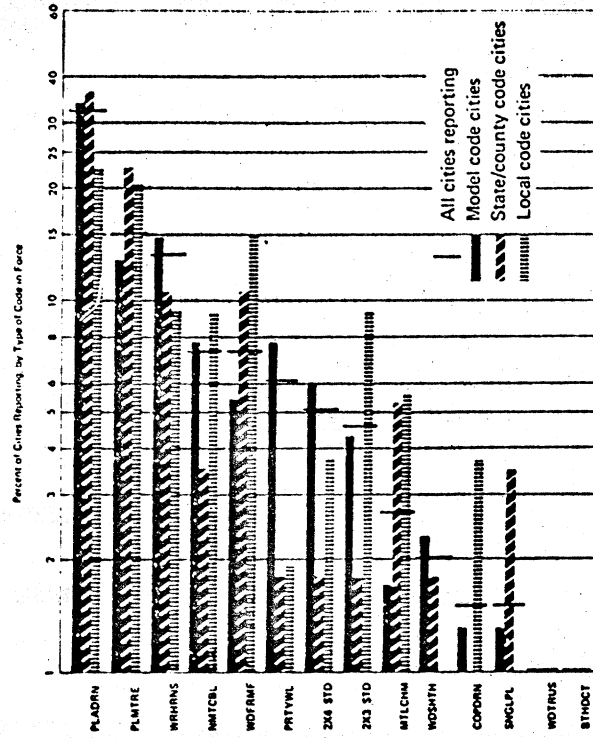


FIGURE 4-2 MOST DIFFICULT CODE ITEM ADOPTION (EXPECTED)



PLADRN	ABS (acrylonitrile-butadiene-styrene) or PVC (polyvinyl-chloride) plastic pipe in drain, waste, and vent plumbing systems	PLADRN	drain, waste, and vent plumbing system for bathroom installation
NMTCBL	Nonmetallic sheathed electrical cable	WRHRNS	Off-site preassembled electrical wiring harness for installation at dwelling
MTLCHM	Prefabricated metal chimneys	SNGLPL	Use of single top and bottom plates in non-load-bearing interior partitions
COPDRN	Copper pipe in drain, waste, and vent plumbing systems	PRTYWL	Party walls without continuous air space
WDRTRUS	Wood roof trusses, placed 24" on center	2X4 STD	Placement of 2" x 4" studs 24" on center in non-load-bearing interior partitions
PLMTRE	Off-site preassembled combination		
		BTHDCT	Bathrooms or toilet facilities equipped with ducts for natural or mechanical ventilation, in lieu of operable windows (or skylights)
		WDSHTH	In wood frame construction, sheathing at least 1/2" thick, in lieu of corner bracing
		2X3 STD	Use of 2" x 3" studs in non-load-bearing interior partitions
		WDFRMF	Wood frame exterior walls in multi-family structures of three stories or less

particularly, local code cities, tended to find controversy occurring in more areas of construction change. Reasons for this relative clustering of model code cities and relative scattering of local code cities may be the following: model code cities share intelligence and information through model code association meetings and publications, thus they are current on controversies that are occurring in other localities as well; and they may be less locally oriented. On the other hand, local code cities must necessarily rely more heavily on their local inputs to the code adoption process, and in keeping their finger on the clientele's pulse are likely to have to placate a wider diversity of special interests. Since the local code cities are generally more sensitive to the clientele, more different items will be found to be controversial.

Another analysis was made to test the hypothesis of more intensive communication among model code cities as opposed to local code cities. The result appears as Figure 4-2. Note the distinction. Figure 4-1 reports difficulty experienced in recent code changes and Figure 4-2 reports difficulty expected in prospective code changes. If the communications hypothesis is true, then there should be much more convergence among model code cities than among local code cities in the amount of expected difficulty. In fact, there is less convergence. This is an especially interesting finding in view of the declared advantages of association with a model code group: access to centralized information clearing-house activities, reports of the evaluation of new products and systems, provision of a range of advisory services to the

local agencies--from in-service training for departmental staff to plan review services. The lack of agreement among the model code cities on this issue suggests that matrix of information and advice which is available to model code cities may not always be taken effective advantage of.

Further comparison of Figures 4-1 and 4-2 yields another, more disturbing insight that fortifies the "climate of fear" hypothesis -- the rank ordering of 14 items on the basis of the controversy their adoption actually generated bears no statistically significant relation to the rank ordering on the basis of expected controversy.¹⁰ It is clear from this analysis that, as a group, local building officials appear to be operating in two different worlds, a real one and a projected one. What are the sources of this discrepancy? what sustains it? This thesis argues that it is the agency's clientele and reference entities, operating through their dominance of the agency's communications with the world outside, that sustains the climate of fear--by provoking "controversy" almost at will--and influences in several subtle ways the technological decisions of the local building department. Some of the influence is asserted at the local level; precisely how is described in the remainder of the present chapter. But influence is asserted by the agency's clients

¹⁰Spearman's Rank Order Correlation Coefficient, $R=0.10$; there is a 25-40% probability that chance alone would have yielded and R this size.

at the regional and national level, too. That is the subject of Chapter 5.

Under the conditions of duress visited on them by their clientele, local building officials (LBO's) are required to determine the adequacy and appropriateness of innovative building techniques before permitting their use in the local jurisdiction. More precisely, before the local building code is changed to accomodate innovative technology, that technology must have gained the assent of the LBO's, custodians of the local building regulations. Nominally, that assent is forthcoming only after the LBO's have judged that the new materials, methods for designs can satisfy the substantive standards in the areas of public health and safety. This is a demanding task, intellectually and financially, a task beyond the means of virtually every local agency in the nation, as a review of agency staffing and funding reveals.¹¹ David Pellish, Technology Officer of the giant New York State Urban Development Corporation dispaired of managing this problem with the resources at his disposal, remarking:

"Unfortunately, we do not have the technical or the financial resources to review all of the innovations that come before us, to analyze them and protect the interests of the future occupants of our housing."¹²

¹¹See Chapter 3, above; also Manvel, Local Land and Building Regulation.

¹²Testimony before the Subcommittee on Housing of the House Committee on Banking and Currency, 1971 HUD Hearings, Part 2, (Washington: USGPO, 1971), p. 612.

The UDC, has access to the governmental facilities of a state that leads the nation in early adoption of innovations in governmental services, generally¹³ and to the resources of a private industrial economy of world scale¹⁴ and whose technological effort is lead by a recognized expert in the field (Mr. Pellish). With all this, the UDC concedes an inability to maintain technological currency in the means used to meet its own standards of architectural design and construction. Pity, then, the hapless LBO whose budget is often confined to the revenues realized in the issuance of building permits and whose own professional expertise is limited to that garnered a generation earlier in a career as a construction worker, often within a single specialized trade, confined to one metropolitan region and to the thoughtways of another technological era. Finally, if the use of performance requirements--which are permissive rather than restrictive with respect to construction details--were to become widespread, then the local building official would be confronted with what could be, in the words of one academic expert, an "impossible burden."¹⁵ The LBO's intellectual and organizational resources are not up to the task. Where does

¹³Jack L. Walker, "Diffusion of Innovations Among the American States", American Political Science Review, Vol. LXIII, No. 3, (September, 1969), pp. 880-899.

¹⁴Neal R. Pierce, The Megastates of America, (New York: W. W. Norton, 1972).

¹⁵Dietz, The Building Industry, p. 259.

the local official turn for technical advice? To the very industry from whence he came and whose regulation in the public interest he is now entrusted. For a while the public at large might view building regulations with rampant indifference punctuated--in the wake of building catastrophes--by occasional outrage. This other, more restricted public--the institutions of the building enterprise--pays rapt attention. And that attention is well rewarded, for it is the argument of this thesis that the clientele and the reference entities of the building department are the prepotent influence on the determination of public policy with regard to innovative building technology to the virtual exclusion of wider constituencies--such as consumers and users of environments and the public interest generally--constituencies without forceful representation in this process.

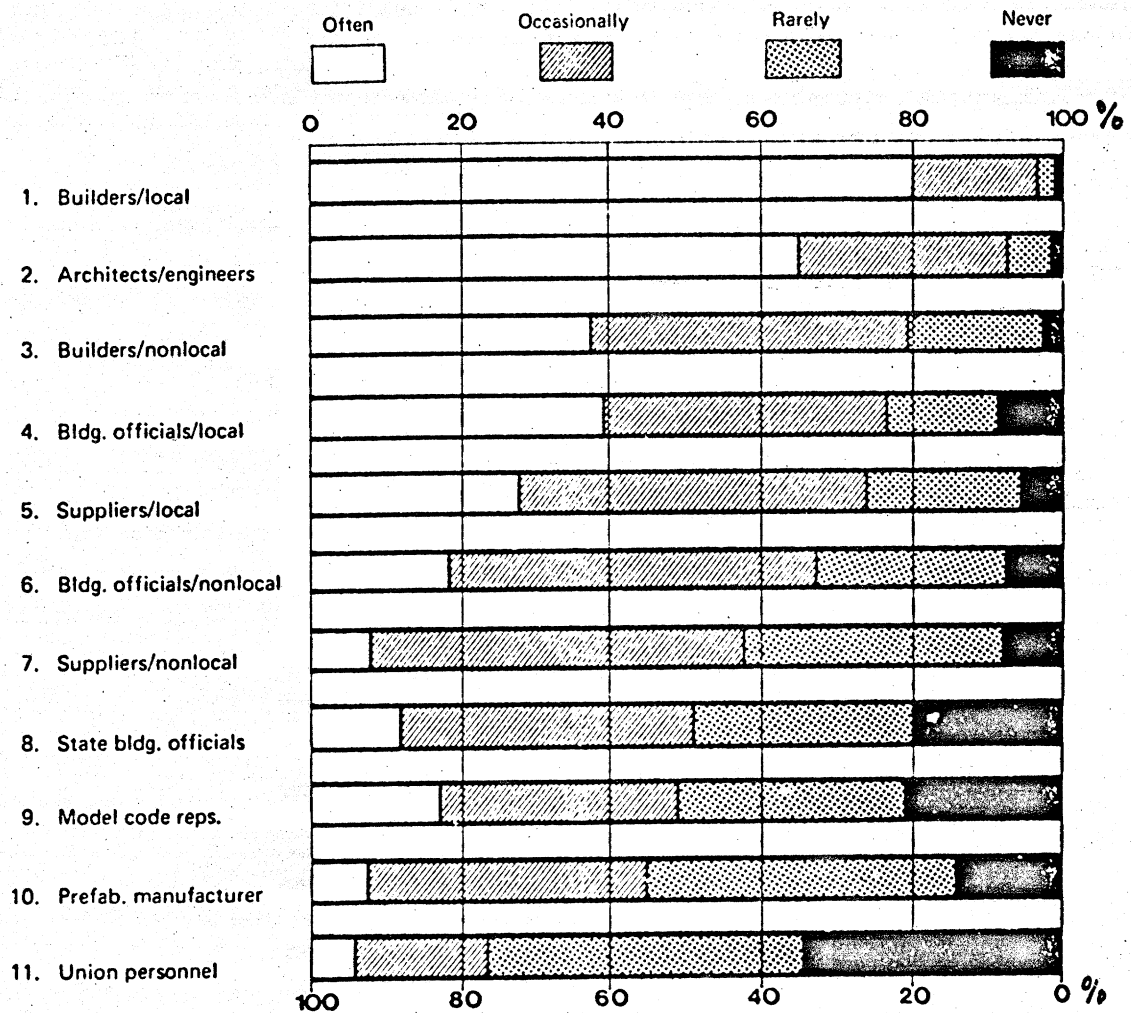
The Local Building Department; Its Clientele and Its Reference Groups

Like most public agencies, the local building department has essentially three constituencies, a large undifferentiated public which pays it little attention, and a much more restricted set of citizens with which it deals often and intimately. We are speaking now of the latter, the "effective constituency" of the agency's clientele and its reference entities. The agency clientele is comprised of those individuals and organizations whose lives and livelihoods are

profoundly affected by its actions. For the building department this clientele is comprised of the elements of the building enterprise active in its locality. Commonly this will be the contractors, builders, suppliers of building materials, representatives of the building trades unions, the owners and managers of real estate investments, and members of the local finance and real estate business. As Figure 4-3 suggests, members of this agency clientele are quite familiar to the local building department. The ICMA survey, as reported in Chapter 3, revealed that about three out of four local building officials are actually recruited from among the ranks of the industrial segment of the clientele (Table 3-11). This is not surprising, given the fact that construction-related experience is a highly regarded prerequisite for recruitment into the building department staff (Tables 3-12 and 3-13). This two way flow of personnel between regulator and regulatee is a commonly observed phenomenon in all areas of governmental regulation. The most infamous examples are probably the movement of Pentagon officers into the executive suites of large defense contractors and the movement of broadcasting executives on and off the Federal Communications Commission.¹⁶ And since neither building officials nor construction tradesmen are noted for their geographical mobility in pursuit of their

¹⁶ Numerous diverse instances are reported in Michael C. Jensen, "Musical Chairs in Business and Government", New York Times, 12 November 1972, Section 3, p. 1+.

FIGURE 4-3 FREQUENCY OF BUSINESS CONTRACT WITH LOCAL BUILDING DEPARTMENT



1. Builder personnel: local. 2. Architects or engineers. 3. Builder personnel: out-of-town. 4. Building officials from cities: within your county. 5. Building material producers and suppliers personnel: local. 6. Building officials from cities: outside your county. 7. Building material producers and suppliers personnel: out-of-town. 8. Building official from state building agency. 9. Representative of a model code group. 10. Prefabricated home manufacturer or his representative. 11. Building trade union personnel.

careers (indeed, Mills has reported that many craftsmen would rather leave the industry than change locales), it is safe to assume that the building official is recruited from the very same clientele he is later required to police.¹⁷

Unlike the general public, which vacillates between the poles of indifference and outrage with respect to the local building department--indifference most of the time, outrage usually only in the aftermath of a building failure--the agency clientele is present every day, without fail. The casual observer might suspect that the agency has the dominant position in the two-way relation between agency and clientele, but students of organizational behavior, and particularly of governmental organizations, have noted that the clientele contributes in important ways to the success and survival of the agency.¹⁸ this is so for two reasons. In the first place, the enterprising head of the public agency can utilize his clientele to lobby in his behalf when he seeks to influence his organizational superiors at budget-setting time, and on

¹⁷The lack of mobility of local building officials was noted in Richard L. Sanderson, Codes and Code Administration (Chicago: Building Officials Conference of America, Inc., 1969), p. 188. Mobility of construction workers is discussed in D. Quinn Mills, Manpower in Construction: New Methods and Measures, Proceedings of the Twentieth Annual Winter Meeting of the Industrial Relations Research Association, (Washington: December 28-29, 1967), pp. 269-276 and by Lowell F. Gallaway, Geographic Labor Mobility in the U.S: 1957-1960, (Washington: Social Security Administration, Office of Research and Statistics, Research Report No. 28, 1967), Chapter 4.

¹⁸A thorough discussion of clientism is found in Grant McConnel, Private Power and American Democracy (New York: Vintage, 1966). And in Ira Sharkansky, Public Administration: Policy-making in Government Agencies (Chicago: Markham, 1970), pp. 182-189. A pioneering analysis was Phillip Selznick's, TVA and the Grass Roots

other occasions when agency effectiveness is under review. In the second place, if the clientele is well organized into user groups or voluntary associations of some sort, it can speak for the public as a whole and can dominate the message channels that the local agency utilizes to monitor its technological and political environment. This thesis argues that this second function of the agency clientele--its dominance of the message channels that the agency utilizes in monitoring its political and technological environment--has had serious consequences for the diffusion of innovation in building technology. However, the clientele is diverse in its continually shifting composition and many erroneous impressions about it are abroad. Hence the following examination.

A closer view of the agency clientele reveals that it is comprised of labor and management, supplier and purchaser, regulator and regulatee. Because of its diverse nature that clientele as a whole is ambivalent about building code reform or modernization. There are elements among the clientele who wish to introduce innovative building practices, who wish to market novel construction materials, who wish to reorganize their building activities, and they find the existing pattern of building codes a restraint, something to be overcome. On the other hand, those who supply conventional or traditional building materials, those firms capable of serving only a highly localized market, those material distributors who have for long periods of time enjoyed exclusive area franchises,

and those labor groups who find certain work jurisdictions preserved under the innocuous sounding terms and definitions used in the existing local building regulations, are not likely to welcome any disruption of their privileged status. For these latter groups the existing pattern of local building codes, and the contents of those codes with respect to specific technological currency, are quite satisfactory.

Reference Groups

Closely related to yet distinct from the clientele are the groups and individuals among whom local building officials cultivate an intellectual and status reinforcing relationship as opposed to the client-patron relationship. We speak now of the reference group, defined by social psychologists as the

groups to which individuals refer themselves when forming attitudes, norms and values....Individuals take as a reference group a group to which they aspire to belong and begin to socialize themselves to what they perceive to be its forms (without their becoming formal members).¹⁹

A building official like most modern individuals may have several reference groups simultaneously. He may be a card-carrying unionist and a member of a model code association while he aspires to be recognized by the technical editor of a respected trade publication. Each of these sentiments might predispose him toward certain actions as he acts out his destiny. One can readily imagine that the local

¹⁹Herbert H. Hyman, "Reference Groups", International Encyclopedia of Social Science, Vol. 13, pp. 354, 356.

official deprived of job security, salary and status, might have a greater need for psychic references to groups beyond his work environment than other perhaps more immediately satisfied individuals.

References entities. The premier reference entities of the local building departments are voluntary associations, primarily model code groups, the professional associations of local building officials and other local building officials individually. These entities differ markedly from the remainder of the reference entities and from the agency's clientele, that are given chapter length treatment elsewhere (Building Officials in Chapter 3 and Voluntary Associations in Chapter 5). What follows is a description of the remaining reference entities.

The operative question for the moment is, however, how do the reference individuals, groups or other impersonal entities (such as the technical literature) that deal in a symbolic currency, enter the technological determination of the local agencies. Do they have an effect that reinforces or nullifies that of the material inducements proffered by the agency's clientele.

The remainder of this chapter provides that view and also identifies the roles taken by members of the agency clientele and reference groups when the agency itself is faced with a potentially controversial decision on the accommodation of the local building code to innovative technology.

In the pages that follow, members of the building departments' clientele are described in considerable detail as an introduction of

the analysis of their influence on agency decisions. This serial description is intended also to acquaint the reader with the changes occurring among and between members of the agency's clientele. It will be shown that changes in the provisions of the local building code bear serious economic consequences for most of them. The clientele members described here are those identified in the survey questionnaire (See Appendix, Exhibit A, pp. 7-8) administered to the local building departments of the Nation. The findings of that survey are at the heart of this study.

Chapter 6 will identify the implications of these findings for the diffusion of innovative building techniques and Chapter 7 will interpret the meaning of those implications for public policy. For now, let us examine in close detail the composition of the agency's clientele and the precise reasons for its scrupulous attentiveness and assiduous participation in the code modification process.

Building Material Producers or Supplier Representatives

Centralized building materials producers service a highly dispersed construction industry through a network of wholesale firms that function as local distributors, sales agents and/or trade representatives. Essential as these marketing services are, material producers and local suppliers further their influence on the local building community through their less well-known role as suppliers of capital. All of these functions are undergoing change that is certain to affect the diffusion of innovations in the building industry.

Direct purchases from supplying industries amount to nearly three-fifths (57%) of the value of construction, most of this, of course, moving through the local distribution channels that link the industrial user--the builder or contractor--with the originating manufacturer. That local supplier provides his customers with services for which he exacts a fee in the form of trade margins--selling expenses and profits--added to the costs of the materials themselves. The type of service varies from one buyer to the other. Homebuilders for instance, are increasingly prepared to pay for specialized inventorying and distribution services (such as delivery of materials in one house "bundles").²⁰ General contractors, on the other hand, who work on longer lead times,

²⁰ Reavis Cox, et.al., The Supply-Support Requirements of Home-builders, (Washington: The producers Council, Inc., 1962), pp. 2, 26, 49.

value more reliable fabrication and on-time special order deliveries rather than prompt delivery from inventory.²¹ Architects rely on the suppliers for product and price information.

Those requiring different services, of course, pay different margins. The aggregate, wholesale and retail trade services--highly localized services--account for 14.8% of total direct construction purchases. Two other local supply services, transportation and warehousing, add a further 5.5% so that distribution and supply services account for 20.3% of direct construction purchases ²² Not goods but services, and local ones at that. In 1971, this amounted to more than \$22.2 billion.²³

These distribution and supply services are provided on a decentralized basis by wholesale and retail merchants, by merchandize agents or brokers, all local, and by the manufacturer's own sales forces operating through branch offices. A shift is under way in the shares of sales volume commanded by each of these entities. The antagonism lies not so much between wholesale and retail operators--a blurry line separates them--but many function in both areas. In fact lumber yards and

²¹ Reavis Cox, et. al., Adaptation to Markets in the Distribution of Building Materials, Vol. 1, Introduction and Recommendations, (Washington: The Producers Council, Inc., 1963), p. 319.

²² George R. Kinzie, "Construction's Input-Output Profile", Construction Review, Vol. 16, No. 8 (August, 1970), Table 1, p. 6. All figures are exclusive of the costs of the products themselves.

²³ Computed from U.S. Bureau of the Census, Statistical Abstract of the United States: 1972, (Washington: USGPO, 1972), p. 671.

building materials dealers which are very large suppliers to construction are classified as retail establishments by the Office of Economic Analysis.²⁴ Rather a struggle ensues between local and out-of-town agents. In this struggle, local wholesalers and retailers make common cause against the interlopers and do not hesitate to use the provisions of the local building code to further their joint cause.²⁵

Retail establishments selling building materials and supplies (excluding hardware stores) numbered 42,472 in 1967, down from 46,746 four years earlier. Sales however grew 13.5 percent in the same interval.²⁶ Their wholesale counterparts are more difficult to enumerate since they are classified by kind of business, e.g., electrical goods, only a fraction of whose outlets serve building construction. Table 4-2 provides servicable estimates of wholesale activity related to construction

²⁴ Allan H. Young and Claiborne M. Ball, "Industrial Impacts of Residential Construction and Mobile Home Production, Survey of Current Business, Vol. 50, No. 10, (October, 1970), p. 16. The Office of Economic Analysis is the new designation for the Office of Business Economics.

²⁵ Aspects of this controversy are described by the remarks of Kenneth E. Behring, Chairman of the Behring Corporation of the 49th Annual Meeting of the Producers Council, Incorporated at Atlanta, September 15-17, 1970 and reported in Construction Products and Technology Vol. 46, No. 4 (November 1970), p. 21. Milton Smithman, an executive of the National Association of Homebuilders who specialized in codes and industrial standards matters, remarked to this author in an interview on 17 December 1970, that the local materials dealers having "sewn up the situation" are against local code changes that would facilitate inroads by non-local suppliers. Such changes as those bringing local codes into uniformity are especially to be repelled, goes this argument.

²⁶ U.S. Bureau of the Census, Census of Business, 1967, Vol. II, Retail Trade--Area Statistics, Part 1, U.S., Summary, (Washington: USGPO, 1970), Table 1, parts A and B.

TABLE 4-2

Estimates of Wholesale Establishments Specializing in Sales
to the Construction Industry

Supplying Industry	Percent Distribu- tion of Total Di- rect Construction Purchases, Among Major Supplying (1) Industries, 1963	Construction Pur- chases as percent of Supplying Industry Sales 1963 (2)	Total Wholesale Establish- ments 1967 (3)	Wholesale Establish- ments Assigned to Con- struction, 1967 (4)
(a)	(b)	(c)	(d)	(e)
Heating, Plumbing and Structural Metal Products	13.9	80.4	9110	7320
Construction Materi- als (stone and clay products) (5)	12.9	100.0	7423	7423
Lumber and Wood Products (except containers) (6)	8.9	41.0	6199	2540
Electrical Lighting and Wiring Equip- ment	2.7	47.0	7742	3640
Paint and Allied Products	2.4	50.4	2377	1190
	40.8			22,113

Notes to Table 4-2

1. Kinzie, "Construction's Input-Output Profile", Table 1, p. 6.
2. Ibid., Table 3, p.7.
3. U. S. Bureau of the Census, Census of Business, 1967, Vol. IV, Wholesale Trade--Area Statistics (Washington: USGPO, 1970), Table 1.
4. Computed from Column (c) and Column (d); Calculations to slide-rule accuracy.
5. Census of Wholesale trade includes in its definition of "Construction Materials" those industries Kinzie designates "stone and clay products". See Volume IV, Wholesale Trade--Areas Statistics, Appendix, p. 55-11.
6. Lumber yards are classed as retail establishments if sales to homeowners, the general public and sales to contractors and builders are greater than half of total receipts. Ibid. The number given here undercounts considerably. There are 24,296 retail lumber yards with payroll. A large fraction of these also operate as wholesalers, too. See Census of Retail Trade, Table 2.

by combining data from input-output studies of construction with recent business censuses for only those industries that are among the major construction - supplying industries. The crudity of the estimates issues from the fact that the two sources reported their findings at different levels of aggregation. The figures are approximations for this further reason, the fraction of supplying industry wholesale outlets "assigned" to construction in Table 4-2 is likely to be low because, given the dispersed nature of the industry, more wholesale outlets are required per unit of sales than would be the case if the construction industry were concentrated in a few regions of the country or were decidedly metropolitan in orientation.²⁷

Illustrative of the redefinition of tasks and division of labor in wholesale activities between the dispersed, locally-based wholesalers, jobbers and brokers on the one hand, and the typically centralized manufacturers on the other is the shift underway in the shares of wholesale trade that they command. Briefly, the traditional locally-based distributor is caught in a pincers movement. On one flank the merchant homebuilders, their erstwhile customers, have grown large

²⁷See Chapter 3 of Walter Isard, Location and Space-Economy, (New York: Technology Press-Wiley, 1956), for a detailed survey of empirical studies of spatial dispersion.

An anomaly to this rule is the situation in the apparel trade. Here despite highly dispersed retail outlets, 70% of clothing wholesale sales occurs in New York City. The percent in certain speciality lines is even higher. Herbert Kashetz, "Changing Style on Seventh Avenue", New York Times, 26 November 1972, Section 3, p. 1.

enough to deal directly with manufacturers and basic producers in order to both reduce unit costs but also to establish product specifications and standards that would simplify his own on-site work.²⁸ On the second front (another military analogy, how combative is this business!), the building materials producers, espying the large fraction of the building dollar going to wholesale and retail trade services as a source of potential profit and able to take advantage of both hard technologies like the Interstate Highway System and soft technologies such as computer-aided inventory control, are moving down the supply channel to meet the merchant builder. The most recent Census of Business bears out this contention by reporting the following shifts among the three types of wholesale operations in the sales of lumber and millwork:

In 1963, wholesale sales of lumber and millwork were \$7,525,894,000 and were handled as follows:

Through merchant wholesalers	75.5%
through manufacturer's sales branches, offices	15.4%
through merchandise agents, brokers	9.2%
	<u>100.1%</u>

In 1967, wholesale sales of lumber and millwork were \$8,251,375,000 and were handled as follows:

through merchant wholesalers	70.0%
through manufacturer's sale branches, offices	20.4%
through merchandise agents, brokers	9.3%
	<u>99.7%</u>

²⁸Edward P. Eichler and Marshall Kaplan, The Community Builders, (Berkeley: University of California Press, 1967), p. 51-52.

Sales through manufacturer's own outlets grew 46.2 percent in four years, 23 times the rate of growth of sales through merchant wholesalers and over four times the growth of sales through brokers. Payroll growth was not commensurate, suggesting that changes are underway in the manner in which work is organized as between capital and labor, too. This tendency is also indicated by the fact that in the four year intercensal period the number of merchant wholesaling and brokerage establishments dealing in lumber and millwork decreased by 13 percent and 21 percent respectively, but manufacturer's sales establishments increased by 19 percent.²⁹

The case is made a fortiori in identifying the same trend in the stone and clay products industry, dealing in materials with extremely low value-to-weight ratios and, consequently, a greater elasticity of demand for the transfer service. But even here a move away from local sources is manifested, contrary to the logic of industrial location economics as that might seem.³⁰ Wholesale operations in these commodities have undergone the following shifts:

²⁹U.S. Bureau of the Census, Census of Business, 1967, Volume IV, Wholesale Trade--Area Statistics, (Washington: USGPO, 1970), Table 1, pp. 1-8, Computations to slide rule accuracy.

³⁰Edgar M. Hoover, The Location of Economic Activity, (New York: McGraw-Hill, 1963), p. 25.

In 1963, wholesale sales construction material (defined as stone and clay products) were \$6,261,010,000 and were handled as follows:

through merchant wholesalers	48.5%
through manufacturer's sales branches, offices	46.0%
through merchandise agents, brokers	5.5%
	<u>100.0%*</u>

In 1967, wholesale sales of construction materials were \$8,138,220,000 and were handled as follows:

through merchant wholesalers	40.2%
through manufacturer's sales branches, offices	55.4%
through merchandise agents, brokers	4.2%
	<u>99.8%*</u>

Sales through manufacturer's own outlets grew 56.8 per- cent in four years, over seven times the rate of growth of sales through merchant wholesalers and over 50 times the rate of growth of sales through brokers (sales through brokers actually declined 0.6 percent). Whereas merchant wholesalers' payroll increased at half the rate of increase in sales. Mechanization of operations and other efficiencies in large scale materials-handling no doubt account for this disparity which is likely to further the inroads of the primary producer into local sales. Finally, in the four-year intercensal period, the number of merchant wholesaling and brokerage establishments decreased by more than 10 percent and the number of merchant wholesalers of stone and clay products grew by less than one percent, but manufacturers' sales establish- ments increased by over 29 percent.³¹

³¹Census of Business, 1967, Wholesale Trade--Area Statistics, Table 1, p. 1-8, Computations to slide rule accuracy.

The same calculations can be made for the other construction supply industries: plumbing, heating, electrical, etc. A cursory review indicates that all are tending in the same direction but at different rates. They portend a restructuring of the materials-input side of the industry, where over half the construction dollar is spent. They auger a change in the functionally interdependent relations among manufacturers, wholesalers, retailers and the facilitating agencies like transportation and warehousing, whose combined services (as measured by trade margins) account for over one-fifth of construction expenditures. One cannot say that the change was not anticipated. The editors of Fortune described a need to change the building materials distribution in a book published in 1932!³² What is remarkable is that others now speculating on the future technology of the industry continue to ignore this distribution aspect although it draws more resources than does on-site labor.³³

³² Housing America (New York: Harcourt, Brace, 1932), cited in Behman, et. al., Productivity Change for Carpenters and Other Occupations in the Building of Single-Family Dwellings and Related Policy Issues, Center for Labor Research and Education, Institute of Industrial Relations, University of California, Berkeley, April 1971, p. 12.

³³ See for example, Gerald M. McCue, William R. Ewald, Jr., and The Midwest Research Institute, Creating the Human Environment (Urbana: University of Illinois Press, 1970), pp. 216-217. And Selwyn Enzer, Some Prospects for Residential Housing by 1985 (Middletown, Connecticut: Institute for the Future, January 1971). On pp. 4-7, 35 forecasts are advanced, none deals with the system of distribution.

A reconstitution of the building products supply chain is in progress, so much is clear from the data adduced. The reasons for it are not obscure and have also been identified admittedly in abbreviation fashion, for they are not central to the analysis at hand. Symmetry leads us then to advance an equally brief prognosis for the consolidation of retail, wholesale and direct production operations. It is likely that the nature of building materials distribution will respond most sensitively to further changes in the technology and means of "transfer operations" (as Professor Hoover used the term, that is, to include procurement and distribution services³⁴) as well as the increasing returns to scale in the transformation of materials (say, piping) into more valuable forms (plumbing walls, to follow this example). With increased value come greater transportability and as construction materials of low unit value give way to higher value components, the once relatively high transfer costs are made relatively lower and local industry finds itself in need of protection against encroachment from without. The "natural" protection of once-relatively high transfer costs that encourage local self-sufficiency in local industry in the first place³⁵ is no more. The two trends are mutually reinforcing:

³⁴ Hoover, The Location of Economic Activity, pp. 7-8.

³⁵ Ibid., p. 167.

higher value building components, with a lessened elasticity of demand for the transfer service, appear at the same time that transfer services are dramatically improved (the latter benefiting from advances in hard technology--the Interstate highway system, mainly--and in soft technology--methods of inventory control and computer-aided marketing services). As the economics of the situation encourage the consolidation of numerous local market service areas into fewer regional ones, deliberate public action will be required to sustain historic, business relationships. Anti-trust and other public interventions into market economies had as their impetus much the same sentiment. Namely, the preservation of historic market relationships among and between buyers and sellers. It is this sentiment, too, that might prompt local merchants to seek legislative and administrative protection of their markets through the local building code and other development controls.

Architects or Engineers. These professionals clarify and interpret the substantive needs of owners, clients or users of environments or facilities and through a series of intellectual operations develop the production documents that guide the work of builders and contractors in the execution of new environments or facilities. The A and E's, as they are familiarly known, bridge the realms of ideas and of practical action. The function both as the client's agent and as organizer of the building team. Like all professionals, their work

is distinguished by the application of special knowledge, usually acquired by means of advanced education, by the exercise of relatively autonomous discretion, and by a commitment to a standard of excellence or virtue (of a special sort) into which narrow and immediate self-interest is subordinate.³⁶

A part of the professionals' service to clients is the communications link he represents with advanced practice the world over. Thus, the A and E's have a professional interest in maintaining their own technological currency. Moreover, their standing as relatively autonomous quasi-intellectuals, not to mention their avowed professional standards, impels them to creativity and invention in the dispatch of their responsibilities. In brief, then, the A and E's have a special role in the diffusion of innovation in their fields of endeavor. But, as we shall not explain, their material interests are sometimes better served with the continued use of obsolete methods and in the continued existence of geographically fragmented regulation of the building industry.

As elements of the building industry, architects and engineers manifest the attributes of the industry as a whole, diverse, dispersed, detached and discontinuous. The diversity

³⁶This discussion is based on Corrinne Gilb, Hidden Hierarchies: The Professions and Government, (New York: Harper and Row, 1966). and Talcott Parsons, "Professions," International Encyclopedia of Social Science, (New York: Macmillan, 1966), pp. 536-547.

of the A and E's occurs within the firm and is in part a reflection of the complexity of the building enterprise and the reluctance of professionals to specialize: fewer than 10 percent of architectural firms specialize in only one type of work, say, schools or shopping centers.³⁷ Engineering firms are more likely to have specialized as between structural, mechanical and land planning design.

There are a total of almost 50,000 architectural and engineering firms in the U.S. and over half (55%) are essentially one-man operations (firms without payroll). Larger firms, employing four or more, although comprising only 22% of firms, accounted for over 85% of receipts. The one-man operations, in contrast, realized only 6% of receipts. The geographic dispersion of A and E's conforms to that of the construction industry itself, varying from ubiquity two ways: a tendency toward metropolitan areas, particularly those in economic ascendancy or those handful like San Francisco and Boston, prominently--that are uncommonly attractive to architects, artists and advertising men.³⁸

³⁷ Francis T. Ventre, "An Introductory Comment on the Periodical Literature in Architectural Design and Construction," Journal of the American Institute of Planners, Vol XXXIII, No. 5 (September, 1967), p. 359.

³⁸ Except for the last phrase, all the foregoing is based on U.S. Bureau of the Census, Census of Business, 1967, Subject Reports, Selected Services: Architectural and Engineering Firms (Washington: USGPO, 1970), passim.

The architectural design, construction specifications and working drawings that comprise the contract documents directing the builder or contractor's efforts must be in compliance with the pertinent development regulations in effect at the time of the work. The A and E's, by custom, secure the required regulatory approvals; these are usually granted only after the local building departments have reviewed the documents. A and E firms, deployed chiefly as small offices the country over, become expert in the intricacies of the local codes and the idiosyncrasies of local code enforcement and administration. Moreover, the architects and engineers themselves, although somewhat more cosmopolitan in experience and outlook, retain membership in the local building fraternity, the same group from which the local building official is recruited.

The distinctiveness of local building conditions has been among the historic causes of a localized orientation of the building industry and has also been given as a reason for local building regulations. Over time the local code has itself emerged as one of the distinctive local conditions to which the local building industry, including the A and E firms, have to adapt. It stands to reason, Hometown architects know the Hometown code best; it is likely they even helped to write it. In a certain sense, the local architects and engineers, worldliness and cosmopolite professional ethos notwithstanding, are like the other local building industry interests, they have a stake in maintaining a distinctive local

code. Let it be the complicated liturgy, they will be its priests, interpreting it to outsiders, for a fee. For example: Hometown chooses the site for a prestige office structure for a national firm, which has engaged a "name" architect from Boston. The prestigious architect early seeks a Hometown firm with which to associate for the project. The reasons for these ad-hoc associations have almost always to do with prosaic operations: site data, observation or supervision of construction operations, call-backs after the project is completed, intelligence as to fitness of local contractors and suppliers of labor and materials and, usually first chronologically, the local code and the manner of its administration and enforcement.³⁹ The ad-hoc association gains the out-of-town firm expedience and also gains the local firm a client and, if the out-of-towner is prestigious enough, exposure in the architectural press. These are considerable benefits for a professional whose code of ethics preclude advertising.

This situation poses a dilemma, however, for the conscientious professional. On the one hand (and in the interest of the building industry's technological progress) he may wish to see building codes rationalized, simplified and consolidated

³⁹This catalog of tasks was recited for the present author by two architects whose Boston-based firms practice the world over and almost invariably associate with firms local to the remote-from-Boston site.

into national standards, accelerating thereby by process of innovation, facilitating the exchange of communication and even widening the geographical range of individual practice. On the other hand, maintenance of the present fragmented pattern of local building regulation does preserve each local professional group its own bailiwick.⁴⁰ Enough professionals overcome the latter, selfish impulse to sustain an overall reputation for progress in terms of universality and heterophilia.⁴¹

Builders. In this category are combined operative builders (SIC 6561) of the country (most often homebuilders) who build on their own account for sale to others and general contractors (SIC 1511) who provide construction services to clients who assume ownership upon completion of the project. discussed later are speciality contractors (SIC 17) whose relations with other elements of the industry, particularly distributors,

⁴⁰The strength of architectural ethics are such that the present author, whose early education and experience is in that field, had not originally considered A and E's in such a technologically regressive role. Charles Field, a research colleague who had not undergone a socialization into the profession (he studied in the liberal arts), pointed out the possibility. To discover that I had come as far as I had and still harbored such illusions was embarrassing.

⁴¹A most outstanding recent example was that of a Boston architect, co-author of the new Boston Building Code and Chairman of the State Board of Schoolhouse Standards (SBSHS), who testified before the State Legislative Committee in support of reform legislation that would have the effect of abolishing both the Boston Building Code and the SBSHS and its code.

are distinctive and often specific to a particular technology. Let it suffice for the moment to say that speciality contractors function, at best, as temporary consorts to general contractors and, at worst, as adversaries. Whereas with home-builders or operative builders, on the other hand, relations can be fairly characterized as being more cooperative than competitive, wherein home-builders and their specialty contractors have been known to function for years as a building team without competitive bidding!⁴² Another source of antagonism between general and specialty contractors is the differential risks that are borne by these co-venturers in a business that even in the best of situations operates in the face of high risks and low returns on sales,⁴³ two phenomena that "shouldn't", under the tenets of business economics occur in the same enterprise. But these issues call for examination beyond that required for the present purposes.

The main reason for focussing on the homebuilders and general contractors is that it is they who are required to tender plans for examination by the local building department-- including the plans directing the work of the specialty

⁴²For a beginning discussion of these differences see Reavis Cox, et. al., The Supply Support Requirements of Homebuilders, p. 8.

⁴³U. S. Economic Development Administration, Office of Minority Business Enterprise, Urban Business Profile: Contract Construction, (Washington: USGPO, April 1972), pp. 1, 5-7.

contractors--and it is they who must secure the building permit before any work can begin on the site.⁴⁴

The most recent Census of Construction enumerated 156,000 general building contractors of which 61,351 (39.3%) were establishments without payroll, comprised of proprietors and working partners only, and 13,237 operative builders with payroll.⁴⁵ Enumeration of operative builders without payroll is complicated by the high rate of entry and exit from this enterprise. Virtually any carpenter with a pick-up truck would qualify for this category. Both general contractors and operative builders are supremely locally oriented and rarely range beyond the states wherein they are physically located. Only 4,462 of the 95,049 general contracting firms with payroll report work in other states. For operative builders the figure is 190 out of 13,237.⁴⁶ The territorial range of operative builders is even more restricted than that indicated by the Census of Construction. Cost confine themselves to a single metropolitan housing market and one quarter of the build at only on site or subdivision in any given year.⁴⁷

⁴⁴ Sanderson, Codes and Code Administration, p. 152.

⁴⁵ U. S. Bureau of the Census, Census of Construction Industries, 1967, United States Summary Part A--Statistics for All Construction Establishments (CC 67-1-1A). (Washington: USGPO, 1970), Table A1, p. 1A-2.

⁴⁶ U. S. Bureau of the Census, Census of Construction Industries, 1967, Construction Industry Statistics General Building Contractors, SIC 1511, CC 67-1-2 (Washington: USGPO, 1970), Table i, p. 2-9.

⁴⁷ Michael Sumichrast and Sara A. Frankel, Profile of the Builder and His Industry, (Washington: National Association of Homebuilders, 1970), p. 160.

Increasingly in recent years builders have turned from a production to a marketing orientation, a change forced on them by increased competition in local markets that was, itself, induced in part by the spread of rationalized construction methods among firms of all sizes. As in other commercial spheres, price competition is giving way to other forms of product differentiation: the "planned community" setting, promotional tie-ins with manufacturers of household appliances and other consumer durable goods, and most recently, housing service contracting, wherein the final sales price includes a guaranteed maintenance arrangement in which the complete unit is serviced by the builder's crews. These changes bring the local homebuilder, and to a lesser extent, the general building contractor, into a further consideration of regulatory practices.

With price competition so keen, any introduction of new devices and techniques that would precipitate either union reluctance or prolonged deliberation by local code authorities would be, in the words of the staff vice-president of the NAHB Research Foundation, "foolish and imprudent" since these attempts

would surely involve great expenditure of time and money on (the builder's) part and in a proportion wholly unrealistically related to the business value of its use.⁴⁸

⁴⁸Ralph Johnson, "Constraints to Builders Use of Cost Saving Innovations and New Products," p. 5.

The disproportion repeatedly adduced in these discussions usually takes the form of the rhetorical question: why jeopardize the marketability of a \$25,000 unit by dallying with a potential cost reduction of \$25.00.

Related to the disproportionality argument is the reluctance to incorporate changes that "might damage our reputation to unfavorable comment by the competition."⁴⁹ Builders--like other suppliers of consumer durables--are as often selected on the basis of their general reputation as they are on the price and design of the particular product. Builders husband their reputations jealously. Johnson found that fear of loss of reputation lay behind builder reluctance to incorporate innovations using lesser amounts of material even through the structural integrity remained well above safety minimums and resulted in buildings incorporating less material but more value as a result.⁵⁰

The role of the building code in all this is to enforce a uniform set of physical minimums within which all local builders must compete. Furthermore, Field has suggested that local codes serve as a "tariff barrier" to competing builders from beyond the immediate community. Either way, builders live intimately with their local codes and are prominent in its formulation, as we shall see. But beyond the provisions of the code itself is the manner of its administration and

⁴⁹Ibid., p. 5.

⁵⁰Ibid., p. 6.

enforcement. Here the local building department, can by means of selective enforcement, destroy whatever uniformity of conditions exists among local builders. This is an opportunity for regulatory abuse that is more of a problem than that of the obsolete substantive provisions of the code document. Shipler's expose of the City of New York Building Department and Johnson's survey of over one thousand homebuilders the country over both reveal that great discretionary power is in the hands of these officials.⁵¹ Johnson found that the sixth ranking constraint was "Although not prohibited specifically by the code, local building officials frown on it and we comply with their desires."

⁵¹The Shipler articles are cited in the Introduction, fn. 7. The revelation from the homebuilders appears in Ralph Johnson, "Constraints to Builders Use of Cost Saving Innovations and New Products," p. 6.

The Special Problem of the Specialty Contractor

Code changes affecting production method confront specialty contractors with difficult choices in the matter of mobilizing influence for or against those changes. And when such a large constituency--71% of construction establishments are specialty contractors--is ambivalent, no firm estimates can be made about their likely effect in the local agency's decision affecting "method" changes. The quandary that occupies specialty contractors issues from the fact that they frequently serve both as contractors of services and vendors of building supplies and in these roles have contradicting demands. Take the case of the plumbing, heating (except electric) and air conditioning contractors who numbered over 47,000 in 1967.⁵²

The logic of off-site preassembled plumbing trees, once accepted by local building departments and adopted as common practice, could conceivably lead to fabrication at points beyond the specialty contractor's own shop, beyond the jobber's warehouse and as far up the channels of supply as the producer of the pipe and fittings as well as the bathroom fixture manufacturer. This is an extremely important consideration for the local plumbing contractor who frequently serves the local construction industry as a plumbing and heating retailer and wholesaler as well as intermediate fabricator and installer.

⁵²1967 Census of Construction (CC67-1-5), p. 5-1.

The local specialty contractor is compelled to this double function--as fabricator-installer-contractor as well as wholesaler-middleman--for two reasons. First, since he deals as the contractor for services which can be performed by one rather restricted set of workers who, through their unions, either dominate that special work force or monopolize that special work force⁵³ is extremely vulnerable to changes in the wage rates of, often, a single special trade union⁵⁴ (albeit likely that the specialty contractor himself retains card-carrying membership in the very local from which he has recruited his work force.)⁵⁵ This leaves little room for maneuver in close bidding competition with other specialty contractors in the same specialty whose whorkers are likely to be recruited from the very same union local. Secondly, the cost of the materials fabricated or installed by the specialty contractors is so high--40 to 55 percent of the value of construction put in place in the case of plumbing and heating materials⁵⁶--that the more perceptive among the specialty contractors realize that a great deal of their effort in securing a steady flow of work and in managing a

⁵³Dunlop, "The Industrial Relations System in Construction," pp. 255-277 passim.

⁵⁴George Strauss, Unions in the Building Trades, University of Buffalo Studies, Vol. 24, No. 2 (June, 1958), p. 68.

⁵⁵Ibid., p. 69.

⁵⁶Martin Segal, The Rise of the National Association, p. 14.

skilled work force was yielding great revenues to supply firms with healthy trade margins. Margins, moreover, that were not eroded by upward pressures of union wage demands. "You cannot make it," a New England mechanical equipment manufacturer and distributor told an interviewer, "selling labor alone."⁵⁷

For either or both of these reasons--one essentially defensive, the other imaginatively entrepreneurial--specialty contractors perform multiple functions. A consequence of this double-role is a certain ambivalence in the face of technological innovation, especially concerning those innovations that require a lower level of skill than was required for the practice of the technique to be displaced. On the one hand, specialty contractors seek to increase the productivity of their workers while at the same time maintaining a demand for specialized and highly developed skills that are a substantial part of their stock in trade (not to say their raison d'etre as specialty contractors). On the other hand, those specialty contractors that have moved into the supply

⁵⁷ Richard L. Degen, Assistant Treasurer, Sterling Radiator Company, Inc., interviewed at a meeting of the MIT-Harvard Study of the Construction Seminar, Winter 1972. The situation of Mr. Degen's firm is evidence that not only do contractors move backward up the channels of supply to improve their competitive positions, but producers of building materials and components are integrating their operations forward down the supply channel.

business are likely to wish to develop and propagate construction materials and methods that will have a wider market, appealing to the lesser-skilled "force-account" construction⁵⁸ work force, the handyman jack-of-all-trades.⁵⁹

As if this were not complicated enough, the ambivalence of the specialty contractor facing technological innovation affecting the skill mix required on future jobs is compounded by labor-management relations in this sub-field of construction. Unlike the general contractor, who generally hires large numbers of workers in a variety of trades (mostly laborers, carpenters, and masons) for brief duration,⁶⁰ the specialty contracting firm, in contrast, is much smaller in size, with each specialty group being more socially, economically, politically and ethnically cohesive,⁶¹ and whose work is more steady, accomplished by crews whose composition is itself stable overtime and who execute their work with much less

⁵⁸"Construction undertaken by non-construction firms for themselves with their own work force" (often maintenance men, F.V.), to be contrasted with "contract" construction firms that undertake construction work for others. See Peter J. Cassimatis, Economics of the Construction Industry, (New York: National Industrial Conference Board, 1969), p. 26 and fn. 11.

⁵⁹As Seidman has pointed out, the bete-noir of craft-conscious unionists. Joel Seidman, The Worker Views His Union, p. 58.

⁶⁰Arthur L. Stinchcombe, "Bureaucratic and Craft Administration of Production: a Comparative Study," Administrative Science Quarterly, vol. 4, no. 2 (September 1959) pp. 168-187. See also Dunlop, "The Industrial Relations System in Construction," passim, who argues that the aim of the industrial relations system in construction is to provide some continuity for an always changing set of actors.

⁶¹R. R. Myers, "Interpersonal Relations in Building Industry," Human Organization, Vol. 5, No. 2 (Spring 1946), pp. 1-7.

immediate supervision (bear in mind we are dealing with a highly skilled, relatively uniform workforce). Moreover, the specialty firm is likely to be owned and operated by a card-carrying mechanic who, in slack times, will rejoin the ranks of the practicing craftsmen.⁶² He is much more loyal to his own trade, his union, and even to other specialties, than he is to either the basic trades or his managerial counterparts, the general contractors.⁶³

Thus the specialty contractor is divided between loyalty to his original trade and its current artisans, the appeal of wider markets for his wares and his antipathy toward general contractors and the basic trades allied with them. Technological innovations in the building industry will affect each of these constituencies in varying and sometimes opposing ways, benefitting some while discomfitting others. Hence, the specialty contractor's ambivalence in the face of change, an ambivalence strikingly in the case of plumbing and mechanical services which account for 55% of the value of residential construction put in place.

⁶² Gordon W. Bertram and Sherman J. Maisel, Industrial Relations in the Construction Industry, (Berkeley: University of California, Institute of Industrial Relations, 1955), p. 12.

⁶³ Ibid., p. 43. General contractors return this slight by "bid shopping" among competing specialty firms, preying particularly upon marginal firms in order to chasten "responsible", established firms. Remarks of Joseph Courter of Courter Construction, a New York City mechanical contractor at the MIT-Harvard Construction Seminar, Winter, 1971.

Union Representatives: The building trades unions are included among the clientele of the local building department for several reasons. Most prominent among them is that the provisions of the local building code have a prima facie impact on the volume of work and the conditions of that work performed by local building tradesmen, whether or not they are unionized. (This, of course, is a perfect analogue with the local code serving as a guarantor of protected markets for the building products suppliers discussed earlier.) That impact is so pervasive and is manifested in so many ways that it is analyzed that several points in this study.⁶⁴ At this point we address the role of the construction labor unions as an actor in the decision process leading to change, or lack of it, in the local building code. This role is strengthened by social ties between construction unionists and local building officials, of whom at least a half are former Craftsmen, (See Table 3-11) many of whom retain their union cards, and by the deployment of union strength into locals whose territorial jurisdictions are of a scale congruent, but not identical, to the legal jurisdictions of the local municipal building departments. This last, as will be demonstrated, is an important consideration.

Like the construction industry as a whole, union strength in the aggregate is massive: 3.5 million members (not all

⁶⁴Notably in Chapter 5 and Chapter 6.

of whom are at work in construction itself, however) of the 17 unions comprising the Building and Construction Trades Department of the AFL-CIO.⁶⁵ Like construction as a whole, the effective unit, of course, is not the aggregated national membership but the craft specialization, and within that, the union local. The number and size of the construction local varies by craft. There are about 2600 locals of the United Brotherhood of Carpenters and Joiners of America but only 108 locals of the International Union of Elevator Constructors; in all, there are about 10,000 locals of construction unions. The average membership of a local of the International Union of Operating Engineers (whose "locals" sometimes span state lines)⁶⁶ is about 1000 but locals of the Wood, Wire and Metal Lathers International Union average 50 members⁶⁷

This local deployment enables the national international unions to mount a ground-swell of grass-roots support for or resistance to changes in the local building codes that affect

⁶⁵ Estimate of C. J. Haggerty, President, B and CTD of the AFL-CIO reported in "Labor Looks at Breakthrough and Speaks Its Mind," HUD Challenge, Vol. 11, No. 3, (March 1971), p. 4. There are often discrepancies in these figures. The Directory of National and International Labor Organizations in the U.S., published by the Department of Labor's Bureau of Labor Statistics, is issued biennially and with figures that are so much as three years old. Persons knowledgeable in these matters defer to the figures that appear in the Officers' Reports to the biennial AFL-CIO Conventions and printed in the published proceedings.

⁶⁶ Gordon W. Bertram and Sherman J. Maisel, Industrial Relations in the Construction Industry, (Berkeley: Institute of Industrial Relations, 1955), p. 11 ff.

⁶⁷ Computed from U.S. Conference of Mayors, Community Relations Service, Changing Employment Practices in the Construction Industry, Experience Report 102, (Washington: USCM, September 1965) and the BLS Directory mentioned in fn. 65.

union welfare. The accompanying hazard of this dispersed deployment is that recalcitrant locals can stymie the best laid plans of the union's home office. This has been one of the effects of the Labor-Management Reporting and Disclosure Act of 1959 (known familiarly as the Landrum-Griffin Act) which greatly diminished the once-preponderant influence of the home office on the local's internal affairs and community involvement. International-local differences have erupted over the rate and extent to which innovative technology should be accommodated by local building codes. Let an example illustrate: The United Association of Plumbers and Pipefitters (UA), have collaborated with the Cast Iron Soil Pipe Institute (CISPI) in stemming the invasion of the domestic piping market by the producers of plastic pipe.⁶⁸ Unfortunately for the campaign planners, not all UA locals cooperated. In the words of one UA official:

There are over 700 business agents across the country in the UA and each one of them has to be convinced. Some locals liked plastic pipe! It's cleaner work, the plastic pipe weighs less and you don't have to know as much. The business agent can get his worst guy work setting plastic.

Moreover, when CISPI introduced its counter-innovation, "no-hub" and "compression gasketed" cast-iron pipe, many locals turned down their former allies, complaining that the

⁶⁸This episode is given fuller treatment in Chapter 6. The present account is based on a 27 January 1971 interview with Robert E. McMillan, in successive years legislative counsel to both the UA and CISPI.

labor-saving devices would deprive plumbers of work. This episode points up not only the lack of monolithic consensus between unions internationals and their locals, but also the necessity to examine the pressure politics of construction regulation in technological context. This latter task is elaborated in Chapter 6.

Union participation in policy setting at the local level is markedly different from their involvement in national councils. Usually, leaders of the international unions can be counted on to articulate broad societal goals to legislative bodies;⁶⁹ but even here the leadership of the Building and Construction Trades unions are noted for their diffidence and lack of interest in broader goals,⁷⁰ and concern themselves more with preventing the dilution of craft skills and with maintenance of craft jurisdictions.⁷¹ The job of the Building and Construction Trades Department leadership (made up of the

⁶⁹ As described by Andrew Biemeller, former Congressman and currently legislative specialist with the AFL-CIO in a conversation with Theodore Lowi reported in End of Liberalism, p. 707.

⁷⁰ Derek C. Bok and John T. Dunlop, Labor and the American Community, (New York: Simon and Schuster, 1970), p. 428.

⁷¹ Ibid., p. 468. Of course, "preventing the dilution of draft skills" is a code message meaning "enforce obsolete skill requirements and lengthy apprenticeship."

presidents of the 17 AFL-CIO international unions⁷² that represent construction workers in collective bargaining) is, in the words of one union official, to "have no one say no (to technological change."⁷³) Their job is to set the atmosphere and define the terms of subsequent local contract negotiations. Where new technologies are involved, approval of underlying concepts are secured and are often reflected in the wording of national contracts. But it is the local level that "delivers the goods or stops things in their tracks."⁷⁴ And those who have studied the local political involvements of labor unions note that, especially since World War II,

⁷²The member unions are: United Brotherhood of Carpenters and Joiners of America; Bricklayers, Masons, and Plasterers International Union; International Union of Operating Engineers; International Brotherhood of Electrical Workers; International Union of Elevator Constructors; Laborers International of North America; Granite Cutters International Association; International Association of Bridges, Structural, and Ornamental Ironworkers; United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; International Association of Marble, Stone, and Slate Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers, and Marble, Mosaic and Terrazzo Workers and Helpers; Wood, Wire, and Metal Lathers International Union; International Brotherhood of Painters, and Allied Trades; International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmith, Forgers, and Helpers; International Association of Heat and Frost Insulators and Asbestos Workers' Operative Plasterers and Cement Mason's International Association; United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; Sheet Metal Workers International Association.

⁷³Interview with Reese Hammond, Director of Research and Education, International Union of Operating Engineers, on 28 August 1969.

⁷⁴Ibid. Predictably, the identical dynamic occurs in the relation of the relation of the model code associations and their subscribing local government units.

labor leaders who are often indifferent to local government matters, energize themselves only for goals of "immediate practical tangible importance;" moreover patronage is sought "only if it results in influence over agencies directly keyed to welfare."⁷⁵ The local building department becomes the principal focus of whatever energies the local Building and Construction Trades Councils (the powerful affiliated locals of the several building and construction trades unions) wish to apply.

In the construction industry generally, the local institutions--not their national counterparts--are the primary agents. So it is with the regulators and so with the trade unions. One measure of the pre-eminence of local units in the construction labor movement, and the key to their autonomy, is their financing. Whereas in the industrial unions of the country, \$3.00-\$3.50 out of the \$8.00-\$12.00 monthly dues are forwarded to international headquarters in Washington. In the construction unions, the locals traditionally advance about \$0.75 to Washington.⁷⁶ This has two immediately inferred consequences: local autonomy--as manifested in the plumber's refusal to cooperate with the International with respect to plastic and cast iron pipe--and the creation of sizeable treasuries for disbursements for deserving local causes. Little wonder that local politicians court the support of the local

⁷⁵Book and Dunlop, Labor and the American Community, pp. 427-430.

⁷⁶Hammond Interview.

Building and Construction Trades Councils (campaign appearances in a "hard hat" is now de rigeur for office seekers) and that local officials reserve "labor seats" on regulatory boards and commissions that affect the construction industry. The effect is that local building codes are written with union assistance (thus offsetting advice from building materials producers through their trade associations and their local dealers). But one advantage tacitly reserved to the unions (and denied to the suppliers is that the codes are administered and enforced by persons with experience in construction work; ment appointed from among the active or recently retired local union membership.⁷⁷ This is a blue-collar counterpart to the well-established--and legal--tradition in local government of rewarding loyal campaign contributors with special consideration in the dispensing of municipal building construction contracts.⁷⁸

Civic or Voter Groups and Mass Media (TV, Magazines, Newspapers). American political tradition is distinguished by the belief in the active participation of an enlightened citizenry in the affairs of government. An article of faith in the minds of the Founding Fathers, notably Jefferson; a

⁷⁷ See, for instance, Joel Seidman, et. al., The Worker Views His Union, (Chicago: University of Chicago Press, 1958), p. 44, and Tables 3-9, 3-11, 3-12 and 3-13 of this study

⁷⁸ "(Mayor) White Gives No-bid Jobs to Campaign Contributors," Boston Globe, 5 October 1972, p. 1.

foreign observers like de Toqueville and Bryce; resuscitated by Progressive reformers; given official (and budgetary) sanction in the Great Society; and a slogan only recently adopted by a radical Left (apparently lacking in fresh ideas) in the challenge (which now sounds dated): "Power to the People!" A belief in the worthiness of popular participation is too fundamental to require much explanation here.

Students of urban politics and analysts of urban policy have attempted to apprehend the reality of wider citizen involvement in the affairs of government: the nature of involvement, the extent of participation among various socio-economic groups. A substantial corpus of empirical work has been completed and even more is underway to answer these questions. Usually couched in terms of General Systems Theory or a more general social ecology model, these studies attempt to relate environmental stimuli or "inputs" (such as intra- and extra-community socio-economic and political variables) to policy responses or "outputs" (such as delivery of urban services), treating city government or the "political system" which operates on the "throughput" as--of all things--a residual black box about whose inner workings this school of political science has surprisingly little to say.⁷⁹ Civic

⁷⁹A useful review and summary of scores of such studies of local governments is Brett W. Hawkins, Politics and Urban Policies, (Indianapolis: Babbs-Merrill, 1971). On a larger geographic scale see Mattei Dogan and Stein Rokkan (eds.) Quantitative Ecological Analysis in the Social Sciences, (Cambridge: MIT Press, 1969).

or voter groups are seen as one prominent vehicle by which the involved citizen gains access to his local government and, wishing both to extend this tradition of research and to test the validity of its generalizations to the arena of regulatory politics in the building field, we include them among our clientele. Also included in this analysis are the means to which local groups turn as intermediaries when addressing their governments, the mass media.⁸⁰ We refer in this category to the public communications to the local building departments except the technical and trade press, which is examined elsewhere in this section. The empirical studies of community power and community decision-making make continual reference to the influence of local and national communications media. We shall inquire into the utility of these media in informing the decisions of, or stimulating to action, the local building department in Chapter 6.

Prefabricated Home Manufacturer. Although ventures in prefabricated housing are not new to the U.S.--there is a story, probably apocryphal, that the Mayflower carried a pre-cut house--the attention lavished on Operation Breakthrough during the late 1960's has revived popular interest in rationalizing building construction by means of building complete houses in factories and then shipping them, intact, to homesites. This, of course, is one end of a continuum of rationalizing techniques; other less spectacular advances

⁸⁰The dynamics of this process are described in Michal Lipsky; Protest in City Politics, (Chicago: Rand McNally, 1969.

in production method. such as partial prefabrication and pre-cutting of lumber, have increased worker output in house-building considerably.⁸¹ Factory production methods vary from firm to firm and so does the extent to which these methods have displaced most traditional on-site fabrication. Over two thirds of home manufacturers surveyed by Field do no more than either pre-cut materials, or fabricate panels (usually of wood and comprised of structure, sheathing and, sometimes, mechanical appurtenances) or some combination of the two. In these cases, much erection and finishing work remains to be done after the unit is delivered to the site and the disruption of the locale building routine is minimal. In fact, both pre-cutting and off-site preassembled panels are used by a great number of traditional "stick builders." This discussion is to show that the definition of "home manufacturer" is difficult because many of his techniques are widely used throughout the "conventional" industry. Similar definitional problems exacerbate the difficulty of assigning quantities to either the number of home manufacturing firms and the size of their output. The U. S. Government, for instance, has since 1970 included mobile homes (surely a manufactured home) in its figures for housing starts; other

⁸¹One rather complete analysis of selected crafts in Sara Beman, et. al., Productivity Change for Carpenters and Other Occupations in the Building of Single Family Dwellings, passim.

students of the industry, notably Field, do not. The discrepancies in estimates are sometimes ludicrous. The National Association of Building Manufacturers estimates that in 1969, one in four dwellings produced was a "modular" or "sectional." A special subcommittee of the Federal Statistics Users Conference reporting figures for the same year estimated 6.6% of starts in the form of modulars or sectionals.⁸² Combining government figures with Fields' and using Fields' extensive definition (although it does not include mobile homes), manufactured houses have accounted for from 12 to 17% of U.S. production in the 1960's. And, although the volume of manufactured housing even including mobile homes will grow, its share of total housing production has been forecast to fall as the capital markets return to "normal" and money for home mortgages becomes more readily available.⁸³

The beginning of this return to normalcy may already be at hand for recent business reverses of several of the once-glamorous industrial housing producers--all of them at the "complete unit" end of the continuum and a few of them

⁸²The two discrepant figures are reported with no explanation on successive pages of Henry B. Schechter and Marion K. Schlefer, "Housing Needs and National Goals" in House Committee on Banking and Currency, Paper Submitted to Subcommittee on Housing Panels, Part I, 92d Congress, First Session (Washington: USGPO, June 1971), pp. 58-59.

⁸³D. Quinn Mills, "Housing and Manpower in the 1970's," Papers Submitted to Subcommittee on Housing Panels, p. 290. Also, "Mobile Homes Help Fill Housing Goals," Engineering News-Record, 9 April 1970, p. 33.

participants in Operation Breakthrough--have damped the more exuberant enthusiasts of this mode of innovation in residential construction technology.⁸⁴ Two building code problems one said to have hindered wide use of manufactured buildings. Many codes impose requirements in materials and methods of construction that either diminish the relative advantage of off-site prefabrication or rule out altogether. Secondly, being instruments of local governments, the building code requirements often vary from one municipality to another. This disparity of codes even within a single housing market area requires the manufacturer to either vary his designs accordingly or to design for the most restrictive condition. If he chooses the first course, he cannot achieve volumes that bring favorable returns to scale, the chief virtue of serial production in the first place. If he chooses the latter course, he is forced to sell an overdesigned, and hence, overpriced unit in the less restrictive jurisdiction. The prefabricated home manufacturer has a direct stake, therefore, in not only the technological currency of the local building code but their inter-jurisdictional compatibility as well.

⁸⁴Two news items, one year apart, represent the ascending enthusiasm and the sober reassessment: "The Great Housing Crisis," Newsweek, 22 June 1970, pp. 69-74; and "Instant Nothing ?/Factory Housing Faces More Sticky Obstacles Than Its Boosters See/Unions, Red Tape, Old Codes All hinder 'Glamour' Field From Getting Off Ground/Is it 'Ahead of Its Time'?" Wall Street Journal, 8 April 1971.

In several key respects, the prefabricated home manufacturer is the mirror-image of the local "stick-builder," whom we have described earlier.⁸⁵ Where the builder or contractor is a man of importance in the locale of the construction the home manufacturer is an unknown out-of-towner. Where the builder deals with hundreds of local suppliers and a dozen specialty contractors, the manufacturer is an economic isolate, dealing with far fewer local institutions. These differences, as we shall see, have their consequences in the differential impact that the two groups have in the determination of local regulatory policy and practices.

Government Publications. Although governments are prodigious publishers, government publications--even those

⁸⁵ For a more complete profile and contrast see Charles G. Field, "Home Manufacturing and Building Codes: A Confrontation Between Technology and Institutional Regulation," Unpublished Ph.D. Thesis, Harvard University, 1971, Chapter 2 and pp. 72 ff.

oriented to the technological community--are not perceived by commercial firms as major channels for acquiring technological information.⁸⁶ Whether or not this is true for the local governmental regulators of the building industry prompts the inclusion of this category in the roster of participants in the code modernization process.

The Federal government, alone, maintains in print 40 reference works in the field of building science, 21 on cement and concrete, 22 commercial standards and 22 product standards related to building.⁸⁷ State governments are the principal sources of specialized texts for codes affecting mechanical systems and life safety aspects of building regulation, as was pointed out in Chapter 2.

Trade or Professional Magazines or Journals. Each segment of diverse building industry claims several trade and technical periodicals. For instance, and citing only those distributed in the U. S. and Canada, 43 periodicals service the plumbing and heating industry; another 28, air conditioning; 46 in lumber and millwork; 5 in sheet metal; 13 in brick and ceramic tile; 6 in stone and rock. Other periodicals attempt to reach several segments of this heterogeneous design, construction and management audience at once. These are the

⁸⁶ John S. Gilmore, et. al., The Channels of Technology Acquisition in Commercial Firms, and the NASA Dissemination Program, (Denver: Denver Research Institute, University of Denver (NASA CR-790), June 1967, pp. 26, 45-48.

⁸⁷ Scientific Tests, Standards, Price List 64 (Washington: USGPO, May 1972), passim.

30 periodicals centered on architecture and the 130 taking as their central concern, the field of construction.⁸⁸ Most trade publications, of the sort enumerated above, cover relatively restricted fields and deal with applicable technology comfortable within the state-of-the-art. With so many publications in the same field--though there is a tendency toward geographic regionalism among them (like, for instance, Southern Heating and Cooling or Western Plasterer)--duplicate coverage of innovative technology is highly likely. Articles tend to be oriented to practice or to surveys of the state-of-the-art. The more successful of them are studded with often informative advertisements and almost all feature new product sections, sometimes printed on special paper stock to signify special importance.⁸⁹

Journals, oriented as they are toward highly specialized academic disciplines and serving as forums for very precise discussion of esoteric subjects, are not the common reading fare of technologists. This has been shown to be true of even the "high technology" or "128-type" industries.⁹⁰ Rather, their readership is among the active researchers, and more

⁸⁸ Ayer Directory of Publications, "Trade Technical and Class Publications," (Philadelphia: Ayer, 1971).

⁸⁹ For the characteristics of the design and construction "trades," see Francis T. Ventre, "An Introductory Commentary on the Periodical Literature in Architectural Design and Construction," Journal of the American Institute of Planners, Vol. 33, No. 5 (September, 1967). Much of this discussion is drawn from that invited review article.

⁹⁰ John S. Gilmore, et. al., The Channels of Technology Acquisition in Commercial Firms.

likely the academic rather than the industrial researcher. The relative lack of use of the journal medium by local building officials is manifest and, henceforth, our discussion will center on the trade and professional periodical literature other than the learned journals.

In practice, the utilization of written communications, as an aid in specific problem-solving, even among engineers in high-technology industries, is either low or non-existent.⁹¹ However, in maintaining a state-of-the-art awareness--clearly the situation in which the local building official finds himself--the literature is pre-eminent as an aid to technological decision making.⁹²

In certain respects, our discussion of the professional and technical trade press is an extension of the remarks made on the voluntary trade associations, since many of the periodicals are either endorsed by, subsidized by, or published by the industry association. As such, they carry with them the potential abuses that have been manifested by the voluntary associations. These entities are so important to the study of innovation and regulation in the building industry that Chapter 5 in its entirety is devoted to a discussion of their origin and mode of existence.

⁹¹Thomas J. Allen, "Performance of Communications Channels in the Transfer of Technology," Industrial Management Review, Vol. 8, No. 1 (Fall, 1966), p. 92.

⁹²Thomas J. Allen and Stephen J. Cohen, "Information Flow in Research and Development Laboratories," Administrative Science Quarterly, Vol. 14, No. 1, (March, 1969), p. 18. This article also cites support for this view in the mass communications research literature.

Building Products Catalogs. The previously cited studies of communication flows into and within commercial and industrial firms all acknowledge the preponderance of vendor-dominated channels of information. This reliance on externally-generated technological information occurs even within the high-technology industries with extensive R and D facilities of their own. It is altogether likely that industries like the building industry, which as Chapter 1 described, have no internal research capability, is even more dependent on these vendor-dominated channels. For this reason, building product catalogs are included in our analysis of local agency decision-making processes in the face of technological change.

The ephemeral promotional literature describing building products is voluminous. As a matter of survival, the building industries in virtually every country have imposed upon themselves a cataloging scheme to order this burgeoning paper output. In the U. S., the American Institute of Architects initiated the Building Products Register and McGraw-Hill, through its F. W. Dodge subsidiary, has compiled the Sweet's Catalogue. The size and scope of the Sweet's (as it is universally referred to) places a dimension of this blizzard of colored, glossy--and often informative--paper. The Sweet's is a compendium of product literature that is distributed free of charge (the costs are borne by the firms who wish to become a part of the Sweet's file) to architectural and engineering firms of the Nation whose annual gross receipts are large enough for them to qualify for the service. The

current Sweet's is comprised of 12 over-sized volumes that occupy 37 inches of shelf and weigh the proverbial ton; Sweet's is replaced annually to accomodate product lines changes, additions and deletions. Add to this the promotional materials developed and distributed by the building products manufacturers that do not choose to pay for the Sweet's service and those whose markets are regional and local only. Moreover, since Sweet's deals only with relatively standardized industrial products, there is still the literature describing numerous customized specialty products--built one-of-a-kind--as well as documents pertaining to the hundreds of commodities--lumber, sand, gravel, etc--where lack of brand-name differentiation, and, consequently, brand-name advertising, excludes them from the Sweet's compilation.

Decision-aiding Communication in Local Building Departments

When faced with potentially controversial decisions, the scant local agency resources for independent determination of technological questions are routinely augmented by the agency's clientele and other sources of information. Although nominal participation is widespread across an array of groups that informally assist, only a handful of these groups dominate extra-agency and non-governmental information inputs to these decisions. Moreover, these departments, whose perceptions of their political and technological environments may be said to be a produce of the agency-clientele interaction, often act as if a "climate of fear" attended their technological decisions.

The decision-aiding communications to the local building departments take several forms. There are personal interactions with technical representatives acting for vendors of building products and with local contractors and builders, and architects who appear frequently at the agency's door in the course of routine business (see Figure 4-3). There is association with other local building officials either in periodic formal meetings (typical for cities subscribing to one of the model codes) or on an occasional basis. There is, too, the sporadic involvement with citizens, singly or in groups, seeking relief of one sort or another. Finally, there are the impersonal sources: principally, promotional literature, trade periodicals and government publications. These are the means, each with its special aptitudes, used by local agencies to maintain a continuing surveillance of their political and technological environment.⁹³ From this environment and these sources come stimuli for agency action or inaction. All these messages course through channels to the significant officials in the building department. And, in the course of transmission, the weight lent to the message

⁹³A discussion of the several media and their uses in the diffusion of innovation is found in Rodgers and Shoemaker, Communication of Innovations. The importance of environmental monitoring and its particular relation to innovation is described and analyzed in Paul R. Lawrence and Jay W. Lorsch, Organization and Environment: Managing Differentiation and Inegration, (Boston: Division of Research, Harvard Graduate School of Business Administration, 1967).

is affected by the qualities of the sources and the channels. All the foregoing are commonplaces of communications theory⁹⁴ and all are manifested in the communications attending the technological decisions of building departments.

Although the local building department staff themselves occasionally originate suggestions for improving the local code, the preponderance of the more innovative practices are originated outside the agency, chiefly by the agency's clientele. Discussions are carried on widely. But support for and resistance to the code change under review call forth intensive participation by only a few members of its clientele and professional reference groups. Most important to an understanding of the code modification process is the realization that the agency interposes a filter of skepticism between its most ardent suitors from among its clientele and the information sources among its reference entities. This realization--adapted to the particular circumstances--must inform any analysis of collective decision making.

The foregoing findings are drawn from responses of agencies who identified, from a roster presented them, those individuals and organizations that participated in recent

⁹⁴See, for instance, Colin Cherry, On Human Communication, (Cambridge: MIT Press, 1957), and Ronald G. Havelock, et. al., Planning for Innovation, Ann Arbor: University of Michigan, Institute for Social Research, July 1969), especially Chapters 5 and 6.

code modification decisions. The accompanying illustrations summarize survey responses to the following questions:

1. Where did the idea for this change originate?
2. With whom was it discussed?
3. Which were the most trustworthy sources of information?
4. Which groups most supported the change?
5. Which groups most resisted the change?

The respondents identifies participants in two code modification decisions, those provoking the "most" and the "least" controversy. Responses to these directly opposing extremes were sought for it was felt that these actions might have had higher salience in the agencies' collective recall. The response rate--indicating salience--was much higher for the "most difficult" change--that is to be expected. But what was unexpected was the finding that the participants appeared in almost identical roles regardless of the extent of controversy attending the code change decision.⁹⁵ The lowest inter-correlation occurred on the "resist" question where radical shifts in the degree of active resistance by a few actors were enough to alter rank-order correlations. Specifically, the "out-of-town union representative" declined from the third most active resistor to the most controversial

⁹⁵ Specifically, Spearman's Rank Order Correlation Coefficients for participants in controversial or non-controversial decisions were, in order from Figure 4-4a through 4-4e: 0.93; 0.97; 0.98; 0.90; and 0.74 and all were statistically significant, with $p < 0.0005$.

change to the sixteenth most active resistor on the least controversial charge. (But the local union representative was the most active resistor on both changes). The second shift was "civic and voter groups" who moved from obscurity (eleventh most active resistor) on the controversial change to fourth place on the least controversial change. This presages what will be for fully developed shortly: the essential irrelevance of lay groups to the code change process. They cannot foment controversy, that is the job of the clientele.

Figures 4-4a through 4-4e indicate that participation in the code modification process at the local building department is widespread. Nevertheless, it is dominated by building supply interests and builders--especially the localities among them. The vendors of materials and local builders are prominent sources of new ideas. Somewhat surprisingly, architects and engineers whose professional ethos would place them in a technological avant-garde are not prominent innovators--at least not on code changes that are controversial. They are, however, prominent originators or innovations considered less controversial and hence "safer"; local building officials from nearby cities demonstrated this same shift.⁹⁶ This manifestation of conservative behavior suggests the design professionals that serve

⁹⁶These two shifts accounted for most of the difference in the rank-ordering of originators of most- and least-difficult code changes.

Figure 4-4 a-e

PARTICIPATION IN COLLECTIVE DECISION MAKING IN THE LOCAL BUILDING DEPARTMENT, BY ACTOR AND BY ROLE.

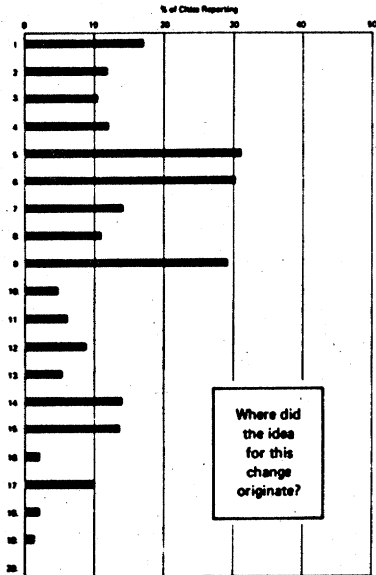


Figure 4-4 (a)

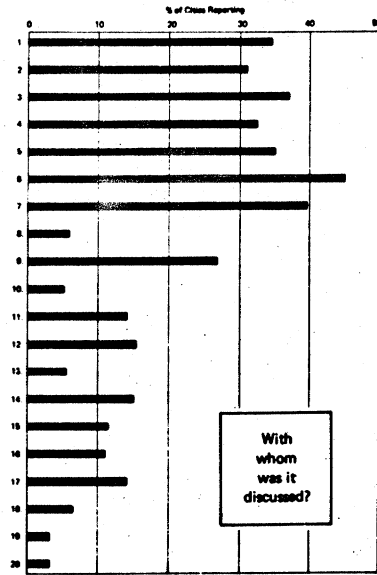


Figure (b)

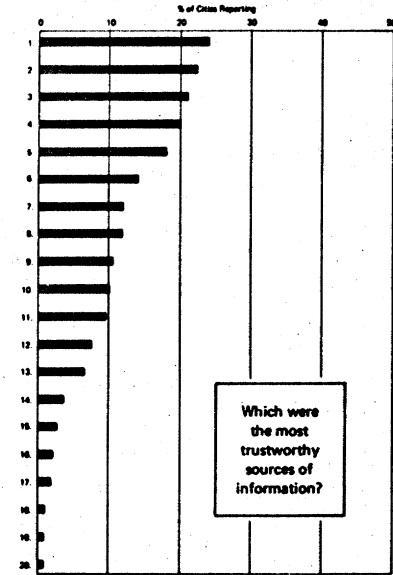


Figure (c)

1. Meetings of professional associations.
2. Building officials from cities outside county.
3. Building officials from cities within county.
4. Architects or engineers.
5. Building material producers or supplier representatives: local.
6. Builder representatives: local.
7. Building department staff.
8. Trade or professional magazines.
9. Building material producers or supplier representatives: out-of-town.
10. Government publications.
11. Other sources.
12. Meetings or conventions of materials producers.
13. Building product catalogs.
14. Yourself.
15. Prefabricated home manufacturer representatives.
16. Union representatives: local.
17. Builder representatives: out-of-town.
18. Civic or voter groups.
19. Mass media (TV, magazines, newspapers).
20. Union representatives: out-of-town.

For the most difficult code item adoption: (a) where did the idea for this change originate? (b) with whom was it discussed? (c) which were the most trustworthy sources of information? (d) which groups most supported the change? (e) which groups most resisted the change?

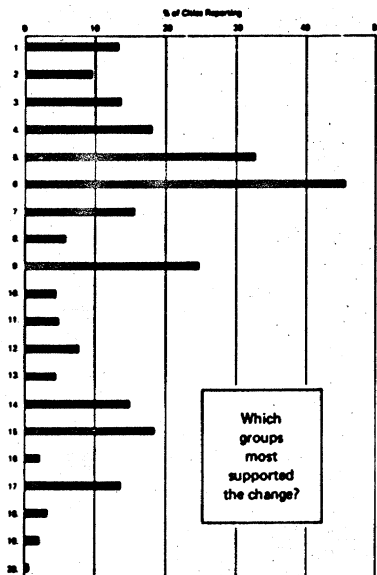


Figure 4-4 (d)

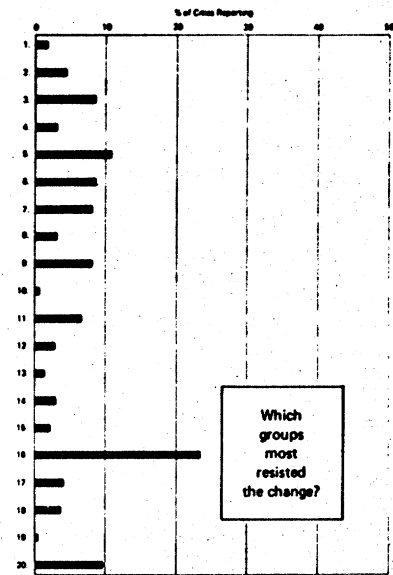


Figure 4-4.(e)

the building industry may be less venturesome than the operative professionals, the builders.

Figure 4-4a reveals that local building officials are exceptional in the primary reliance on personal experience and interaction rather than on documentary sources of novel technology. Most studies of technological communication--whether in the realms of medicine or agriculture and the referents are physicians or farmers--report that impersonal media and documentary sources usually bring the first awareness of an innovative practice. Generally, this initial awareness for impersonal sources is followed by personal contacts and face-to-face relations between the change-agent and client that legitimize the information (often by adding detail) previously transmitted through the impersonal medium. (And it is the interpersonal communication that is typically the most important factor in the decision to innovate.⁹⁷ This "two-step flow of communication" from impersonal media through the opinion leader to the final receivers--⁹⁸ so prominent in

⁹⁷ Elihu Katz, "The Social Itinerary of Technical Change. Two Studies on the Diffusion of Innovation," Human Organization, Vol. 20, 1961, pp. 70-82. And Eugene A. Wilkening, "The Communication of Ideas on Innovations in Agriculture", in Wilbur Schramm (ed.), Studies of Innovation and of Communication to the Public, Stanford University, Center for Communications Research, 1962, pp. 39-60. Both are cited in Havelock, et. al., Planning for Innovation.

⁹⁸ Elihu Katz, "The Two-Step flow of Communication: An Up-to-Date Report on an Hypothesis," Public Opinion Quarterly, Vol. 21, (Summer, 1957), pp. 61-78. This is a landmark article establishing the importance of the impersonal medium-personal contact chain. This concept displaced the then-extant notion of media influencing mass behavior directly.

the study of mass communications and in consumer as well as industrial innovation--does not apply to the local building official.⁹⁹ Rather he relies on more basic, primitive means of monitoring his technological environment, interpersonal ones. On the view of some media specialists, this reliance on personal communication instead of more efficient mass communications is defining characteristic of primitive societies in developing countries.¹⁰⁰

A final observation also touches on the anomalous behavior in the local building department when a technological change is initiated. In most studies of innovation--and especially those involving collective decisions (as when an agency and its clientele participate)--initiators of those decisions are likely to be cosmopolites and persons without routine contact in the social system that is the locus of the change.¹⁰¹ Not so the local building department. Here, even the "idea men"--mostly from among the clientele--tend to be the local building material supplier, the local builder, the local staff.

⁹⁹ Nor, surprisingly, to the average engineer (who) makes little or no use of the scientific and professional engineering literature. Thomas J. Allen and Stephen I. Cohen, "Information Flow in Research and Development Laboratories", Administrative Science Quarterly, Vol. 14, No. 1 (March, 1969), p. 12. What technologists do read, however, are the less sophisticated trade publications that deal less in exotica and more in "applied" knowledge. See Donald G. Marquis and Thomas J. Allen, "Communication Patterns in Applied Technology", American Psychologist, Vol. 11, (November, 1966), p. 1057.

¹⁰⁰ Rogers and Shoemaker, Communication of Innovations, p. 256. See also, Richard L. Meier and Karl Deutch on communications as an index of development.

¹⁰¹ Ibid., p. 277.

Discussion (Figure 4-4b) of prospective code changes serves several important purposes both for the agency and for the agency's clientele. It gives both an opportunity to identify and collaborate the probable impact the prospective code change might have and it is the place where the agency collectively puts a technological toes in the political water.

"Discussion" is a relatively costless activity with a high payoff in several categories. It is virtually costless to both agency and clientele since most of the discussants are regularly encountered during the routine office day.¹⁰² Thus, like any "free good", it is quite liberally distributed--everyone gets into the act. None of the five decision-aiding activities analyzed here enjoys such wide participation.

Another explanation of its popularity, benefits of discussion accrue to all. For the clientele, the discussion step serves as a distant early warning (what the Air Force once called a DEW-line; yet another military analogy!) of potential policy changes that might induce conflict or a disruption of stable relations.¹⁰³ If the discussion period is long enough--and it may be months--the local clientele has an opportunity to consult with their national and regional

¹⁰² Compare Figure 4-4b with Figure 4-3 for an approximation.

¹⁰³ This aspect of administrative relations in regulatory agencies was identified by [Senator] Lee Metcalf in "The Vested Oracles: How Industry Regulates Government". Metcalf's specific reference was to the quasi-official advisory councils appended to many agencies.

trade associations for advice on tactics to advance or retard the change.

The agency, for its part, consults with its reference groups, notably, the model code associations or building officials nearby or in distant cities with similar development characteristics. Another agency benefit is the momentary visibility it enjoys among the clientele. And, through this, show that the local code is an "open code, openly arrived at."

However, the principal agency use of the discussion stage is to identify, possible effects of the code change that might redound harshly upon the agency itself. Such circumspection would save the agency later embarrassment at the hands of parties aggrieved by the code decision and its consequences. Now the avoidance of embarrassment is a prominent consideration in most organizational decisions--whether it is the joint Chiefs of Staff or the local building department--and especially so when a "wrong decision" might affect the economic welfare of local industry groups or the life safety of a community's inhabitants. Either eventuality could result in disciplining the erring department. For most local officials (remember, only one-in-eight has a specified term of office, and for half that one-in-eight, the term is one year) discipline could take one form: dismissal.

A final function of discussion may be psychological. The insecure, low paid, low-status local officials take the opportunity to associate with their certainly more affluent and often higher status clients. It is a truism of social

psychology that lower status members of social hierarchies with little or no possibility of social mobility direct their communications upward "as a form of substitute upward locomotion."¹⁰⁴

On visual inspection along, Figure 4-4d shows that, generally speaking, those who initiate the changes are those who come out and fight the hardest for them-- this is to be expected. For the record, the "originating" and "supporting" actor rosters are highly rank order correlated, $R = 0.93$. And also to be expected, the rosters of actors "supporting" and "resisting" the code modification are in disarray but one is not the inverse of the other (if they were, their Spearman Rank Order Correlation coefficients would approach $R -1.0$. As it is, their coefficient of rank-order correlation is $R = 0.26$ and is statistically insignificant). An arresting development occurs in the "resisting" group roster, (Figure 4-4e) however, that reveals the truly ambivalent nature of the agency's clientele and reference groups posited earlier and calls into question the aptness of the "local tariff" analogy to the local building code. This observation will be explicated and further analyzed at the conclusion of this chapter.

In identifying the patterns of communication and of potential influence on the agency decision process, Figure

¹⁰⁴Allan and Cohen, Information Flow in Laboratories, p. 16, citing several authorities, notably H. H. Kelley.

4-4c is the most telling diagram of all. It reveals that local building departments are very leery of and weigh with deliberateness the flood of signals, messages and blandishments that bombard them from the individuals and organizations identified in Figures 4-4a,b,d, and e. Some are severely discounted, others are respected. The difference depends on their legitimacy in the eyes of the local building officials.

Legitimacy...denotes a condition of positive valuation, validity and acceptance enjoyed by individual [entities] by reason of the accordance of such [entities] with some law, principle or source of authorization.¹⁰⁵

Local building officials know that they, as custodians of a regulatory agency that can dispense or withhold certain economic privileges, are pursued ardently by their clientele. This suit must be weighed against considerations of the public welfare with which the agency is also entrusted. Moreover, there are motivations internal to the agency and to the individual officials themselves that affect the degree of skepticism or deference accorded the incoming messages. In the parlance of MIT, the local official must discriminate between signal and noise. Whatever the source of behavior (it is certain that local agencies encode these incoming messages to reflect their perceptions of the legitimacy of the plaintiff's suit and their loyalties,¹⁰⁶ a study

¹⁰⁵ Julius Gould and William L. Kolb (eds.), A Dictionary of the Social Sciences (New York: UNESCO-Free Press, 1964, p. 386.

¹⁰⁶ The notion of coding schemes and the several purposes they serve are elaborated in Havelock, et. al., Planning for Innovation, p. 6-21.

of communication and influence is incomplete without this consideration. The extent of legitimacy extended to the several participants is identified in Figure 4-4c and can be used to calibrate the volume and nature of client-agency communication.¹⁰⁷ Roughly speaking, the higher the trustworthiness of an information source, the higher likelihood of its credibility and influence with the decision-maker. In a structure of formal authority, of course, the hierarchical place of the information source would likely dictate its credibility further down the line.¹⁰⁸ But the present study deals with an informal social system outside the formal

¹⁰⁷An adjustment for each actor on any innovation might be stated symbolically as:

$$PI_{ij} = fT_{ij}[(O_{ij} + D_{ij})(S_{ij} - R_{ij})], \text{ where}$$

PI = potential influence;
 T = trust index;
 O = index of original sponsorship of innovation;
 D = index of discussion activity;
 S = index of supporting activity;
 R = index of resisting activity;
 i = actor;
 j = specific innovation;

O and D are cumulative properties but S and R are complementary; the cumulation of the latter yields an algebraic sign that is associative and is distributed across all terms in the expression making a vector out of a scalar.

¹⁰⁸A book-length treatment of this subject is Harold L. Wilensky, Organizational Intelligence: Knowledge and Policy in Government and Industry, (New York: Basic Books, 1967).

structure of governmental authority but a system, as we have shown earlier, with several linkages to the local building department.

The legitimizers--the leading actors in Figure 4-4c--representing the norms and values of that social system give the agency sanction, justification and the moral license to act. However, when the legitimizers of a system appear too frequently as supplicants of the system, then the spectre of corruption emerges. Not only, or even especially, a venal corruption involving pay-offs but, rather, a moral corruption whose off-stage presence is felt whenever two masters are being served at once. A less pejorative term might be a conflict of interest. Nevertheless, the public cynicism extended to local agencies--especially those charged with regulatory responsibilities--issues from an apprehension about corruption of this sort. Does this shoe fit the local building department? The evidence is mixed.

One measure of fit would be the extent to which individual members of the agency's clientele and reference groups serve both as legitimizers of new practices as well as the originators, discussants, supporters and resisters of that new practice's acceptance in the local building code. Rank-order correlation between the respective rosters specify that relation and are given in Table 4-3, which should be examined in conjunction with Figures 4-4a through 4-4e.

Relations between the protagonist (i.e. Originators and both Supporters and Resisters) and legitimizer rosters are

Table 4-3

Concordance Between Rank-Ordered Rosters of
Actors Prominent in Local Building Department
Decisions on Innovative Technology

Rosters Compared	Spearman's R	Student's t	Statistical Significance p
1) Trust vs. Originate	0.68	3.93	0.005%
2) Trust vs. Discuss	0.79	5.46	0.005%
3) Trust vs. Support	0.53	2.65	0.01 p 0.005%
4) Trust vs. Resist	0.12	0.51	25 p 40%
5) Support vs. Resist	0.26	1.15	10 p 25%
6) Originate vs. Support	0.93	4.19	0.0005%
7) Originate vs. Resist	0.28	1.17	10 p 25%
8) Support (with union representatives suppressed) vs. Resist (with union representatives suppressed)	0.74	3.64	0.005 p 0.0005%

appropriately distal, at least relative to the relations between the neutrals (Discussants) and the legitimizers. The vexing problem, of course, is how much is enough. One consolation is that the avowed partisans--supporters and resistors--are the most removed of all. But it is a matter of degree in the case of the supporters whose $R = 0.53$ might discomfit a zealous "good government" reformer.

Figure 4-5c disaggregates by the type of code--model, state/county or local--currently in force the findings reported in Figure 4-4c. This done, it becomes clear that the great impact of the model code movement has been to draw to itself the role of legitimizer of technological innovations. And it might be added this is about all that these associations have done, too, since with the exception just cited, membership in a model code association seems not to seriously affect the overall code modification decision-process at the local level, as a study of Figure 4-5a through e concedes.¹⁰⁹ For instance, it is entirely reasonable that model code cities should discuss their upcoming code changes more widely among building officials from the immediate vicinity, as well as further away, and at the meetings of the professional associations because local code cities simply do not have access to many of these meetings. An advantage of model code

¹⁰⁹The rosters of actors participating in code modification decisions in model- and in local-code cities are highly rank order correlated, function by function. The largest disparity occurs on the "trust" question. The Spearman R's: Originate, 0.93; Discuss, 0.92; Trust, 0.85; Support, 0.91; Resist, 0.88.

Figure 4-5 a-e PARTICIPATION IN COLLECTIVE DECISION MAKING IN THE LOCAL BUILDING DEPARTMENT, BY ACTOR AND BY ROLE, CONTROLLING FOR TYPE OF LOCAL CODE IN FORCE

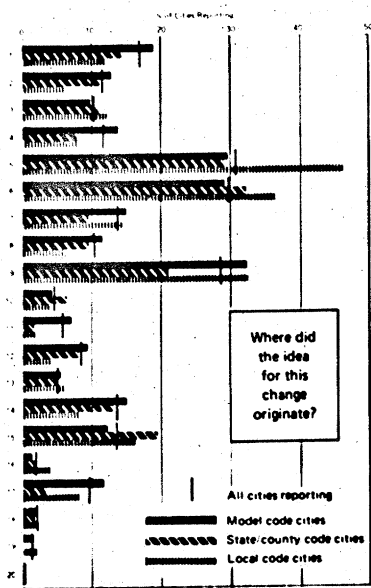


Figure 4-5 (a)

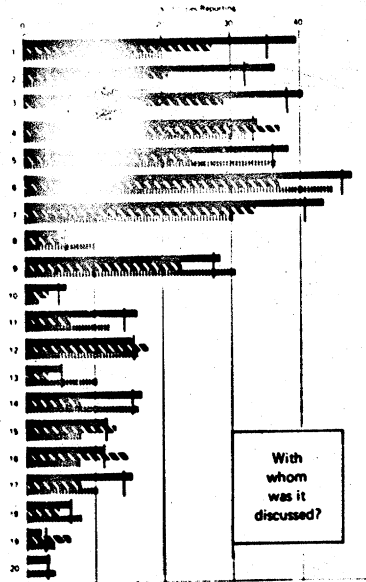


Figure 4-5 (b)

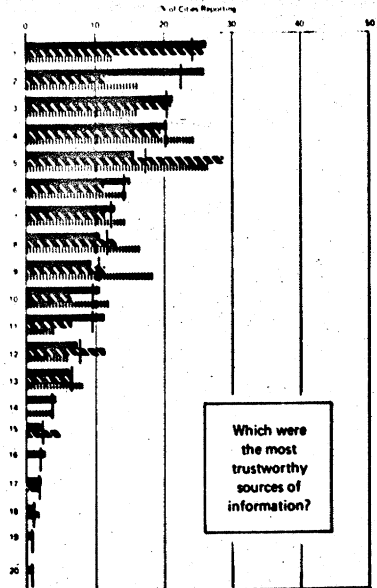


Figure 4-5 (c)

1. Meetings of professional associations.
2. Building officials from cities outside county.
3. Building officials from cities within county.
4. Architects or engineers.
5. Building material producers or supplier representatives: local.
6. Builder representatives: local.
7. Building department staff.
8. Trade or professional magazines.
9. Building material producers or supplier representatives: out-of-town.
10. Government publications.
11. Other sources.
12. Meetings or conventions of materials producers.
13. Building product catalogs.
14. Yourself.
15. Prefabricated home manufacturer representatives.
16. Union representatives: local.
17. Builder representatives: out-of-town.
18. Civic or voter groups.
19. Mass media (TV, magazines, newspapers).
20. Union representatives: out-of-town.

For the most difficult code item adoption with responses disaggregated by code type: (a) where did the idea for this change originate? (b) with whom was it discussed? (c) which were the most trustworthy sources of information? (d) which groups most supported the change? (e) which groups most resisted the change?

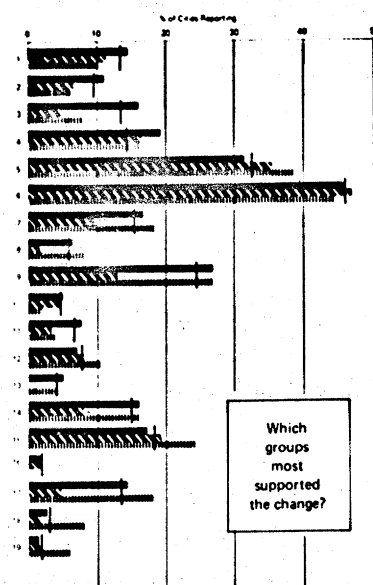


Figure 4-5 (d)

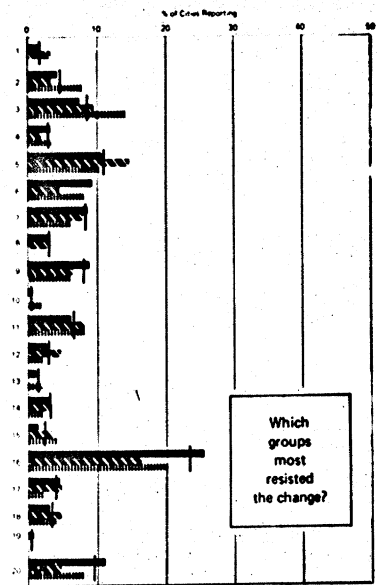


Figure 4-5 (e)

membership is that one can discuss important issues with fellow members. To a certain extent model code cities act with more autonomy and freedom from the constraints of their local clientele. This is demonstrated in Figure 4-5a, where building departments without recourse to facilities of model code association meetings are shown to be necessarily much more reliant on local sources for new ideas. Local building material producers or supplier representatives completely dominate the origin of new ideas among local code cities. But model code cities are not immune either, as Figure 4-5a also shows. Although less reliant than local code cities on ideas from the local material suppliers, model code cities are twice as likely to pick up new ideas from their local clientele as they are from the meetings of their model code groups.

Despite the words of a respected model code official that "One of the major advantages of using the organization's code is to take advantage of the correlative services offered with the code."¹¹⁰ Figure 4-5a through 4-5e reveals that the code modification process in model code cities differs only slightly from that pursued in non-model code cities. This may call into question the utility of the "correlative services that account for the lion's share of the code associations

¹¹⁰ Paul E. Baseler, "Revision and Administration of the Building Code", Management Information Service, Report No. 208 (May, 1961), ICMA, p. 4. (Italics in the original).

income and activity. Both in this Figure and in Table 4-4, which is merely the rank order of the trustworthy sources by code type, we see the difficulty under which most of the local code departments are forced to operate. Too small to specialize internally, attached to governments too small to develop the necessary independent evaluation of building products, the local department is forced to place greatest significance on the testimony of salesmen and vendors rather than on autonomous, independent expertise. And although model code cities place greater reliance on what they learn at professional meetings and from building officials from out of town, the organizations of building officials from out of town face all the same uncertainties that are faced by these building officials when they are at their home departments. The saving grace for the model code associations, and to a certain extent for the voluntary state code groups is that when they pool resources and engage in joint ventures, they can initiate and sustain an autonomous, independent source of technical judgment. This is the declared intention, of course, of the model code associations; how the model code associations discharge this self-assigned responsibility is the subject of Chapter 5. We shall also in chapter 5 gauge the extent to which these groups have taken the building code out of "politics."

TABLE 4-4 LOCAL BUILDING OFFICIALS' RANKING OF MOST TRUSTED SOURCE OF INFORMATION ON MOST DIFFICULT CODE ITEM ADOPTION DECISION, BY TYPE OF CODE

Model code	State/county	Local code
1 Meetings of professional associations	1 Local building material producer or supplier representative	1 Local building material producer or supplier representative
2 Building officials from distant cities	2 Meetings of professional associations	2 Architects or engineers
3 Building officials from nearby cities	3 Building officials from nearby cities	3 Out-of-town building material producer or supplier representative
4 Architects or engineers	4 Architects or engineers	4 Trade or professional magazines or journals
5 Local building material producer or supplier representative	5 Trade of professional magazines or journals	4 Building officials from nearby cities
6 Local builder representative	6 Building department staff	4 Building officials from distant cities
7 Building department staff	6 Meetings or conventions of building materials producers	7 Building department staff
8 Other unspecified sources	6 Building officials from distant cities	7 Local builder representative
9 Government publications	6 Local builder representatives	9 Meetings of professional associations
9 Trade or professional magazines or journals	6 Out-of-town building material producer or supplier representative	9 Government publications
11 Out-of-town building material producer or supplier representative	11 Government publications	11 Building product catalogs or brochures
12 Meetings or conventions of building materials producers	11 Building product catalogs or brochures	12 Meetings or conventions of building materials producers
13 Building product catalogs or brochures	11 Other unspecified sources	13 Yourself
14 Yourself	14 Prefabricated home manufacturer representatives	13 Unspecified other sources
15 Local building trades union representative	15 Out-of-town builder representatives	15 Local building trades union representative
16 Prefabricated home manufacturer representative	15 Civic or voter groups	15 Out-of-town building trades union representative
16 Out-of-town builder representative	17 Yourself	15 Prefabricated home manufacturer representative
18 Mass media	17 Local building trades union representative	15 Out-of-town builder representative
18 Civic or voter groups	17 Out-of-town building trades union representative	20 Mass media
18 Out-of-town building trades union representative	20 Mass media	

Interim Conclusions and Reassessment of Hypotheses

The movement of individual actors from prominence of obscurity accounts for the variations in the inter-roster coefficients of correlation. And a closer look at that movement reveals much about participation in the special interests politics of building regulation. Broken lines in Figure 4-6 connect these actors whose inter-roster movements are large enough to have strongly affected the Spearman coefficient which is extremely sensitive to rank shifts.¹¹¹ Moreover, had the rosters been truncated by the removal of those actors who never ventured from obscurity, who consistently failed to appear among the prominent participants, the R's would have been far lower.¹¹²

It will be recalled that the rosters under review represent rankings according to participation in the "most difficult" code change decision and, it will further be recalled, that rosters for the "least difficult" code change decision were highly and positively correlated.¹¹³ Nevertheless it is instructive to identify the sizeable intra-roster moves between the "most" and the "least" difficult code decision. This is designated in Figure 4-6 by solid lines indicating the direction of movement.

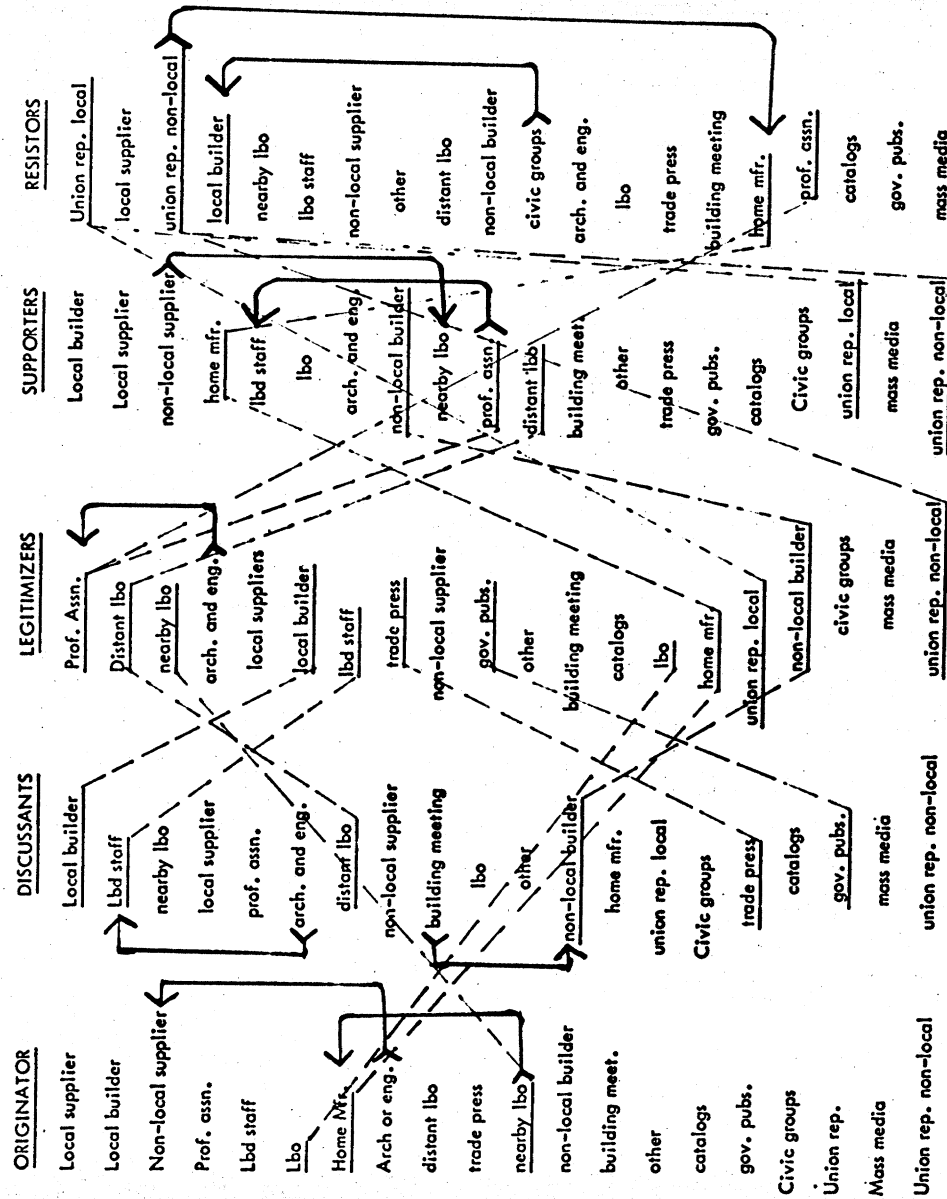
¹¹¹The coefficient is inversely proportional to 6 times the sum of the squares of the net rank shifts.

¹¹²Because the coefficient is inversely proportional to the cube of the number of ranks.

¹¹³See above fn. 95.

Figure 4-6

Rosters of Actors in Local Building Department Decisions on Innovative Technology Ranked by Relative Participation in Selected Roles



Abbreviations are used in this Figure. For complete nomenclature refer to Questionnaire, p. 7, reproduced as Exhibit B in the Appendix.

Reviewing rank-order shifts within and between the foregoing rosters yields several insights that both confirm some and partially refute other earlier hypotheses that directed this analysis. First, the confirmation: the building department's clientele, and to a lesser extent its reference groups, utterly dominates the extra-agency flow of communications affecting prospective code changes. However, the agency's clientele-as-a-whole is characterized by a pervasive ambivalence, an ambivalence made clear from the similarity of rank-ordering among the supporters and resisters of recent controversial code changes. This finding renders suspect the allegation that the local building enterprisers categorically suppress technological innovation.

The support-resist correlation coefficient is low: 0.26 and statistically insignificant; however, this measure is extremely sensitive to large net rank-shifts of but a few actors. Figure 4-6 reveals that the principal actors accounting for this low R are the representatives of the building trades unions, both local business agents and representatives from the district or the headquarters staff of the international union. If these actors are removed from the calculation then, as Row 8 of Table 4-2 reveals, the R climbs to 0.74 and is statistically significant. Hence, with the possible exception of the building trades unions, there are no members of the agency clientele that are in chronic and persistent opposition to general modernization of the local code. So much for "general"

modernization. Do the clients behave differently in the face of particular types of technological change. Only by checking this possibility can the selective mobilization of the several client-groups--including the labor unions--be assessed. This assessment is made in Chapter 6. Now, to the refutation of earlier conjectures.

The tariff analogy, alluded to but un-named and unspecified in earlier studies of building code reform,¹¹⁴ suggests that local building interests--principally builders, suppliers and labor groups--seeking to maintain their advantage over non-local competition, cause to be developed, promulgated and enforced a building code that places "outsiders"--non-local firms--at a disadvantage. Many industry critics and proponents of manufactured building have identified the plethora of local regulating jurisdictions as an obstacle to the large scale mechanized production of housing. According to these critics, the Balkanization of building regulations has two deleterious effects on the rationalization and mechanization of house-building: (1) the too many, too small jurisdictions do not have the resources to maintain a technologically current code; and (2) the variance among the codes--whatever the specific technological currency--stymies efforts to serve wide geographic markets with a standardized or uniform building product. If

¹¹⁴ Principally, Field and Ventre, Local Regulation of Building: Agencies Codes and Politics, passim.

a local code is either technologically obsolete or if it varied from its neighbor in its substantive provisions, then that local code hinders rationalization of the industry because it makes serial production uneconomical since designs would be forced to vary to meet idiosyncratic local codes and no economies of scale would be possible. Both the proliferation of idiosyncratic codes as well as the persistence of technically obsolete codes provide local builders, their suppliers and their workforces with a measure of protection from outside competition. This occurs in two ways: (1) obsolete codes will render illegitimate advanced technologies, particularly those incorporating off-site preassembled elements; and (2) in the realm of traditional building, idiosyncracies of the local code will be unintelligible to "foreign" designers and builders.¹¹⁵

Prompted by this heuristic, the present analysis infers from the analogy an hypothesis and a corollary that can be tested with the data at hand:

if, as the tariff analog holds, obsolete and restrictive building codes serve to maintain a competitive advantage for local building interests as against "foreign competition," then the local building interests will fight to sustain those codes in their present (obsolete) form. Opposition to less restrictive building codes will be drawn from local firms and individuals with a stake in retaining the pattern of local dominance and

¹¹⁵The tariff analog is further explicated in Field, Home Manufacturing and Building Codes, p. 208ff. "The Case of the Local Tariff," and in a subsequent article in the Ripon Forum (in press).

support for less restrictive codes will be drawn from non-local firms and individuals who wish to break into local markets.¹¹⁶

A review of Figure 4-6 concedes, however, that the local building interests participate in the code-change discussion in a manner directly opposite to that predicted by the hypothesis based on the tariff analogy. While it is true that localities do lead resistance to code modification, the volume of this activity is much less than is their activity as originators and supporters of code reforms. Figures 4-4a and 4-4d make this clear. Moreover, there is no implacable, "hard core" resistance to building code modernization by local organizations and business enterprises. An exception might be the building trades unions; but even they, on rare occasions, have been among the originators and supporters of the code changes comprising the index of technological currency. Far from being a bastion of resistance to technological change, as is frequently alleged, the local building industry--encompassing builders, suppliers and designers--are the principal mobilizers of support for building code modernization. This is true even when one "normalizes" the statistics to account for the more frequent interactions that occur between the local officials and their more propinquitous local clientele.

¹¹⁶The 14 innovations comprising the index of technological currency used in this analysis are, jointly and severally, less restrictive of the entry of non-local firms into local building markets than the standards they replace. This is to be demonstrated in detail in Chapter 6; for the moment, it is a stipulated definition of restrictiveness.

Ironically, while these findings deviate from what a theory-bound logician might deduce from the axioms of the economics of international trade, they do confirm findings of two well-known empirical studies of the connection between economic interests and political behavior as presented by Bauer, Pool and Dexter and by Schattschneider in their respective studies of the Kennedy Trade Expansion Act of 1962 and the Smoot-Hawley Tariff of 1929-30.¹¹⁷ The former case-study examined the dynamic of influence on legislative action, drawing on a tradition of research in social psychology and communications theory. Schattschneider was even more eclectic, using theories of organization and group and crowd behavior. The independence of the studies and their discrepant conceptual orientations notwithstanding, these tariff studies were in accord in their principal conclusions. Namely, that "specific action by a businessman or politician contrary to his overall views was a common phenomenon"¹¹⁸ and that "political behavior is seen to bear a highly variable and irregular relation to economic interest."¹¹⁹

Much of the same could be said of the behavior of local elements of the building enterprise; and the reason is

¹¹⁷Respectively, American Business and Public Policy (New York: Atherton, 1963), and Politics, Pressures and the Tariff (Hamden, Conn: Archon, 1963). The latter is a re-issue of Schattschneider's 1935 book.

¹¹⁸Bauer, Pool and Dexter, American Business and Public Policy p. 469.

¹¹⁹Schattschneider, Politics, Pressures and the Tariff, p. 285.

probably the same in both cases. Namely, that omnibus legislative packages--like the two tariff acts named above, and their analog, the building code--are in fact amalgams of many different and sometimes contradictory elements. This was certainly true of the Smoot-Hawley Tariff which, Schattschneider observed, embodied "bad economics but invincible politics by catering to and attracting support from the widest possible constituency."¹²⁰ Naturally, the diverse and contradictory elements mobilize support and resistance from different segments of the national business community in the case of tariff, a point emphasized by Bauer, Pool and Dexter.¹²¹

The index of technological currency used in the present analysis is, likewise, a composite of diverse innovations that would conceivably affect the clientele of the building department with a differential impact and thus, provoke a greater or lesser degree of mobilization for or against the code changes. The tariff analogy is serviceable but only up to a point, for the range of its applicability is quite limited. Field argues that codes have the effects of tariffs.¹²²

But this effect may bear upon the marketing of manufactured housing only, for the evidence that this and other tariff-like obstacles are the result of a locally-based technological

¹²⁰ Schattschneider, Politics, Pressures and the Tariff, p. 283.

¹²¹ In American Business and Public Policy, p. 470.

¹²² Field, Home Manufacturing and Building Codes, pp. 224 ff.

arriere-garde is less convincing and requires further analysis. This is true even if one restricts the analysis to those code items of particular significance to home manufacturers. At a minimum, the tariff analogy cannot be applied indiscriminately, for building codes cannot be treated as monoliths; they are the residual of hundreds, if not thousands, of incremental changes in the technology of building. And each change mobilizes a different group of the local building industries, depending on the technology involved. By examining the biographies of the changes that comprise the index of technological currency, a further partitioning of the building department's clientele becomes possible, a partitioning that will yield new insights into the dynamics of change in residential construction technology. This is the job of Chapter 6.

Chapter 5

PRIVATE SECTOR PRE-EMPTION OF PUBLIC REGULATORY RESPONSIBILITY IN THE BUILDING FIELD

Inter-sectoral Activities in Building Regulation

To provide a vantage for analysis and to place the problem of building regulation in a broader political perspective, this section begins with a digression into political theory. This is required because the code-making process in the 1970's is, to a far greater extent than is generally realized, a political one that occurs beyond the jurisdiction and, hence, reach, of governments. The process, rather, is shared--sometimes overtly, at other times in obscure ways--with the professional societies, building industry trade associations and other private entities that deploy themselves at the national, regional, state and local levels. While it is true that a number of studies on the inter-action of private groups and public agencies have appeared recently, only two have touched on the production of housing. Those that have--the work of Nelkin and of Wolman¹--are useful but perhaps too narrowly focused. Both rely almost exclusively on personal interviews--Wolman mentions sixty; Nelkin, twenty--with persons involved with housing or construction polity at

¹Respectively, Dorothy Nelkin, The Politics of Housing Innovation: the Fate of the Civilian Industrial Technology (Ithaca: Cornell University Press, 1971) and Harold Wolman, Politics of Federal Housing (New York: Dodd, Mead and Company, 1971).

the national level only and neither deals, except perfunctorily, with the highly dispersed, semi-autonomous actors the country over. Yet, as we have attempted to demonstrate and as one of these authors concedes,² this very dispersion makes the housebuilding enterprise--and, we would add, its regulation--distinctive among the nation's industries. The present research complements those earlier studies in this respect: the industry and the means of its regulation is examined in all locales where it is actualized. Namely: partly in Washington; partly in the state capitols, but mostly in the cities and towns of the nation.³

Among the persistent concerns of American political thought, two stand out: keeping the state out of the private affairs of individuals and increasing the responsiveness of government to the needs of previously unrepresented groups. These concerns are unrelated but for the fact that a common means is used to respond to both. A conservative tradition in Western political philosophy, typified by von Gierke,

²Nelkin, The Politics of Housing Innovation, pp. 10-12.

³Leaders of the model code organizations, acting as a National Co-ordinating Council (NCC), did once establish an office in Washington, to develop industry and federal government ties. The office was closed exactly one year later, for lack of use. This reinforces the basic assumption of this research: building regulation is a dispersed phenomenon. The NCC office experience is related in Sanderson, Codes and Code Administration, p. 97.

Laski, and Follett,⁴ would provide for the defense of private privilege using the very same means that liberal reformers, most eloquently and farsightedly, James Madison,⁵ would utilize to widen government's purview to accommodate the needs of the yet unrepresented: the organization of society into private associations convened to advance specifiable and limited aims and objectives.

In the conservative view, private groups of like individuals (von Gierke's "corporation") would interpose themselves between the state and the private citizen or group-member, pre-empting the possibility of even a benign totalitarianism. In contrast, the liberal reformer sees in the formation of private groups -- usually partitioned along the lines of background, interest, or belief -- an opportunity first to amass political power and then to seek political representation. A legislature, indeed, a government, comprised of such representatives would, the liberal argument continues, make for diversity, tolerance, and, at base, cultural freedom in the society. This sounds, for a moment, like

⁴The important and representative works are Otto von Gierke, "The Idea of Corporation," in Talcott Parson, et. al., (eds.) Theories of Society (New York: Free Press, 1961), pp. 611-626; Harold J. Laski, Authority in the Modern State (New Haven: Yale University Press, 1927); and Mary Parker Follett, The New State; Group Organization the Solution of Popular Government (New York: Longmans, Green, 1918). In Community and Power (New York: Oxford University Press, 1962) Robert Nisbet restates this conservative thesis in contemporary terms.

⁵Writing in The Federalist Papers (Cleveland: World Publishing, 1961). See especially Federalist No. 10, pp. 56-65.

syndicalism. This benevolence would be generated in the dispersal of political power among many small groups and their representative agencies for, with power so diffuse, no collective action could be initiated, much less be accomplished, unless sufficient consensus among many groups is established first. Whatever a government organized in such fashion lacked in alacrity would be made up for in its avoidance of extremism, for only options with wide appeal would ever become actionable. Power to act would have to be aggregated in close political battles.⁶ The wily small-group representative is then in a position to trade his present vote on a matter to which he may be indifferent for the best deal he can get for his constituents on other, later occasions; this is the legislative practice of "log rolling."

This ideal of poly-centric, consensus-seeking pluralist system of political organization continues to have, wide appeal: for the urbanist, it could account for much of the success of the federal system of shared powers among levels of government and sectors of the society,⁷ for the partitioning of responsibilities within metropolitan areas⁸

⁶ Bayard Rustin, a Negro (the word is used advisely) moderate, advocated precisely this swing strategy for the Negro bloc in an important essay "From Protest to Politics: the Future of the Civil Rights Movement," reproduced in Bernard J. Frieden and Robert Morris (eds.), Urban Planning and Social Policy (New York: Basic Books, 1966), pp. 335-345.

⁷ Morton Grodzins, The American System: a New View of Government in the U.S. (Chicago: Rand, McNally, 1966), pp. viii, 231-252, and chapter 9 in its entirety.

⁸ Vincent Ostrom, Charles M. Tiebout, and Robert Warren, "The Metropolis as a Polycentric System", American Political Science Review, LV (December, 1961), pp. 831-842.

and influence within individual municipalities.⁹ The pluralist persuasion had consolidated its place in American political theory with the rehabilitation of the reputation of the country's first pluralist political scientist, Arthur F. Bentley¹⁰ and the publication of David B. Truman's, The Governmental Process.¹¹ These two works are, in a sense, the Alpha and Omega of pluralism. For this reason, Bentley legitimized the group process in government, saying that:

"Since there is nothing best literally for the whole people [the legislative process can be] reduced... to the play of group interests [and] compromise, trading and the adjustment of interests make up its very nature."¹²

Truman concurred and went even further. Not only was interactive group process the quintessential feature of representative government, but:

[i]n developing a group interpretation of politics, we do not need to account for a totally inclusive interest, because one does not exist.¹³

And so the search for a community of interest, a public interest, an overreaching, shared sentiment within a political society, a search begun by the Aegean over 2400 years before

⁹ Several studies of community power and influence can be adduced to demonstrate the pluralist, polycentric view, but these studies are countered by the stratification school of community power analysts. A review of the pluralist vs. stratification view and a listing of representative studies is in Nelson W. Polsby, Communication Power and Political Theory (New Haven: Yale University Press, 1963).

¹⁰ Bentley's Landmark The Process of Government, first published in 1908, was reissued by Principia Press in 1949.

¹¹ New York: Knopf, 1951.

¹² Bentley, The Process of Government, pp. 370-371.

¹³ Truman, The Governmental Process, p. 223.

Truman wrote, is aborted. Pluralism marked the zenith of its ascendancy by declaring the notion of public interest to be a null concept, something of interest, perhaps, to antiquarians or to political philosophers with a bent for scholasticism.

The area surveyed generally by Bentley and Truman drew to itself a number of empirical studies that examined in detail both the actual workings of group processes in American politics and the yield of those processes in terms of public policies and their effects. To be sure the analysis of democratic politics in terms of group interest lead to an increased understanding of legislative, electoral, and administrative politics,¹⁴ but with that knowledge came the realization that a group politics legitimated by the pluralists was found wanting in several important ways:

- (1) the "conquest of segments of formal state power by private groups and associations" became more characteristic of American government and was no longer isolated, episodic, or anomalous;¹⁵

¹⁴ See, respectively E. E. Schattschneider, The Semi-Sovereign People (New York: Holt, Rinehart and Winston, 1960); Richard M. Scammon and Ben J. Wattenberg, The Real Majority (New York: Coward-McCann, 1970); and Grant McConnell, Private Power and American Democracy (New York: Vintage, 1970). A general compendium is Betty H. Zisk (ed.), American Political Interest Groups: Readings in Theory and Research (Belmont, California: Wadsworth, 1969).

¹⁵ McConnell, Private Power and American Democracy, p. 162.

- (2) private groups assumed para-legislative and para-judicial functions, usurping the constitutional prerogatives of public government and, particularly, the regulatory agencies which have been said to be "to a significant degree creatures of the enterprise they regulate;"¹⁶
- (3) abuses within private association such as domination of agenda and manipulation of membership by the inter-acting coterie of association executives beyond public scrutiny, lack of "due process" safeguards in protecting the legitimate interests of

¹⁶The quotation, so Naderesque in abruptness, is thirty years old and occurs in James W. Fesler, The Independence of State Regulatory Agencies (Chicago: Public Administration Service, 1942), p. 32. More recent studies reporting similar findings are somewhat journalistic Louis M. Kahlmeier, Jr., The Regulators (New York: Harper and Row, 1969); a more abstract Theodore J. Lowi, "Distribution, Regulation, Redistribution: The Functions of Government" in R. B. Ripley (ed.), Public Policies and Their Politics (New York: W. W. Norton, 1966), pp. 27-40; a new-populist attack by [Senator] Lee Metcalf, "The Vested Oracles: How Industry Regulates Government", Washington Monthly, Vol. 3 (July, 1971), pp. 45-53; a jocose Office of Management and Budget Director Caspar W. Weinberger, "With Friends Like the Regulatory Agencies, Consumers Don't need Enemies", Fortune, Vol. 85 (June, 1972), pp. 177-178; Roger G. Noll, Reforming Regulation: an Evaluation of the Ash Council Proposals; a study in the Regulation of Economic Activities staff paper (Washington: Brookings Institution, 1971); not to mention a handful of "Nader's Raiders" critiques of public agencies with regulatory responsibilities, namely: The Chemical Feast (report on food protection and the Food and Drug Administration) (New York: Grossman, 1970); The Interstate Commerce Commission: to Public Interest and the ICC (New York: Grossman, 1970) The Nader Report on the Federal Trade Commission (New York: Baron, 1969); Old Age: the last segregation (New York: Grossman, 1971); Vanishing Air (New York: Grossman, 1970); Water Wasteland (New York: Grossman, 1971)

minorities (in the parliamentary sense) of the associations' own membership;¹⁷

- (4) entry to the bargaining arena is limited to participants with resources to organize and articulate interests. A consequence is that "bargaining often proceeds among a presidium which disadvantages unorganized segments of society;¹⁸
- (5) a failure of privatized public policy to "take account of more comprehensive needs and aspirations."¹⁹

¹⁷ McConnell, Private Power in American Democracy, Chapter 5 "Private Government," pp. 119-154. Representative John Dingell introduced legislation in the 91st Congress (H. R. 10123) to extend due process protection for members of private standards-setting organizations whose standards ultimately influence public regulations. This was done to correct abuses in the building standard-building code relation. The manipulation of memberships by "palace guards" is well known to students of organization life. See for instance, John R. Seeley, et. al., "Laymen and Professionals," in William A. Glaser and David L. Sills (eds.), The Government of Associations (Totowa, N. J.: Bedminster Press, 1966), pp. 213-218. Also, Amitai Etzioni, "Managers and Experts," especially pp. 211-212, in the same collection.

¹⁸ The source of this criticism is Robert Presthus, Men at the Top (New York: Oxford University Press, 1966), p. 31. The practical consequence is that lower class persons, persons with little education or who have not undergone a political socialization are much less apt to join or form groups or aggregate political strength. See Robert E. Lane, Political Life (New York: The Free Press, 1959), p. 15ff. The "maximum feasible participation" phraseology of Great Society social legislation is one attempt to redress this shortcoming as are the various citizen-client-patients-advocacy wings of the professions of planning, law, medicine, trade, etc.

¹⁹ This last is a telling blow because it was struck by an exponent of pluralism, Phillip Selznick in Law, Society and Industrial Justice (New York: Russell Sage Foundation, 1969), p. 240. Selznick's remarks read like an appeal to the very public interest dismissed by Truman eighteen years earlier.

Taken together, these abuses associated with "interest-group liberalism" have provoked, in the words of Professor Lowi, "a crisis of public authority."²⁰

The Lowi prognosis for the larger society appears apocalyptic, and out of scale with our discussion of building regulation. It is introduced at this point only to serve as index against which to measure the prognoses for building regulation.

²⁰Theodore J. Lowi, The End of Liberalism: Ideology, Policy and the Crisis of Public Authority, (New York: W. W. Norton, 1969), p. viii. Interest-group liberalism is also Lowi's phrase.

The Model Code Associations

The private groups that most directly affect the work of local building departments are the model code associations. But, although these organizations and their members are institutionally and sociologically proximal to the local building department and its staff and appear to be the most immediately influential, there is evidence that model code groups are not the prepotent or even primary agents of decision in the accomodation of innovative technology by local building codes. The evidence adduced for this assertion is found in the histories of these important entites-- the very circumstances of their founding; the mode of their financing; the manner of their internal workings; and in their relations with their member-constituents, the local building officials of the nation.

Model code associations project to the public at large and to their own members an image of detached, disinterested professionalism. But, serious shortcomings--like the abuses of private associations mentioned in the previous section--exist. Moreover, the corresponding local building department is at liberty, under the terms of voluntary affiliation extended by all the model code groups, to be highly selective of just which model code-approved reforms will be enforced at the local level. As a consequence of this selectivity, a

stated affiliation with a model code is no assurance that the local building code is technologically current.²¹

It is probable that local building officials--like legislative draftsmen everywhere--have historically plagiarized written building codes developed for use elsewhere. This early use of adapted precedents was then and remains now an expedient of hard-pressed state and local government officials. Sources of these externally developed codes municipalities which had the same developmental characteristics as the jurisdiction searching for a code.

The first of the current four model building codes appeared in 1905, contemporaneous with but nevertheless, distinct from the proliferation of model statutes and administrative recommendations that streamed from legislative research commissions and Good Government committees of the Progressive reformers. The distinction derives from the commercial nature of the first centrally-written code developed expressly for sale to local governments. In contrast, model legislation developed by Progressive housing reformers like Lawrence Veiller was available to all for the cost of reproduction (in Veiller's case even his small cost was absorbed by philanthropies notably the Russel Sage Foundation).²² The National Building

²¹A point amply documented in the National (Douglas) Commission in Urban Problems, Building the American City (Washington; USGPO, 1969), Part III, Chapter 3.

²²Roy Lubove, The Urban Community: Housing and Planning in the Progressive Era (Englewood Cliffs, New Jersey: Prentice-Hall, 1967), pp. 55. Vieller wrote the enormously influential New York State Tenement House Law of 1901, a statute that was to be duplicated in city and state the country over.

Code was proprietary and made available only for a fee. A ready market existed--between 1900 and 1910 the number of municipalities in the U.S. with a population exceeding 10,000 grew by 36% from 440 to 597²³--and the marketing effort could not have but benefitted from the identification with a Progressivism that advocated displacement of partisan politics by impersonal expertise in the deliberations of legislatures and administrative commissions and in the use of scientific management in the dispatch of government business generally.²⁴ But it is most likely that the primary interest of the initial sponsor was a pecuniary one. The National Board of Fire Underwriters (NBFU), now doing business as the American Insurance Association (A Ins A), was concerned with regularizing and improving the quality of construction that would influence the combustibility of completed buildings. The importance of this consideration to a fire insurance actuary is self-evident and led to the publication and sale of the National Building Code (NBC) in 1905. For twenty-one years, the NBC was the only model code in general availability and remains the only model code with a national subscription.

²³U. S. Bureau of the Census, Historical Statistics of the U. S.: Colonial Times to 1957 (Washington: USGPO, 1960), Series A181-194, p. 14.

²⁴Richard Hofstadter, The Age of Reform: From Bryan to F.D.R. (New York: Alfred A. Knoff, 1956), and Eric F. Goldman, Rendezvous with Destiny: A History of Modern American Reform (New York: Alfred A. Knoff, 1952) are histories of this era; the second work is a more dramatic rendering.

Three other model building codes are in use²⁵ but the NBC is distinctive in that it, alone, of the four is entirely staff-written and staff-revised. There is no participation in code authorship by building officials themselves.

The dominance of the NBC by the fire insurance industry has both benefitted and cost the NBC and the model code movement and affords an opening insight into the relations between code-makers and their clientele. The purveyors of the NBC can offer their customers--the municipal governments of the country--a powerful incentive to initial and sustained affiliation: localities adopting the NBC enjoy favorable ratings by the NBFU (now A Ins A) which results in lower premiums for fire insurance. This is understandable. A fire-oriented code leads to fire resistive structures which leads to lower incidence and spread of fire. This logic is clear. But more questionable is the converse, the implication of this logic in practice. Consider, new construction may add only 5-10 percent to the standing physical plant of a city in any given year,²⁶ thus a city newly-subscribed to NBC might require from

²⁵This discussion will not cover the so-called model "specialty" codes like the National Electrical Code and the National Plumbing Code, neither related to the NBC nor to the Federal government but developed under the auspices of the National Fire Protection Association and the American Society of Mechanical Engineers, respectively.

²⁶Estimate of William L. C. Wheaton, Professor of City Planning, University of California, Berkeley, in a private communication.

ten to fifty years to achieve the NBC standard city-wide. Conversely, a city withdrawing from NBC would require the same span of time to regress to sub-NBC standard. This lag notwithstanding, fire insurance rates are raised or lowered city-wide almost instantaneously; or so the threat is alleged.²⁷

The dominance of NBC by the fire-protection community, while providing this marketing advantage in the short run, resulted in a serious myopia in NBC's substantive content: combustible materials are placed at a serious disadvantage; in a phrase, the code is "anti-wood."²⁸ And since just over 40 percent of the lumber and wood products output goes into construction,²⁹ the producers of combustible materials, with lumbermen in the fore, reacted with a code that would preserve an historic "fair share" among competing building materials, and, in the process, not disadvantage wood.

The lumber-led response came in the form of an organization. The Pacific Coast Building Officials Conference (PCBOC),

²⁷ These serious allegations were encountered several times in interviews in the building regulatory community and only rarely appear in print. One instance: Hal Colling, "Who's to Blame for the Building Code Mess?" House and Home, Vol. XXV, No. 1 (January, 1964), p. 81.

²⁸ Ibid.

²⁹ George R. Kinzie, "Construction's Input-Output Profile," Construction Review, Vol. 16, No. 8 (August, 1970), p. 4. In 1969, the last year for which figures are available sales to construction by the lumber and wood products (except containers) industries amounted to \$5,387,000,000. U. S. Bureau of the Census, Annual Survey of Manufacturers, 1969, General Statistics for Industry Groups and Industries, M69 (AS) - 1 (Washington: USGPO, 1971), Table T-1, pp. 8-9.

predecessor to the International Conference of Building Officials (ICBO), established in 1922 and which published its Uniform Building Code, rival to the NBC, five years later. ICBO reasserted, in the substantive content of its code, the primacy of wood.

This episode illustrates several characteristics of most subsequent building code controversies to be described later: the advancement of tacit arguments for retention of a "fair share" of the building materials market reserved to historic sources of building materials (much as building trades unions fight to retain or extend jurisdiction over "new work"); the local and regional loyalties evoked and invoked (recall that building officials from Western lumber-exporting states organized the rival model code to rectify a perceived anti-wood bias); and the division of building code partisans along combustible or non-combustible characteristics of the materials in question (thirty years later, the epochal controversies over the incorporation of plastics in construction were couched in these "combustibility" terms).

Regional differences and loyalties energized the formation of a third model code group in 1945, the Southern Building Code Congress (SBCC), publishers of the Southern Standard Building Code (SSBC). Again, the fundamental economics of production (in this case, extraction) and distribution of building materials was a massive influence and reinforced a provincialism of the region's building officials. SBCC was organized three years before the secession of the Dixiecrats

from national Democratic politics.³⁰ But the basic issue was economic and was a reflection of both the geo-political deployment of the principal timber stands of the Nation and differences in the means used to turn timber into a building material. Softwood species--notably cedar, cypress, fir, hemlock, larch, pine, and spruce--appear in all regions of the country but commercial production for construction use is confined to regions that specialize. A suggested lumber for framing is either Douglas fir (*Pseudotsuga menziessii*) or southern yellow pine, either loblolly or short-leaf (*Pinus taeda* for *Pinus echinata*, respectively); lumber for siding can be either redwood (*Sequoia sempervirens*) or southern cypress (*Taxodium distichum*).³¹ Notice that of the two pairs just identified one of each is a Western and the other a Southern wood crop. The span tables listed in the code document itself or referenced by the code could effectively eliminate one of these species from competition, depending on which modulus of elasticity (a species specific physical measurement) was used to calculate allowable spans for structural members made of wood. It is understandable that

³⁰Characteristic political ethos are described by chroniclers of the old South. Notably, W. J. Cash, The Mind of the South (New York: Knopf, 1941); The origins and recent manifestations of regional loyalty are discussed in Duvey W. Grantham, Jr. (ed.), The South and the Sectional Image (New York: Harper and Row, 1967).

³¹Suggested uses of species is taken from Whitney Clark Huntington, Building Construction: Materials and Types of Construction, 2nd edition (New York: Wiley, 1941), table on p. 58.

Southern producers did not wish to defer to span tables computed and published by a code group with regional loyalties outside the South.

Another regional difference in wood materials between West and South which a code's substantive provision could effect was plywood. At the time of SSBC's publication, plywood was made almost exclusively from Douglas fir, grown in western Oregon and Washington and northern California,³² and, of these western producers, only the larger firms were likely to have installed the required machinery and equipment.³³ Moreover, and this is a large generalization, Western producers were fewer in number but had larger individual capacity than did the more numerous, "family farm" operations of the South.³⁴

Southern lumbermen faced on the eastern front with the NBC, an anti-wood code, and on the western front (the military analogy is not inapt) with the UBC that was pro-Douglas Fir, pro-plywood, and pro-large producer. The UBC was clearly antagonistic to the growers of southern pine, who were lumbermen as contrasted to plywood manufacturers, and were numerous small units rather than fewer large units. Southern building officials drafted and promulgated their own code and stood fast against later blandishments from larger and longer established

³² See next page.

³³ See next page.

³⁴ Dingell Speech in Voluntary Industrial Standards Hearings, passim.

Footnote Inserts

³²Speech of Hon. John D. Dingell, Industrial Standards--a two-edged sword reproduced in Hearings before the Subcommittee on Activities of Regulatory Agencies of the Select Committee on Small Business, House of Representatives, The Effect Upon Small Business of Voluntary Industrial Standards, Volume 2, 90th Congress, Appendix, p. A83.

³³Harry E. Morgan and Clyde Kallahan, respectively, senior vice-president and vice-president for corporate planning of Weyerhaeuser Company, probably the largest forest-products group in the nation, estimated in a personal interview (June 6, 1972) that lumber producers number about 10,000 but that fewer than one in five is capable of producing plywood.

associations of building officials, PCBCO and BOCA, that sought unification of all model codes within the year after SBCC's founding.³⁵

Although organized in 1915, and formally incorporated in 1938, the Building Officials Conference of America (BOCA) did not begin a formal code-writing program until after World War II when a short-lived subsidiary, the Building Officials Foundation (BOF), was created for this purpose. BOF membership was, in the words of BOCA's current Executive Director, "principally manufacturers of products used in buildings."³⁶ Moreover, the Foundation accepted industry contributions amounting to \$200,000 (in immediate post-World War II dollars!) with which to develop a building code for national, voluntary use. The Foundation was dissolved in 1952, two years after the BOCA Basic Building Code was first published in 1950. With the dissolution of the BOF, industry

³⁵ Colling, "Who's to blame for the Building Code Mess?", p. 84. Colling notes, on p. 85, that SBCC held out against any inter-organizational, interregional cooperation until a "no raiding" agreement (that one code group would not solicit new membership from among cities of another group's region) were reached. Interestingly, "no raiding" provisions were key to the building trades unions participation in the merger of the AF of L - CIO in 1955. Prior to that date, the CIO attempted industry-wide organizing among construction workers. Clyde Johnson interview, August 4, 1972.

³⁶ Richard L. Sanderson. Codes and Code Administration an Introduction to Building Regulation in the United States (Chicago: BOCA, 1964), p. 85.

contributors became a new category of BOCA membership, Industry Member; and the remaining assets of the BOF were directed toward assisting the BOCA program, to promote the adoption of the codes, to promote industry membership and to "assist in other activities to prevent preparation of a Federal [building] code."³⁷ Apprehension over a Federal building code, never far from the minds of code officials and their industry counterparts, grew to paranoiac proportions immediately after World War II. Title III of the Housing Act of 1948 and Title IV of the Housing Act of 1949³⁸ led to several standardization studies (usually precursors of code action). Funds for this activity were cut off in 1954 with the onset of the Eisenhower Administration.³⁹ With funds for Title III studies cut off in 1954, the vestige of the BOF, now an advisory Committee on BOCA, was disbanded in 1956. BOCA, itself, has prospered, drawing its membership primarily from the Northeast and Mid West. In 1970 BOCA changed its name in a way to indicate a broader geographic

³⁷ Sanderson, Ibid. Emphasis added.

³⁸ Respectively, Chapters 832 and 338 of the U.S. Statutes at Large.

³⁹ Dorothy Nelkin, The Politics of Housing Innovation, p. 60, suggests that the White House acted on the counsel of Douglas Whitlock, at the time Director of the Structural Clay Products Institute and a founder of The Producer's Council, Incorporated, a "peak association" of trade associations representing the major producers of building materials. Whitlock, in a January 27, 1971 interview with the present author averred that it was his patriotic duty to prevent his government from "pissing away all that money on questionable studies that no one would use."

and institutional reach than before, but retaining the well-known acronym: Building Officials and Code Administrators, International.

The Operations of Model Code Associations

To the extent that they are known outside the building community at all, model code groups are considered as professional associations and as sources of basic guides for the drafting of regulations for consideration and adoption by state and local governments. But the model code associations provide additional important services to both governmental and industrial clients as well, services that extend beyond the daily, operating needs of public agency members. Model code associations are primarily publishers and promulgators of proprietary documents, purveyors of specialized building technology advisory and plan review services and evaluators-for-fee of commercial products. The relative importance of the several purposes embodied in the model code association may be gauged from the fact that, in the case of BOCA, which continually refers to itself as a membership organization of building officials, publication and service revenues are three times larger than revenues from dues.⁴⁰

Service to industry may be classified as direct and indirect. Direct services, discussed later, are in testing

⁴⁰ Editorial, Building Official and Code Administrator, Vol. 5, No. 1 (January, 1971), p. 32. (Emphasis added.)

and certification of building materials. The term indirect service refers to the role of the model code association as a convenor of regional and national meetings that provide industry representatives with convenient forums to be used for unveiling new products or feeling out regulatory sentiment on an informal basis. Most associations provide industry representative non-voting membership and floor privileges at the annual meetings at which voting members review both standing codes and new items of technology being considered for eventual adoption. In most cases, industry members--with a voice but not a vote--pay dues in amounts several times the dues paid by voting members.⁴¹ The industry representative--each seeking either to gain a foothold or maintain a position of previous advantage vis a vis his competitor with rival materials--pays strict attention to procedural as well as substantive matters. Procedure is important because the meetings are relatively infrequent and thus are inordinately staff-influenced. They dispose of massive agendas and involve a

⁴¹ Statement of Robert E. McMillan, Special Counsel, Cast Iron Soil Pipe Institute before subcommittee on Small Business Problems in Smaller Towns and Rural Areas, of the Select Committee on Small Business, Hearings on The Impact of Crime, Crime Insurance and Surety Bonds on Small Business in Urban Areas, House of Representatives, 91st Congress, 2nd session, p. 232. Hereinafter referred to as Impact of Crime Hearings. In the case of BOCA, the annual dues structure accommodates trade Association Membership at \$600, \$300, and \$120 annually; industry memberships at \$300, \$120, and \$60 annually; whereas voting members pay, in proportion to population served, \$180, \$160, \$120, \$80, and \$50 annually. The figures are taken from BOCA promotional literature.

voting membership--local building officials--not adept at parliamentary maneuver. A whole other matter which is the question of whether problems of considerable technical intricacy are best dealt with in a parliamentary forum at all.⁴² One of the immediate occasions for potential abuse of participatory, parliamentary code writing is the matters of quorum and of rump sessions.

In recent years, a mere 17--and since 1964, 38--voting members could make policy for ICBO and amend its Uniform Building Code, 13 votes could control BOCA; only the SBCC conducted its code rewriting by mail ballot.⁴³ The significance of this small quorum is that the thousands of local jurisdictions that subscribe to the several model codes and that might ultimately convert model code recommendations into binding ordinances delegate considerable quasi-legislative authority to a handful of persons who are not only accountable to local review but may be oblivious to local needs.

⁴² Only one of the model code associations, the American Insurance Association (A Ins A) promulgators of the National Building Code (NBC), does not make code changed by vote of membership; A Ins A staff is entirely responsible for the NBC. One could argue, therefore, that, lacking even the pretense of open debate, the NBC is the code most susceptible to the blandishments of industry experts. Conversely, subscribers to the "impartial expertise" argument would endorse the board of syndics approach of A Ins A.

⁴³ Hal Colling, "Why Today's Model Codes Lags Behind Construction Technology" House and Home, Vol XXV, No. 4 (April, 1964), p. 147. The A Ins A's NBC, entirely staff-written, is entirely staff-revised.

Representatives of industries and of trade associations use their floor privileges to great effect, the lack of the vote notwithstanding. Consider the 1967 meeting of ICBO, in some respects the most progressive of the four national code groups. 161 code changes were considered. Of this number 68 (42 percent) were proposed by code officials, fifty (31 percent) by trade association representatives, and forty-three (27 percent) by professional groups. By meeting's end, thirty-four changes were approved (21 percent of those introduced); sixteen of these were initiated by local code officials themselves, seventeen by trade association representatives and one from professional groups.⁴⁴ If one were to calculate "batting averages" among proposers of code amendments at that ICBO meeting the trade associations, representing the building products and supply industry, are not likely to gain much even if they were granted voting privileges for, as is, they "outhit" the voting membership better than two-to-one in the ratio of proposals accepted to proposals made: trade association representatives $17/50 = .471$; building officials, $16/68 = .212$; professional associations, $1/43 = .023$. Moreover, it is likely that several of the proposals introduced

⁴⁴ Charles T. Mahaffey, A Special Study on Building Codes (for the National (Douglas) Commission on Urban Problems; background paper no. 18), distributed by Clearinghouse for Federal Scientific and Technical Information, PB 185 202, p. 3-7.

by building officials originated with trade association representatives, thus the "true" batting average would be even higher than that calculated here.⁴⁵

Elements of the building materials industry have not hesitated to use rump sessions of code association meetings when the stakes were high enough or when vagaries of geography are particularly conducive. A vivid, text-book clear, instance occurred in the 1966 annual meeting of the Western Plumbing Officials Association (WPOA) a group composed primarily of municipal, county and other plumbing inspectors in the western states. WPOA's model Uniform Plumbing Code is used by most municipalities in the 13 western states. WPOA, now doing business as the International Association of Plumbing and Mechanical Officials (IAPMO), is a counter-part to ICBO, which promulgates a general building code in the same region. The 1966 meeting of WPOA was historic in that it was the occasion of consideration of incorporation of standards for plastic (ABS) pipe, fittings and installation methods into the Uniform Plumbing Code.

Although WPOA is generally identified and formally incorporated as an association of public officials, the registration--not to mention attendance--at the policy-setting annual meeting suggests something different. The 1966 meeting

⁴⁵Prominence of trade association representatives and the lack of prominence of architectural and engineering professionals as sources of building innovation suggestions also occurs in code modernization efforts at the local level. See Ventre, Technological Currency in the Local Building Code, pp. 12-16, especially Figures 10 and 11.

included of 56 voting-eligible plumbing inspectors and a total of 137 other registrants who, though not voting, are permitted under WPOA by-laws to initiate motions, to second them and to have the privileges of the floor to speak on any business before the meeting. The 137 were comprised of 73 manufacturers representatives, 33 plumbing and mechanical contractors, 25 non-voting inspectors, three labor representatives, two trade magazine editors and one professional engineer.⁴⁶ Thus, the voting delegates--many of them diffident and unaccustomed to parliamentary maneuver⁴⁷--were outnumbered on "their" floor in the ratio of 2.41 to one. A former model code executive has estimated that one five-year sequence of annual meetings, representatives of the steel and lumber industries (two historic antagonists) usurped 35 to 52 percent of floor time on code charges affecting their interests.⁴⁸

Seldom is the word "isolated" used with such etymological aptness as when it is used to describe the 1966 WPOA meeting to which we now return. This meeting whose outcome was to

⁴⁶Testimony of J. G. Steertz, Executive Director of the Pipe Trades Industry Program of Arizona in Voluntary Industrial Standards Hearings, vol. 1, p. 118. Steertz is a non-voting member of WPOA.

⁴⁷This characterization is based on personal interaction with dozens of building officials in different parts of the country, men who are, in three out of four cases, former construction tradesmen or professionals and no match for the industry representative in verbal skill and stage presence.

⁴⁸Colling, "Why Today's Model Codes Lag Behind Construction Technology," p. 147.

grant a large advantage to plastic pipe in the lucrative residential construction markets of the western U. S., was literally convened on an island: Oahu; the conference was in Honolulu, Hawaii.

Apprehensive that the travel expenses might discourage participation by or representation of smaller cities, the Plumbing, Heating, and Air Conditioning Councils of San Mateo, Santa Clara, and San Benito Counties in California each offered to defray the travel expenses (in the amount of \$200 each) incurred by local officials wishing to attend the WPOA meeting.⁴⁹ In all, thirty offers were tendered and eleven were accepted. Nine of the eleven were plumbing officials from cities that had previously authorized plastic pipe in residential drain, waste and vent uses. These observations bear some analysis.

First, the model code groups voting rules--even those with proportional representation based on the subscribing municipality's population--actually penalize larger jurisdictions: smaller cities are over-represented.⁵⁰

Secondly, in terms of affiliations of municipalities with model codes and in terms of types and quality of code services,

⁴⁹ Testimony of Henry Berger, Plumbing Contractor, Palo Alto, California, Voluntary Industrial Standards Hearings, Vol. 2, pp. 515-543.

⁵⁰ Only BOCA offers multiple votes to larger governments; but the advantage is very slight: up to 50,000 population, one representative; from 50,001 to 150,000, two; 150,001 or more, three. Source: BOCA promotional literature. Under the IAPMO rules obtaining at Honolulu, there was no proportional representation.

model codes are clearly of, by, and for smaller cities and towns.⁵¹ Thus the plumbing industry in the San Francisco Bay Area was solicitous of small-town welfare where it needn't have been. Officials from smaller municipalities have used the model code apparatus to great effect.

Lastly, the eleven representatives flown to Hawaii and back as the guests of the northern California plumbing, heating and air conditioning contractors were almost 40 percent of the votes required to form a majority of the voting assembly, for under the terms of the by-laws in effect at Hawaii only twenty-nine votes were required to transact the business of WPOA.⁵²

The annual meetings of the model building code groups are similar in most respects to those of the model specialty code groups like WPOA. To be sure, the meetings, like the membership of the building code groups, is somewhat more diverse. The numbers are larger and the proceedings more

⁵¹The enrollment phenomenon is explained and documented in Charles G. Field and Francis T. Ventre, "Local Regulation of Building: Agencies, Codes and Politics," The Municipal Yearbook: 1971 (Washington: International City Management Association, 1971) pp. 143-149, especially Table 1/15. The quality of code service differential is identified in Francis T. Ventre, "Technological Currency in the Local Building Code," Urban Data Service Series (Washington, ICMA, April 1971), pp. 4-7, especially Figures 1 and 2.

⁵²The By-Laws of IAPMO (successor to WPOA) are reproduced in Voluntary Industrial Standards Hearings, Vol. 2, pp. A467-A489.

hectic.⁵³ But the dynamics are the same. Congressman Dingell, who advocates the extension of constitutional due process protection to private as well as public groups, has identified many abuses of due process in the working of model code groups. He has described the groups and their meetings in this way:

[A Model code group] is an association of governmental officials, mainly local, which meets in a conference... for one week each year. Such organizations have a way of breeding their own spirit of "do not rock the boat." The annual trip to the convention is something which many look forward to with eager anticipation. It is a time for renewing old acquaintances and making new ones. It is time for days filled with lectures and exhibits and business and for evenings filled with fun and pleasure. Day and night alike, many conventioners feel they have their own axes to grind. Does not experience of human affairs teach us that he does not grind own ax well who tries to rock the [Model Code] boat.

I do not find it surprising that only two members of [the Model Code group] were willing to take on that establishment nor do I find it surprising that the two who did decide to take it on have thus far been successful.

Far from this circumstance forming an argument that bodies such as [Model Code groups] require no regulation, they tell me instead that they do require regulation.⁵⁴

⁵³ Consider a recent agenda of ICBO, drawn from reports in the newspaper of the host city, the Salt Lake Tribune: 500 members (no specifics as to voting status or institutional constituency) adopted 300 of 650 proposed code changes in five days; 200 code changes were acted upon in the first two days! This information is drawn from the ICBO newsletter, Building Standards (September 1969), n.p.

⁵⁴ Speech of Representative John Dingell, Model Codes and the Public Interest, Congressional Record, Extension of Remarks, 1 November 1968, p. E9764ff. (Emphasis added) Note Dingell's allusion to the pervasive influence of the home-office staff on the model code groups.

What the Congressman called "days willed with lectures and exhibits and business" have been more candidly described by a past code-group executive director as periods of "filibustering, dust throwing, irrelevancy and misleading statements."⁵⁵ And what the Congressman blandly identified as "evenings filled with fun and pleasure" were more precisely, if less genteelly, described by an Ohio official as being pre-empted by "liquor and ass."⁵⁶

As mentioned at the outset of this section, the primary, direct service provided by model code groups to the building materials industry, and an enormous source of revenue for them, is the practice of testing and certifying unfamiliar or new building materials, components and methods of assembly, fabrication or installation. What is distinctive, and thereby significant about this direct service is that it is almost totally in the hands of the code group home office staff whose decisions are merely legitimized, if at all, by the identification (in the psychological sense) of the code's testing

⁵⁵Colling, "Why model codes lag behind construction technology," p. 147 (Remember: 200 code change actions in two day-long sessions. See above, fn. 53).

⁵⁶In a 1970 telephone interview with a research colleague. One wonders what the liberalization of marijuana laws will mean to these evening sessions in the future: a euphonic "ass n' grass"? David Pellish, Technology Office of the New York State Urban Development Corporation, advised this writer to "find out who pays for the hospitality suites if you want to find out who's behind any innovation," in an interview on 8 May 1970.

service with the code body's membership.⁵⁷ And vice versa. That is, on the one hand, the local building official can proudly relate himself to the code group's announced effort to disinterestedly evaluate previously untested building products. On the other hand, the certifications issued by the model code groups evaluating body carry some weight in the building products industry because of the implied consent of the membership-at-large of the model code group. And, by examining the schedule of fees that model code groups exact for these certifying services, this implied consent of thousands of local officials is highly valued by building materials producers. An examination of the evaluation process reveals, however, that, like the deliberations on the floor of model code business meetings, technical decisions are arrived at by parliamentary, and thereby political, means. Is this an appropriate method, one may fairly ask. It manifests the fallacy of prevalent proof. A majority of (possibly uninformed) opinion becomes a method of verification.⁵⁸

Before even the epistemological issue, however, lies an ethical one. In the instances where physical testing is con-

⁵⁷ Irwin Benjamin, an authority on fire safety who's dealt often with model code associations, reported to this author in an interview on 16 December 1970 that "the key work [on model code changes] occurs between meetings. Convince the staff; then sell the board [of directors]. Take it to the membership last."

⁵⁸ David Hackett Fisher, Historians' Fallacies: Toward a Logic of Historical Thought (New York: Harper and Row, 1970), p. 51.

ducted, the fees charged by model code associations--all of which are organized as non-profit entities--are orders of magnitude larger than the costs of testing itself. Both these issues is now examined further.

Technological change in the building industry is incremental, occurring in small, piecemeal steps. In this respect, the building industry is similar to most industries for studies of even the "high-technology" industries like computers, aerospace and weapons development reveal that the cumulative effect of incremental changes are ultimately more significant to progress than are the infrequent technological tours de force.⁵⁹ Manufacturers of building components or products must eventually seek local building code approval of these incremental changes in order to market them the country over; he does this following a procedure called "product approval."

The sponsor of the innovation presents to code authorities data documenting that innovation's compliance with pertinent voluntary industrial or required building code standards. If required by the local building department, the sponsor may have to adduce evidence of further testing by independent laboratories.⁶⁰ Once the local official approves, the material,

⁵⁹See chapter 1, fn. 61, 62 and 63.

⁶⁰William Demarest, Building Codes: Product Approval (New Haven: Ludlow-Bookman, 1964) pp. 1-2.

method, assembly or engineering standard under review becomes a part of the local code.⁶¹ This is the bare-bones outline of the procedure by which local codes undergo incremental modernization. This process is repeated hundreds and hundreds of times--recall: there are over 8,000 building codes in force in the U.S.--with a slightly different roster of participants in each municipality. It is to circumvent this long, repetitive and costly process that sponsors of innovations turn to central testing agencies--most often, to model code groups. Model code groups oblige by providing, for a fee, a procedure for identifying, evaluating and determining the ability of the innovation to meet the sponsor's claims. But detailed examination of this model code operation shows that it leaves much to be desired.

To begin, most model code groups do not maintain testing facilities. A close reading of their own utterances reveals that they merely review the procedures and findings of semi-independent laboratories. "Semi-independent" is used advisedly; two instances justify the use of the term: 1) a close examination of the widely-recognized label of "UL"--The Underwriter's Laboratory--concedes that the underwriters referred to are the National Board of Fire Underwriters, original promulgators of the National Building Code, the first of the model codes.

⁶¹Ambrose M. Richardson, "Building Codes: Reducing Diversity and Facilitating the Amending Process," Harvard Journal of Legislation, Vol. 5, No. 4 (May 1968), p. 607.

NBFU remained a principal sponsor from UL's founding in 1894 until 1968 when sponsorship was enlarged to include public interests in addition to NBFU (now A Ins A)⁶²; 2) the ABS Institute, sponsors of most of the plastic pipe innovations, continually adduces in support of its product findings developed by National Sanitation Foundation, a commercial testing laboratory, one-third of whose testing income is derived from the plastics industry.⁶³ As was said, most of the evaluation of test evaluations is done by the model code staff whose decisions are subsequently ratified by the membership. Whether or not these persons are qualified to evaluate test procedures and results (and, ipso facto) the competence of laboratory personnel is questionable. A word about the nation's little known testing industry may clarify the predicament of a well-intentioned code official.

Commercial testing laboratories, either for a fee or on a contract basis, provide clients with, among other things, physical testing of materials, methods or design against previously stipulated performance criteria. Testing can be one a one-time or serial basis (the latter used, for example, in the quality control of industrial production) incorporating

⁶²Sanderson, Codes and Code Administration, Appendix O. pp. 229.

⁶³Testimony of Charles A. Farish, Executive Director of the National Sanitation in Voluntary Industrial Standards Hearings, Vol. 2, p. 780. In fairness, it must be added that none of the 17-member Board of Trustees of the Foundation are connected with the plastics industry. Curiously, all are from Detroit and vicinity. Statement of Mr. Farish, Ibid, p. 781.

the use of sampling theory and inferential statistics, as required. Testing, in other words, can be accomplished with varying degrees of rigor, replicability, representativeness, relevance, realism and--important in the commercial testing industry--remuneration. The industry is large enough--annual receipts: \$208,000,000; numerous enough--1253 establishments; dispersed enough--no state, except Vermont, is without at least one and most states have several (North Dakota has twelve; South Dakota, six; and Nevada, five); so that finding a servicable (in the double sense of that term) laboratory is not impossible. Contrary to popular belief, commercial testing laboratories are not overrunning with highly paid scientists and engineers. In these laboratories, scientists and engineers comprise only one-fifth of the workforce (whereas in commercial R and D labs they comprise well over one-third the employees) and the "average" commercial R and D employee earns 46 percent more than his counterpart in commercial testing.⁶⁴

Conscientious building officials have serious reservations about commercial testing laboratories and collectively, acting through the National Conference of States on Building Codes and Standards (NCSBCS), have asked the National Bureau of Standards, the nation's foremost testing laboratory, to develop criteria for a laboratory evaluation and accreditation

⁶⁴U. S. Bureau of the Census, Census of Business, 1967, Selected Services: Miscellaneous Subjects BC 67-SS8 (Washington: USGPO, 1971), Table 1 and Table 5.

program in order to police against "sweetheart" contracts between building product innovation enthusiasts and too complaisant laboratories.⁶⁵

Of course not all building officials are so skeptical. Recounting a colloquy with officials of one model code group, a witness--in this case a representative of a dissatisfied client of that group--reported to the Small Business Subcommittee on Activities of Regulatory Agencies the following example of typical testing procedures:

Counsel for Watts Regulator Co.: I personally queried representatives of the [model code group] as to how they determined whether a product was safe or not when they could not test them. They said that they would take the product into a room and study it and then they would come out and the product would be approved if they thought it was OK.

Committee Counsel: Do you know where any of these specific studies were conducted?

Counsel for Watts Regulator Co.: From what I gathered, they could be conducted at certain motels or hotels in the [model code's "territory"].⁶⁶

These travails notwithstanding materials producers do seek model code approvals and pay for it well for carrying the approved product on a "preferred" list which is then distributed to the membership of the model code association, the local building officials. These local officials then use this list as a reference when they are asked to approve a new

⁶⁵ NCSBCS, "Project LEAP," Unpublished description, National Bureau of Standards, Center for Building Technology.

⁶⁶ Voluntary Industrial Standards Hearings, Vol. 1, p. 55.

product for use in their own jurisdiction. The approval fees are asked by the model code associations are not low--\$225 for the initial listing, \$150 a year thereafter (even though no subsequent "testing" is required)--and the same fee is exacted on each item in the product line. Thus a producer so a plumbing and pipefittings must pay a separate fee on hundreds of devices: from water heaters to pipe fittings; from dishwashers to vapor barriers. The advantage proferred by the model code group is considerable. "[b]y paying the license fee," said Counsel for Watts Regulator Co., "we are guaranteed safety and sales. That is the judgement of our company in respect to the [model plumbing code association].⁶⁷

This sentiment, the notion of assuring local acceptance by seeking a model code endorsement first, is widely shared. One building authority regards this step as an "Open, Sesame!" to local acceptance of innovative technology, when he states:

BOCA's approval, of course, is a recommendation and does assure acceptance by local communities. But in actual fact a manufacturer of an approved product can anticipate close to 100% acceptance among BOCA-member jurisdictions, plus a very substantial assist in his submissions to others.⁶⁸

This statement is correct only in so far as it reminds the reader of the advisory, non-binding nature of the model

⁶⁷ Ibid., p. 57. And the testimony of William A. Lauderdale, a manufacturer's representative (in this case a commission salesman), ibid., Vol. II, p. 560.

⁶⁸ Demarest, Building Codes: Product Approval, p. 5 (Emphasis added.) Demarest adduced no "facts" in support of this statement. The passage reproduced above also appears verbatim (plus punctuation) but without acknowledgement in Sanderson, Codes and Code Administration, p. 92.

code group's recommendations. But the reminder is gratuitous since the code groups acknowledge as much in their formal utterances. Take, for example, the following disclaimer cum promotion that prefaces the March 1, 1972, listing of approvals that was distributed to BOCA members:

The recommended approval of products, systems or quality control agencies by the Research and Approvals Committee of Building Officials and Code Administrators International does not constitute an approval or acceptance by any local community. Such acceptance is a function of local government administered by the designated local official. However, a BOCA International Approval Recommendation is recognized and accepted by many local officials without the necessity of submitting further data because it is supported by condensed factual reports describing the nature and use of the product or system and its performance under designated standard tests.⁶⁹

Demarest's statement is erroneous, however, when it promises "close to 100% acceptance" among BOCA code users. The error is subsequently magnified in Sanderson's unsubstantiated and self-serving assertion that "...it is rare that [these recommendations] are not accepted."⁷⁰ Two recent national surveys of local building departments deflate these claims⁷¹ but the myth of code uniformity through voluntary adherence to model code recommendations persists, mostly in

⁶⁹ Insert to The Building Official and Code Administration, Vol. VI, No. 3 (march 1972). (Emphasis added).

⁷⁰ Sanderson, Codes and Code Administration, p. 89.

⁷¹ Manvel, Allen D., Local Land and Building Regulation, Research Report No. 6, U.S. National (Douglas) Commission on Urban Problems (Washington: USGPO, 1968) and Ventre, Technological Currency in the Local Building Code.

the promotional literature of the code groups themselves. This is not to deny that localities that have adopted model codes in some form at some time do not have more technologically current codes. That they do is demonstrated by Manvel and by Ventre.⁷² But total acceptance of model code recommendations by subscribing is not frequent. About one subscribing local government in seven, for example, was completely current with the standards of their "own" model code and half of the subscribing municipalities were rejecting for local use one out of every three items advanced by the model code group. Moreover, 20 percent of the population that is served by model codes are served by local building departments that have rejected half the code modernization recommendations proposed by the model code group of which they themselves are voting members.⁷³ The Douglas Commission, with one concrete example, encapsulates much of the frustration inherent in voluntary, consensual approaches to the reform of dispersed institutions of which building departments--indeed all local government functions--are examples:

⁷²Ibid. Respectively, Table 10, p. 36, and Table 3, p. 5.

⁷³Chapter 3, Figures 3-3 and 3-4 and Table 3-18.

...One of the four major national building code groups has an eight member committee which passes on such issues as the use of plastic pipe for inclusion under the provisions of the model code. On the bases of evidence presented to the committee, its members voted unanimously to accept the use of plastic pipe in the drainage system of non-multi-family residential construction. They recommended that such use be incorporated locally as a part of the plumbing chapter provisions of their building code. Even today, however, the use of plastic pipe for this purpose is allowed under the local code in the jurisdiction of only one of the eight members who voted to include or accept it in the national code.⁷⁴

To conclude: Once the history and current practices of the model code associations are reviewed, and then contrasted with the image they have propagated and sustained within the building industry and among its regulators, it appears that members of that industry attribute to these groups qualities of independence, autonomy and disinterestedness that they simply do not possess. Moreover, product approvals and other endorsements made by model code associations are accorded a significance beyond their specific and precise meaning. These points will be elaborated and illustrated with examples when the analysis turns to the actions of local building officials reviewing the technological currency of the codes they enforce.

⁷⁴U. S. National (Douglas) Commission on Urban Problems, Building the American City (Washington: USGPO, 1968), p. 258.

The Trade Associations

The previous section began with an admonition to the effect that, of the private associations they bear on the regulatory decisions concerning innovative technology, the model code associations are neither the originating nor the most powerful groups. This section identifies and examines the activities of the private groups most central to the task of advancing or retarding technological change in the building enterprise--the trade associations.

The contemporary trade association has been described in the following way by Theodore Lowi:

an administrative structure whose most important mission is regularizing relations among participants in the same industry, trade or sector. Where the market seeks competition, the trade association seeks to administer.⁷⁵

When those "regularized relations" are subject to duress or threat, another function of these private associations is manifested: "...to order their [members'] relations as a group with other groups."⁷⁶ When the protection and maintenance of the equilibrium of "regularized relations" requires resources beyond that which the voluntary association can by itself provide, recourse is made to the "wider powers of some more inclusive institutionalized group..."⁷⁷

⁷⁵The End of Liberalism, p. 36.

⁷⁶Truman, The Governmental Process, p. 56.

⁷⁷Ibid, p. 105.

The trade associations that cluster about the construction enterprise serve in all three capacities: 1) as internal regulator; 2) as monitor of potentially hostile environments and defender against incursion; and 3) as intermediary between industry and government, which in modern Western society is the most "inclusive institutionalized group." But to trade groups in the building industry a distinctive responsibility adheres. Given an industry as atomistic and dispersed as construction, the trade associations (and a special sub-group, the labor unions) are among the few poles about which the industry can cluster and identify itself. This has profound consequences for technological progress in the industry, for these entities--trade associations and labor unions--that are capable of catalyzing anything even approximating industry-wide action are the very entities that, in the circumstances of their origin or in their customary behavior, are the more regressive forces in virtually every industry. This last generalization and its aptness to construction will be discussed in the concluding chapter. For the present, however, we will describe the workings of trade associations in each of the three capacities and in passing, remark on the consequences for technological progress of these association activities. It is the last of these activities--that of industry-government intermediary--that bears most heavily on the subject on this study. The relations of the building industry with its regulators, the local building officials.

Voluntary associations of business enterprises in the same industry have performed their greatest service to society at large in the execution of item 1) above, as internal regulators of their industry. This judgement is prompted by the work these groups have done in establishing and enforcing voluntary standards in the production of physical goods, for without a common technical terminology and convention of measurement one would be hard put to even imagine an industrial system of production and distribution at all. Basic producers require standards or conventions in the mass production of uniform goods and effect great economies through the use of standard designs, equipment, procedures and tests. Distributors benefit from industrial standards in having to stock fewer varieties and sizes of commodities and from simplified inventories. Industrial and household purchasers rely on industrial standards as an aid in deciding the relative merits of competing products. The impact of standards pervades modern economies. Somewhat surprisingly, though, given the vital importance of a standards system, the establishment and enforcement of standards is, in the United States, almost entirely in the hands of industry. So it is with building standards. This has serious implications for building regulations, for these codes, which have the force of law, either incorporate directly or refer to specifically these standards written by the very industries being regulated!

Standards serve one of two purposes: the one to define the ends to be achieved by the technology under discussion; and the other, to define the means used to achieve that end. We shall refer to the different standards as "substantive" and "functional", respectively. Functional standards are definitions of expected performance or descriptions of products or processes, "a set of conditions to be fulfilled or an object for comparison."⁷⁸ An example of functional standards in the electric supply industry would be the ferrule size and thread design of a lighting fixture using incandescent lamps. Any electric light bulb manufacturer of any size and in any region in the country can then make his bulbs to be interchangeable with any other bulb made and suitable for use in any lighting fixtures. Manufacturers of lighting fixtures, if they abide by the standard, are assured a source of bulbs. Any electrical contractor--unless otherwise restrained--can install any bulb he chooses when installing the fixture. An a building owner has the same liberty. No rule of law stipulates these sizes or makes for such co-ordination. Rather, industry members through their trade associations volunteer their participation in the formulation of these functional standards, most often in terms of descriptive specification of physical products, devices of systems.

⁷⁸ Testimony of Leroy L. Wyman, Jr., Consultant to American Society for Testing and Materials (ASTM) in Voluntary Industrial Standards Hearings, Vol. II, p. 437. ASTM is concerned more with basic materials than with industrial products.

Substantive standards are those that relate the performance of physical materials, devices or systems to the "affectable characteristics of human users; i.e. physiological needs, psychological needs and sociological needs."⁷⁹ It is by referring to these substantive standards that choices are made between competing materials, devices and systems for use in designed environments. The purpose of building codes is to require, with the force of law (specifically, the police powers of government) a minimum performance of these environmental functions to assure the public health, safety, welfare and comfort. Thus, the public interest is much more concerned with the formulation of substantive than with functional standards. But the two kinds of standards--though logically and analytically distinct--are, in practice, closely related. Here is where abuse and potential corruption enters in.

An estimated 13,000-14,000 standards are now in use in the U.S.⁸⁰ and, except for the fewer than 500 are administered by the U. S. Department of Commerce (5% of the total), all are devised and enforced entirely by the voluntary trade associations. This is a type 1) activity of these trade groups, and except when some businessmen are discriminated

⁷⁹ John P. Eberhard, Project Director, The Performance Concept: A study of its Application to Housing, Institute for Applied Technology, National Bureau of Standards, June, 1969 (Washington: Clearinghouse #PB184458), p. 48.

⁸⁰ Testimony of J. Herbert Hollomon, Acting Under Secretary of Commerce in Voluntary Industrial Standards Hearings, Vol. 1, p. 8.

against in this work,⁸¹ there is little to prompt public concern. Increasingly, however, these same industry associations are moving into the area of substantive standards and are assuming the quasi-legislative functions of public governments as they move into type 2) and 3) activities: monitoring potentially hostile environments and defending against incursion; and influencing governmental regulatory agencies in their behalf. We have already shown how these activities are manifested in the meetings of model code groups.

In 1968, Albert G. H. Dietz reported an estimate of approximately 450 associations representing specialized groups in the building industry.⁸² A short time later Construction Review published a roster bearing the names and addresses of 554 such private groups.⁸³ Table 5-1 classifies the constituents of this roster, but excludes those groups devoted to highways and heavy construction. (Labor unions, governmental agencies, and sub-national associations were not included in the Construction Review enumeration). An analysis of the roster

⁸¹This happened often enough in the past to prompt the House Select Committee on Small Business to several investigations including, beside the already cited Effect Upon Small Business of Voluntary Industrial Standards, another one of interest to the construction industry, a report on The New Softwood Lumber Standard and its Impact Upon Small Business (91st Congress, 2d Session, House Report No. 91-1750).

⁸²The Building Industry, Douglas Commission background paper no. 24 (Washington: Clearinghouse, PB185208).

⁸³Vol. 14, No. 12, (December, 1968), pp. 4-14.

TABLE 5-1 - Classification of Building Industry Private Trade Associations

Building Products suppliers		387
Building Products Manufacturers	354	
Raw Materials	151	
Semi-Finished Materials	120	
Manufacturer Components	83	
Distributors	33	
Builders		62
Contractors	47	
Building Manufacturers	15	
Professional Societies		55
Architecture and Engineering	41	
Planning, Public Works,		
Real Estate	14	
Research and Standards		26
*Research	17	
*Standards	9	
Miscellaneous Entities**	12	
		<u>542</u>

*Non-governmental

**e.g., Construction Industry Joint Conference; National Fire Protection Association.

is instructive: over 70% of the associations are in the supply channels of the industry. If contractors and building manufacturers are included as the final element of the channel, over 80% of the organized entities are supply oriented. Who speaks for the users one may fairly ask. Apparently no one in the private sector. This precisely, is the substance of the fourth critique of the pluralist's group interpretation of government drawn at the beginning of this chapter.

What do these private groups in the building industry do? As internal regulators, building industry trade associations are responsible for, among other things,⁸⁴ the establishment and maintenance of functional standards for the products they manufacture and distribute. This prosaic work is essential to the diverse and dispersed construction industry with hundreds of producers for each of thousands of elements incorporated into a single structure.

Since buildings are combinations of inputs from hundreds of industries, functional standards must be developed to facilitate the ready combination of thousands of separate items. For these purposes, cross-industry collaboration is required and private associations assist here as well. Modular

⁸⁴ Voluntary trade associations are frequently alleged to fix prices, cartelize markets, and otherwise restrain the normal flow of trade. These alleged activities are beyond the purview, the present analysis.

co-ordination in building design is an example. The building industry recognition of the 4" (approximately 10 cm.) three-dimensional grid was achieved through an industry-wide consensus developed over several years by committee A62 of the American Standards Association, now doing business as the American National Standards Institute (ANSI). ANSI is one of the 486 American organizations that organize these intra- and inter-industry standardization agreements,⁸⁵ most of which are in the private sector. ANSI is organized to supervise, assist and approve the formulation of standards; it does not write them. Rather, this basic work is done by the industry trade associations that, in turn, finance and lend technical support to ANSI as the latter seeks a national consensus for the standard. In short, ANSI, along with the eight other groups that establish voluntary standards for the construction industry,⁸⁶ rely for most of their financial and technical support upon those who will be subject to the restrictions inherent in the standard.⁸⁷

Voluntary standards bodies, having none of the coercive powers of governments, must perforce rely on consensual methods in arriving at the standards they promulgate. Consensus is easiest to gather about proposals that discomfit as few as

⁸⁵ National Bureau of Standards, Directory of United States Standardization Activities, Miscellaneous Publication 288 (Washington: USGPO, 1967).

⁸⁶ See Table 5-1 above.

⁸⁷ This review of voluntary standards activities draws heavily on the Final Report of the National Commission on Product Safety (Washington: USGPO, 1970), pp. 51-55.

possible. In ANSI's case, consensus is operationally defined as "4/5 of those organizations substantially concerned." If at least 21% disagree, the work toward consensus-making stops!⁸⁸ The consensus principle yields, then, minimally acceptable standards⁸⁹ described by one skeptic as "lowest common denominator" standards.⁹⁰ While lowest common denominator standards may serve for product or functional standards, we shall argue later that this is an irresponsible method if used for substantive standards, those involving public health, welfare, comfort and safety.

The second major task of voluntary associations that concern themselves with construction is to order relations with entities outside the respective industry. One such activity of importance is the relations that most building industry associations maintain with the labor unions that either fabricate or install (or, in fewer cases, that manufacture) the products made by the trade association members.

National representatives of the unions and the trade associations, concentrated in Washington, see each other

⁸⁸ Ibid., p. 52.

⁸⁹ Theoretical studies of coalition formation have reduced this to an invariable outcome among rational actors. See for example, the writings of William Riker.

⁹⁰ "Lag in Job Safety is charged to U.S.", New York Times, October 1972, p. 27. This article, describing Consensus methods used to establish guidelines implementing the Occupational Safety and Health Act of 1971, carries the description quoted above. The speaker further remarked that Consensus standards are the "end result of the best special interest lobbying effort."

frequently, both formally and informally. There are cases, even, of persons moving across the table in the course of a career. That is, from serving as an agent of a union and then a trade association.⁹¹

An instance of mid-career shift more common to the building regulatory community was the personal experience that one witness recounted to the Dingell Subcommittee on Regulatory agencies: from plumbing inspector of Beverly Hills to the Copper Development Association (working to bring about code acceptance for copper drain, waste and vent pipe) in which capacity the witness was responsible for "contact[ing] city, county and other code bodies to bring about code approvals for copper piping materials;" thence to become manager of the construction industries department of the Los Angeles Chamber of Commerce where, he related, "I had occasion to aid in evaluating and formulating many recommendations for revisions of State, county and city building regulations including those related to plumbing matters; thence to his the-current employer, R. and G. Sloane, a major producer and supplier of fittings for plastics piping systems."⁹²

⁹¹ Precisely this move was made by Robert E. McMillan, currently special counsel to the Cast Iron Soil Pipe Institute (CISPI) who a few years earlier served in a similar capacity with the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada. Personal interview, 27 January, 1971, Washington, D.C.

The CISPI-United Association formed a common front in the Battle of Plastic Pipe during the 1960's and early 1970's, a relation examined further in Chapter 6.

⁹² Testimony of Norbert Grengs in Voluntary Industrial Standards Hearings, Vol. II, p. 715.

The same witness, in response to pointed questioning by committee counsel conceded that the ABS Council, a constituent of the Plastics Pipe Institute of the Society for the Plastics Industry formed to promote the use of plastic in plumbing piping systems, recruited as its first executive director the then-current executive director of the Western Plumbing Officials Association.⁹³ This career path is not unique or even unusual; rather, it is the norm.⁹⁴

Among the formal occasions of trade association-labor union meetings are the numerous joint labor and management boards that adjudicate jurisdictional disputes between unions and between specialty contractors; that oversee the operation of apprenticeship programs (operated by unions but financed by levies on contractors) and act as trustees for common retirement funds; and that monitor the collective bargaining on wages, hours and working conditions that are negotiated by local Building and Construction Trades councils and local units of the Associated General Contractors (AGC), the Building Trades Employers Association (BTEA, which speaks for specialty

⁹³Ibid., p. 717

⁹⁴This statement is based on the present author's participation in a three year-long effort to reform building code legislation in Massachusetts. Dozens of trade representatives were dealt with in the course of this work and most of them had career biographies nearly identical to those just recalled. These are widespread examples of just such a phenomenon at work at all levels of government. See Michael C. Jensen "Musical Chairs in Business and Government" New York Times, 12 November 1972, Section 3, pp. 1 +.

contractors), or local affiliates of the national trade association involved. It should be emphasized that the "home office," national levels of both unions and trade associations in the building industry only "set the atmosphere" for the hard bargaining that occurs at the local level,"⁹⁵ and enter these disputes only when local resources are exhausted. The premier example of home-office co-operation are found in the electrical trades and is worthy of elaboration here.

The Council on Industrial Relations (CIR) is comprised of seven members of the National Electrical Contractors Association (NECA) and seven members of the International Brotherhood of Electrical Workers (IBEW) and is presided over by the president of the IBEW. According to the CIR, its "primary purpose is to remove the causes of friction...by providing a forum for...settlement of controversies between IBEW locals and NECA chapters."⁹⁶ The CIR, an outgrowth of the World War I industrial mobilization engineered by Bernard M. Baruch, has met quarterly since 1919 to arbitrate disputes

⁹⁵ Reese Hammond, Director of Research and Education, International Union of Operating Engineers, interviewed on 28 August 1969. This long-standing custom in the building trades is now enforced by the provisions of the Landrum-Griffin Act which stripped national unions of many powers previously used to discipline recalcitrant locals. Many, but not all. The ultimate weapon of the international is to revoke the charter of the local.

⁹⁶ The Council on Industrial Relations, 9th ed., p. 18 (Washington: CIR, January 1968). Quoted in Elizabeth K. Allison, Union Administration: A Management Control Study, unpublished Ph.D. thesis, Harvard University, 1971, pp. 2-28 and 2-63 fn 53.

in the areas of "work rules (including the incorporation of new technology), grievances and pay that cannot be resolved locally."⁹⁷

The effectiveness of the CIR can be gauged in several ways. There has been no known violation of a CIR local arbitration decision in 55 years,⁹⁸ Electricians are among the highest paid of all the specialty trades in the construction industry.⁹⁹ They suffer the least in terms of construction industry unemployment,¹⁰⁰ and, owing to the efficacy of CIR's companion panel, the Joint Apprentice and Training Committee, they enter the construction industry with the highest grade of beginning skills,¹⁰¹ a feature that further justifies the continued participation of the electrical contractors. These are the fruits of joint labor-management efforts through the agency of voluntary trade associations. Radicals may protest such Comperism, but apparently the electricians don't mind.

⁹⁷ Interview with George Roscoe, a senior NECA official since 1946, on 19 January 1972.

⁹⁸ Allison, Union Administration, pp. 2-28 and 2-63 fn. 55.

⁹⁹ Department of Labor News Release, "Results of BLS Survey of Compensation of Workers Employed by Construction Special Trade Contractors" Friday, 25 June 1971 (USDL 71-312).

¹⁰⁰ Haber and Levinson, Labor Relations and Productivity in the Building Trades, p. 128.

¹⁰¹ Howard G. Foster, "Non-apprentice Sources of Training in Construction" Monthly Labor Review, Vol. 93, No. 2 (February 1970), pp. 23-24.

The third major task of the voluntary trade association is to "supplement their own resources by operating upon or through that institutionalized groups whose powers are most inclusive in that time and place."¹⁰² Perhaps this statement, rendered as an "iron law of voluntary associations," should be modified to read "...whose powers are just sufficiently inclusive to get the job done." For by working with quasi-governmental entities, voluntary associations avoid the risk of public exposure (leading to premature disclosure) of their activities. This is not to suggest the voluntary groups are engaged in illegitimate enterprise. Rather, no association purpose is gained by "going public" and a great deal of independence of action and freedom of movement would be lost.

Quasi-governmental entities are for this discussion stipulatively defined as those organizations that speak with sufficient authority in certain delimited areas to legitimize their later usurpation of governmental responsibility. It is this presumption of authority in the area of substantive standards--an area constitutionally reserved to the police powers of the inclusive state--that is the occasion for potential abuse of an implied public trust.

When private quasi-governmental entities succeed in promulgating substantive standards, they have arrogated to

¹⁰²Truman, The Governmental Process, p. 105.

themselves jurisdiction over matters that are constitutionally reserved to public governments. This transfer of jurisdiction-- and the redistribution of power it masks¹⁰³--occurs, in the present context, when private entities enlarge their sphere of influence beyond the establishment and promulgation of functional standards to the establishment, promulgation and enforcement of substantive standards. The following instance illustrates this subtle shift from functional to substantive standard-setting.

Recall our light-bulb example of a functional standard. Speaking more precisely, we were dealing with an incandescent filament lamp whose technical characteristics are specified with great precision: filament material, length, diameter, coil spacing, mandrel size, lead-in wires, number of filament supports, method of mounting filament, the vacuum or filling gas; gas pressure, bulb size, shape and surface treatment, and bases. Each of these components and their combinations into incandescent filament lamps--commonly known as light bulbs, are designed to functional standards whose purpose is to make compatible the outputs of dozens of suppliers to the bulb makers. Also, purchasers of bulbs are assured interchangeability across brand names that makes price competition possible.

¹⁰³On the use of this transfer device in the historic transfers of economic and political power see Louis L. Jaffe, Judicial Control of Administrative Action, abridged student edition (Boston: Little, Brown, 1965), p. 5.

These standards are established and promulgated by the Illuminating Engineering Society (IES), publishers of, among other more narrowly-focussed documents, the IES Lighting Handbook: The Standard Lighting Guide.¹⁰⁴ There can be no faulting the IES in its efforts to rationalize the design and production of illuminants and their appurtenances. This is a natural undertaking for a voluntary trade association or, a special variant, its captive professional society, the IES. The IES may be referred to as a captive society since 80% of its dues-paying members (not to mention its institutional and corporate members) and a large fraction of its officers are employees of lamp and fixture makers, utilities and others "with a direct economic stake in lighting practices."¹⁰⁵

The lighting practices referred to are the substantive standards promulgated by the IES that specify illumination levels for various tasks pursued in domestic, commercial, industrial and institutional occupations. Although nominally recommendations, the industry-written standards--continually being raised with subsequent editions of the IES Lighting Handbook--become de facto lighting codes in those states that reference the IES tables in their own codes. In these

¹⁰⁴ 3d edition (New York: IES, 1860 Broadway, N.Y., N.Y. 10023, 1959).

¹⁰⁵ Thomas Lindley Ehrich, "Too Much Light?/Critics Say Illumination in Many Buildings is Greater than Needed/Traditional Standards Called Excessive, Costly; Industry says They Improve Vision/The British Settle for 90%," Wall Street Journal, 28 September 1972, p. 1 +.

situations, we witness an ingenious industry persuading the police powers of the state to enforce on building owners what is a thinly-veiled mandatory purchasing order for greater use of that industry's product. The basis of IES's claim to authority in the substantive (end achieved) area is its acknowledged authority in the functional (means chosen) area.¹⁰⁶ Moreover, the IES Lighting Handbook, a veritable industry bible, concludes with 156 pages of paid advertising by the suppliers of lamps and lighting fixtures.

As illuminating as the foregoing example is, it is far from unique or even unrepresentative. Many voluntary associations are, in their very by-laws, directed to monitoring the regulatory environment in which their members practice. Take the Plumbers Union again, for instance. As their legislative representative candidly put it to the Subcommittee on Regulatory Agencies of the House Select Committee on Small Business:

Even today, if you were to look up the section of our constitution captioned "Legislative Committee:", you might be surprised to find that the legislative committee is not to be concerned with minimum wage or labor management legislation or social security or any of those things that are typically associated with the political or legislative aims of labor unions, but rather the sole aim of what we still call the legislative committee is the plumbing code. ...and the big political objective

¹⁰⁶In fact, of the references cited as justifications for the prescribed illumination levels, 75 are from IES or other industry sources, 12 are from scientific sources and only one from the U. S. government. See IES Lighting Handbook, Figure 9-53, footnotes.

in a plumbers' local union was to keep watch on the code and to try all possible and legitimate means to elevate the standard of work done under the code.¹⁰⁷

But one suspects that more mundane considerations than the instinct of workmanship prompt the United Association's participation in the writing of codes that have effect of "elevating the standard of work." Rather, construction craftsmen use the codes as a device to guarantee a market for their labor inputs in much the same way the building products trade associations do for their material inputs. The unions (and their management allies--remember Dunlop's Caveat) use the codes in two ways to assure the demand for labor services. One is to use codes to enforce a particular assignment of work among the several specialty and basic trades, the other to stipulate labor-intensive field operations in the erection of structures and the installation of equipment.

The assignment of work among trades often follows de facto from the definitions found in the prefatory portions of the codes themselves. An innocent-appearing definitional change was attempted in the most recent version of the National Plumbing Code, a proprietary advisory code developed and promulgated by an inter-industry committee of ANSI. This code

¹⁰⁷ Testimony of Robert E. McMillen, Legislative Representative, United Association, in Voluntary Industrial Standards Hearings, vol. 1, p. 192. Emphasis added.

As Thorstein Veblen pointed out long ago, the "instinct of workmanship" is one of those elemental traits that distinguishes the genus homo sapiens.

included in its definition of plumbing sprinkler systems and other fire control devices. Heretofore, sprinklers were installed by piping specialists who, although members of the United Association, are not plumbers. Under the terms of the Code, anything included in the definition of plumbing could be installed by licensed plumbing contractors only. Thus one small construction specialty would be legislated out of a livelihood in any jurisdiction that adopted for local use the proposed latest version of the National Plumbing Code.¹⁰⁸

A similar definitional dispute has occurred in the codes affecting the installation of "outside utilities," mostly in the laying of pipe and conduit (carriers of water, sewage, electricity or steam) in trenches. Historically, much of this has been "laborers work" and organized by the Laborers International Union of North America, AFofL-CIO. But the National Electrical Code has recently undergone redefinition of terms so as to include even the installation of conduit (the thin-walled metallic pipe through which electrical conductors and grounds are later drawn) under the definition of electrical work and de facto requiring that this work be done by licensed electricians only. This disenfranchises members of the Laborers Union who have traditionally done this work. Even more bizarre are the provisions of the Uniform Plumbing Code, a model code promulgated in the Western

¹⁰⁸ Drawn from the Voluntary Industrial Standards Report, 90th Congress, 2d Session, House Report No. 1981, p. 19.

U. S. and Canada by IAPMO. This model code "specifically mandates that only licensed plumbers may do the pipe laying work which occurs 'within property lines';"¹⁰⁹ presumably a different standard of workmanship and of public health--the putative reason for all plumbing codes--applies on each side of the property line.

These disputes over definition and their jurisdictional ramifications are a text book example of Dunlop's Caveat to the effect that disputes between craft unions often mask basic antipathies between general and specialty contractors. Take the case of the installation of drain tile used to carry off ground water which, if not removed, may reduce the bearing power of the soil or may tend to cause damp or wet basements. A line of (usually perforated) sewer pipe laid with open joints is commonly installed to lead this subsurface moisture away from the roadway of building.¹¹⁰ Historically this work has been done by the general contractor rather than a specialty contractor, and actually executed by his employees, construction laborers. The Association General Contractors (AGC) have joined forces with the Laborers International Union

¹⁰⁹Maurice Fancher, "A Labor Union Official Looks at the Model Codes," The Building Official and Code Administrator, Vol. V, No. 3 (March 1971), pp. 13-17. The quotation is on p. 16.

¹¹⁰Whitney Clark Huntington, Building Construction: Materials and Types of Construction, Second edition (New York: Wiley, 1951), p. 193.

to fight the widening of the definition of plumbing to embrace subsurface drainage, arguing from the principle that imposition of such a definition restricts "[construction] management's prerogative to assign work."¹¹¹ More work assigned to plumbing or electrical specialty contractors means less work and profit for the general contractor. Here is a marriage of convenience between historic antagonists, the AGC and the Laborer's Union, joined against a hostile environment.

The second important use of building codes by labor unions is in the incorporation enforcement of provisions that have the effect of restricting use of labor-saving devices. This is what the popular press refers to when building codes are accused of perpetuating obsolete labor practices. If job actions like strikes, picketing and boycotts encounter unfavorable public opinion or judicial findings, unions must find other means to present their case to the construction industry. Although it is literally true that secondary boycotts are not illegal when employed by construction tradesmen intent on preserving work historically theirs,¹¹² such job actions that involve work stoppages are costly to the unions both financially and in terms of public image. So

¹¹¹Letter of William E. Dunn, Executive Director, Associated General Contractors, in Voluntary Industrial Standards Hearings, Vol. II, p. 911.

¹¹²Arthur B. Smith, Jr., "Boycotts of Prefabricated Building Products and the Regulation of Technological Change on Construction Jobsites," Industrial and Labor Relations Review, Vol. 25, No 2 (January, 1972), pp. 186-199.

much so that whereas strikes were once the sign of militancy, they are increasingly looked on by some unionists as breakdowns and indicators of union mismanagement.¹¹³ Why bother, one may fairly ask, when much the same effect--control over introduction of labor-saving techniques--can be accomplished without costly and unpopular work stoppages. Equally effective is the more genteel device of communicating to the code writers, either at the level of the advisory model code association or at the more determinative local government level, the arguments for raising standards of workmanship or the maintenance of public health. Remote as the last two concerns seem from issues of off-site preassembly of plumbing trees, both have been adduced in union presentations before code writers.¹¹⁴ Moreover, once the code reflects this sentiment, the police powers of the state are then employed to promulgate it. Nasty strikes or expensive work stoppages can be foregone.

The presentation thus far has described the negative, defensive actions of voluntary trade associations and, although this may be the dominant tenor of the relation between these associations and governmental regulators, the expansive, not to say imperial, mode is also manifested. One official of

¹¹³Allison, Union Administration, p. 2-2.

¹¹⁴Voluntary Industrial Standards Hearings, passim., and in the hearings of the Massachusetts Board of Examiners of Plumbers which this author has attended.

an association on the offensive described the interest and participation of his group in the making of code policy this way:

This interest is further stimulated by our deep involvement in building research and building regulations. As part of the assignment from our membership, our Association is responsible for the broadening of plywood markets through the engineering and testing of new uses and the recognition of those new uses by building regulatory agencies. This makes us intimately familiar with the real world problems of building regulations and the introduction of new technology.¹¹⁵

This is an example of a trade association on the move, seeking new markets and searching for, if not allies, at least a sympathetic hearing from the building regulatory community. The annual meetings of the model code associations serve the trade associations as convenient staging areas for campaigns for product approvals on items to be marketed nationally. Three annual meetings, plus associated executive sessions in the interim, afford building industry trade association representatives great efficiencies locating those officials whose collective judgement can make or break a product approval campaign.

The efficiency comes in that not 8,000 jurisdictions must be persuaded but 3 conventions per year. So important has this activity become that a group of industry representatives has, since 1952, been formally organized to monitor the model code: BIAR--Building Industry Association Representatives.

¹¹⁵Statement of Bronson J. Lewis, Executive Vice-President, The American Plywood Association, on H.R. 9058, 1971 HUD Hearings, part 2, p. 658.

BIAR is not a very public group. They operate at one or two removes from the members of the model code associations. This remoteness has engendered some suspicion. In the view of one partisan (the word is used advisedly), BIAR exists to 1) maintain the status quo, 2) sow confusion at annual meetings, 3) maintain industry interests in the substantive and procedural areas of model code activity, and 4) foment diversity (if not hostility) among the several model code associations.¹¹⁶

BIAR is tolerated because the industries that BIAR members represent are major sources of model code association finances as well as providers of needed technical studies to bolster and legitimize model code actions. BIAR defends itself against these allegations with the argument that they

...joined together to offer a continuity between the geographically separated model code groups in the development of policy and procedures affecting the modification of codes, approvals of materials and the procedures utilized.¹¹⁷

This section has described the symbiotic relationship between the public governments that enact and enforce building regulations and the private governments--voluntary associations in the form of model code association, trade groups and labor unions--that anticipate, dominate and even pre-empt important

¹¹⁶ Hal Colling "How Industry's Competitive Zeal has Compounded Code Chaos," House and Home, Vol. XXV, No. 6 (June, 1964), pp. 116. Colling's remarks concerning BIAR must be weighed carefully, for he later alleges that when he was executive director of ICBO that organization's publications were boycotted by BIAR in a pique over ICBO's rejection of BIAR's blandishments.

¹¹⁷ Letter from D. E. Brackett, Chairman BIAR to the Editor of The Building Official and Code Administrator, Vol. VI, No. 4 (April, 1972), p. 5. The latter is a publication of BOCA.

public responsibilities. Along the way, important issues of access and accountability are dealt a short shrift by these private entities that exert much influence over the ultimately responsible agencies, the local building departments.

So much of what these private bodies do is hidden from the public view, although, ultimately, the quality of that public's built environment is under the influence of these groups. Under these circumstances, a certain public cynicism and suspicion gains as to what are the true purposes of these entities, and the extent to which they manipulate public governments. Students of these private-public relations have not dispelled this cynicism nor have they engendered more of it. Rather, these writers--chronologically, Bentley, Herring, Truman, McConnel and Dexter--have argued that although these private entities cluster at all levels of public government and in the legislative, administrative and judicial spheres, these groups are essentially passive in nature, are rather more defensive in outlook than imperialistic and that the more effective of them are concerned with a highly restricted set of issues.

The thesis of the essentially defensive nature of these private associations was first developed by E. Pendleton Herring over 40 years ago.¹¹⁸ Herring's analysis of relations with

¹¹⁸ In Group Representation Before Congress, (Baltimore: Johns Hopkins Press, 1929).

the legislature was broadened to include other spheres of government by David B. Truman who summarized his own studies by paraphrasing Herring as follows:

...the major reason for the concern of these trade associations with government action has been not the promotion of their own interest per se, but the defense of their interests, both by fostering legislation or regulation to control the activities of their rivals and by fighting legislation or regulation that operates to the disadvantage of their members.¹¹⁹

The preceding section has adduced numerous examples of this tendency on the part of building industry trade associations. They are apparently no different in this regard from their counterparts elsewhere in American business enterprise. The preceding section, and others to follow, will show building trades unions--another type of an industry association--in much the same light. The union defensiveness in the face of technological changes is a manifestation of the same instinct to self-preservation that prompts the trade association. (We shall later identify union-trade association coalitions in resistance to technological changes where it is a case of hanging together to stave off hanging singly, as Benjamin Franklin aptly put it).

The lack of progressiveness on the part of the building trades unions issues less from a mindless Luddite tendency as from a pervasive craft-consciousness and excessive skill-pride that results in a concentration on the means and not

¹¹⁹In The Governmental Process, p. 80.

the ends of their labor. Construction craftsmen invest years and income foregone in the patient accumulation of skills that are their sole economic resource. Little wonder that their unions are so concerned with "preserving work" that can be accomplished with those skills alone. Preserving work, maintaining an economic demand for specialized skills, is the symmetrical image of the trade association assuring an economic demand for their specialized product. What Christie said of the Carpenter's union in pursuit of preserving work can fairly be applied to the producer's trade associations goal of maintaining an economic demand:

Not an administrative technique, a structural development nor a conscious policy has been developed...which cannot be traced back to it.¹²⁰

and any trade union or trade association that did less would be remiss in its obligations to its membership. And neither hesitates to invoke the provisions of the local building code to aid this pursuit of work or of markets. The problem for the public lies in the fact that, in the face of technological change, these private groups do not do more for their membership and for the public they ostensibly serve.¹²¹

¹²⁰ Christie, Empire in Wood, p. 320.

¹²¹ Sumner Slichter, identifying "determinants" of union policy technological change, observed that whatever "more" the Unions did came late, only when the hand of technological change was writing on the wall. In Union Policies and Industrial Management (Washington: Brookings Institution, 1941), pp. 345-348.

As was stated at the outset, private trade associations and their special sub-set, the labor unions, manifest halting, hesitating, protectionist tendencies in the face of change. This occurs in all industries. Its occurrence in the construction industry is particularly inimical to technological change, however, because given the diverse, dispersed, detached and discontinuous nature of the construction enterprise,¹²² these conservative private entities carry much greater influence on industry and government policy. This is so because they are the only poles about which industry consensus can gravitate, their being no single actor or small set of actors with sufficient power to influence the system the smallest bit. Unfortunately, both have as their latent and, less frequently, manifest function, if not aim, the stability and maintenance of the status quo,¹²³ the very antipathies of technological progress.

¹²²More fully described in Chapter 1.

¹²³Too many serious and sympathetic students of both institutions arrive at this conclusion: Dunlop, "The Industrial Relations System in Construction," passim; Lewis Anthony Dexter, How Organizations are Represented in Washington, (Indianapolis: Bobbs-Merrill, 1969), p. 62; Christie, Empire in Wood, passim; and the several studies cited throughout this section.

CHAPTER 6

DIFFUSION OF INNOVATION IN BUILDING TECHNOLOGY AND THE BATTLE OF PLASTIC PIPE

This chapter undertakes a technology-specific discussion of 14 building methods, gauges the rate and extent of their acceptance into the residential construction codes of the Nation and searches for serviceable explanations of the variability of that diffusion process. The twenty building industry actors introduced in Chapter 4 re-appear as participants to the building agency's deliberations but this time as partisans of particular kinds of change. The tariff analogy is further analyzed and is found wanting. Latent coalitions of industry actors are identified by the extent to which their actions on any change of technique (e.g. to originate, discuss, support or resist) are associated more closely than they would be by chance alone. Finally, the archetypal controversy that ensued over the accommodation of local building codes to plastic pipe is given close examination and contrasts are drawn with the careers of other significant building innovations.

The fourteen construction advances that comprise the index of technological currency represent incremental advances of the state of the building art; they are the very kinds of changes--small in scale and often inexpensive in themselves--that historians of technology know to be the very mundane, prosaic, but necessary stuff of industrial progress. Those less

familiar with the evolution of industrial technology--which is to say most critics of the construction industry--are likely to dismiss these advances as minute and inconsequential departures from traditional practice. Each of the 14 had, by the time of the survey, already been accepted for use by the pertinent model code group and many enjoyed considerable employment in the industry if not complete acceptance by all local jurisdictions. But the disparate diffusion rates and a hit and miss pattern of local code recognition soon becomes apparent. The fact that any of the 14 can be readily applied and put to use by even the most modest-sized, least enterprising construction entrepreneur, makes their erratic diffusion more problematic, since there would less likely be inhibitions to innovation stemming from too large an outlay of capital relative to the fixed assets of the firm or from technological conservatism of most business enterprises.

Taken together, the 14 affect all of the major building trades that are occupied in residential construction. Similarly both general contractors and specialty contractors are involved in the practices identified herein; products and processes included in the index of technological currency involve several of the retail and wholesale merchants that service the construction industry; the work of architects and engineers is affected and the 14 items represent a variety of different enforcement tasks for the local building department. The list of construction advances that comprise the index of technological currency is identical to that used by

the Douglas Commission in its 1968 survey of municipal building departments and is used to provide a comparison of technological progress at two points in time, namely, 1968 and 1970.¹

In the sections that follow each of the 14 items will be described briefly with respect to both its physical technology and to the impact that it is likely to have on housing production and, more importantly for the purposes of this research, the ramifications among the system of building industry actors and institutions without whose participation, and indeed, as we shall see endorsement, any of these technological innovations would die aborning. This tracing of effects beyond the job site is most important for, to a far greater extent than is generally acknowledged, residential construction calls into play a large number of business and professional services that in the aggregate, represent one fifth of the value of the construction put in place. This is a larger fraction, incidentally, than that contributed by any single goods-producing industry group;² and represents a larger economic input than on-site labor itself.³ This being so, an examination of the diffusion of innovative technology in residential construction would be seriously deficient if

¹Several of the items appeared also in a somewhat less systematic unpublished national survey of standard practices and residential construction conducted by the National Association of Homebuilders in 1963.

²Young and Ball, "Industrial Impacts of Residential Construction," p. 14, Table 1.

³Kaiser Committee, A Decent Home, p. 118, Table 4-2.

latent changes in industry structure and deployment of industry actors beyond the job site were not given adequate attention. Hence, it is in the sphere of industrial politics organization, that explanations will be sought for the differential rates and characteristics of diffusion of residential construction technology.

Fourteen Innovations: A Technical and Political Precip of Each

In this section, each innovation will be identified, given a six-letter abbreviation, briefly described in terms of both its own physical attributes and function and the attributes or functions of the traditional materials, methods or designs for which the innovation is a substitute or modification. Finally, we will suggest for each innovation the consequences of its widespread adoption and use, consequences for both immediately and remotely affected elements of the building industries. The greater part of what follows is drawn from the author's personal experience in architectural practice and in general construction work and from associates in the building trades and professions. The trade literature--including periodicals as well as manufacturer's promotional literature--was useful to the extent that egregious boosterism and advertising hyperbole could be tempered and otherwise corrected. Textbooks on building construction seem not to be developed in sufficient detail for our purpose (hence the resort to ephemeral trade publications, promotional literature and interviews). Documentary sources or individuals that have

been particularly helpful are cited where appropriate.

Nonmetallic sheathed electrical cable (NMTCSBL) is manufactured by the principal manufacturers of electrical wire and cable and is almost universally referred to as "Romex", the name given it by Rome Cable Company, the firm that introduced the product.⁴ NMTCSBL, introduced before World War II, is accepted for local use in about 85 percent of U.S. localities that regulate residential construction.⁵

NMTCSBL is generally composed of from two to four individually insulated conductors plus a similarly insulated ground wire, all wrapped about a fibre core; the entire composite is wrapped in twisted paper and enclosed in an outer sheath of impregnated fabric or plastic. Specifics of the size and number of conductors and on the insulation or protection from mechanical damage vary with the exigencies of use of purpose. NMTCSBL is used as power inlet cable from the service drop to the individual use or to domestic branch circuits in the interior partitions. In these uses, NMTCSBL replaces both armored cable or rigid conduit. The former, commonly referred to as "BX", is identical to NMTCSBL

⁴George Roscoe, a veteran staff member of the National Electrical Contractors Association (NECA) in Washington, related much of this history of NMTCSBL and its early use. NECA members are responsible for the installation of most of the electrical systems in the built environments of the nation.

⁵Table 3-18.

except that the outermost sheath is a flexible, metal wrapping in place of impregnated fabric or plastic. Rigid conduit, a thin-walled pipe, is used as both a conveyance for and a protection of individual conduction wires which are pulled through after the rigid conduit is in place. By far the oldest and among the more expensive of internal electrical distribution devices, rigid conduit came into use when existing gas lights were converted to electric illumination and turn-of-the-century electricians merely adapted the existing gas lines servicing each light fixture to a new use as a wire conveyance.⁶ In new construction, rigid conduit is expensive because it must be cut, shaped and installed even before wires are pulled through it. And highly paid electricians do all this preliminary work.

Adherents or opponents cite advantages and disadvantages to the use of NMTCBL. (Among them: lighter and more flexible than its antecedents, NMTCBL is an economical substitute in that it is capable of faster installation. Moreover, although both armored cable and NMTCBL eliminate wire-pulling as a separate operation, NMTCBL is considerably less expensive than armored cable.⁷ And under some site conditions, only a non-metallic substance will do; e.g., in places of very high

⁶This entirely plausible explanation is found in Reyner Banham, The Architecture of the Well-Tempered Environment, (Chicago Press, 1969), p. 66.

⁷Savings of from \$150 to \$300 on each single-family house are reported by Sanderson, Codes and Code Administration p. 32. See also, Douglas Commission, Building the American City, Table 7, p. 262.

humidity, or in air or soil with corrosive pollutants. Among the disadvantages of NMTCBL are the susceptibility to mechanical damage--e.g., puncture of the insulation with the house-holder's picture-hanging nail--and the permanent hazard affecting the plastic most commonly used for sheathing, PVC, which, on burning releases toxic and corrosive gases.⁸

The substitution of NMTCBL for any of its antecedents would not infringe on the customary make-up of work crews on the job site, nor on the channels of distribution of electrical supplies and equipment. It remains electricians' work and the national system of wholesalers and jobbers for one form of wire is much the same as for another. Rather more affected are the productivity of the electrical crews at the building site and the sales of the manufacturers of rigid conduit and of armored cable. In practice, however, manufacturers are not so specialized and can produce both cable and conduit. For example, Triangle Industries, supplier of armored cable for retail sale by Sears, Roebuck also makes steel conduits.

In a certain sense, wire-pulling as a separate field operation has not been totally eliminated. It has been removed from the construction site to the cable factory. If such a move results in a diminished demand for electricians' on-site

⁸Public Affairs Council of the Society of the Plastics Industry, Answers to Questions You are Asking about Plastics and the Environment (New York: SPI, 1972), pp. 5-6.

work, the International Brotherhood of Electrical Workers (IBEW), custodian of the welfare of and principal advocate for the 77 percent of electricians who work for construction firms under union contract,⁹ might view this with some equanimity since the IBEW organized the factories that produce cable as well.¹⁰ Persons closer to the electrical trades, however, point out latent hostility between the construction and manufacturing divisions of the IBEW. Although the manufacturing membership outnumbers the construction membership in the ratio of 2.6 to one, the national leadership of IBEW is drawn mostly from construction.¹¹

But practicing electricians and contractors who specialize in electrical work (who have for the most part graduated from the ranks of journeymen) have resisted the incursion of this simpler-to-install material with the warning that this simplicity would encourage inexperienced and unskilled hands to undertake electrical installation work in the belief that all such work is as simple as running branch circuits through partitions. The hazard comes, say the electrical tradesmen, when inexperienced hands involve themselves with more complicated parts of installations where service switching requirements

⁹Department of Labor, News Release, "Results of BLS Survey of Compensation of Workers Employed by Construction Special Trade Contractors", Friday, 25 June 1971, (USDL 71-312).

¹⁰Reels of cable carry tags bearing the union seal and the legend "Produced by Manufacturing Members of IBEW". Robert McMillen, former legislative Counsel to the United Association of Journeymen and Apprentices of the Plumbing and Pipe-Fitting Industry suggested possible IBEW indifference on on-site, off-site shift.

¹¹Elizabeth K. Allison, Union Administration: A Management Control Study of the IBEW, (unpublished Ph. D. Thesis, Harvard University, 1971, pp. 2-26.

are increased or circuit legs multiplied. Moreover, improper cable running, itself, could lead to costly repair work and continuing fire hazard long after the job is completed. For electricians, as with plumbers and, indeed, all mechanics, there is a prominent fear of job take-overs by "handymen" if skill requirements lapse.¹²

Off-site preassembled electrical wiring harness for installation at electrical service entrance to dwelling (WRHRNS) is an innovation capable of adoption by virtually any electrical specialty contractor regardless of size for, as the description implies, the capital plant involved beyond that found in any contractor's shop is a few jigs. Nevertheless, fewer than half (48.3 percent) the jurisdictions that enforce building regulations permit the use of WRHRNS in residential construction.¹³ In a sense, WRHRNS is the method-change counterpart of NMTCL, a material-change. Both changes involve the electrical trades, men who are the highest paid special trade craftsmen in the construction industry,¹⁴ who suffer the least in terms of construction industry unemployment,¹⁵ and who enter

¹² Joel Seidman, et. al., The Worker Views His Union, (Chicago: University of Chicago Press, 1958)p. 58.

¹³ Table 3-18.

¹⁴ Department of Labor, News Release.

¹⁵ William Haber and H. Levinson, Labor Relations and Productivity in the Building Trades, (Ann Arbor: Bureau of Industrial Relations, University of Michigan, 1956), p. 54. This comes about because of the relative lack of seasonality in electrical work (most of which takes place after a building is enclosed or, at minimum, roofed) and restrictions on entry to the trade.

the construction industry, from either apprentice or industry training, with the highest grade of beginning skills.¹⁶ Electricians consider themselves an elite, and extend to other skilled workers some disdain and (to plumbers) even contempt.

The apparent lack of success of WRHRNS issues from the fact that electrical servicing needs of houses even within the same price class, layout and structural type are so variable that wiring harnesses themselves must be "custom designed" for each installation. Any set-up for prewired connections between load centers and electrical devices scattered throughout the structure would have to be so flexible that excessive redundant capacity would soon cancel any economies of pre-assembly.¹⁷

Copper pipe in drain, waste, and vent (DWV) plumbing systems (COPDRN); ABS (acrylonitrile - Butadiene - styrene (polyvinylchloride) plastic pipe in DWV plumbing systems (PLADRN); Off-site preassembled combination DWV plumbing system for bathroom installation (PLMTRE) are considered as a unit because all affect the plumbing industry. Two of them, COPDRN and PLADRN are adjacent and analogous links in the

¹⁶ Howard G. Foster, "Nonapprentice Sources of Training in Construction", Monthly Labor Review, Vol. 93, No. 2 (February, 1970), p. 23-24.

¹⁷ Interview with Joseph W. Bird, general manager, Systems Division, Ralph Pill Electric Supply Company of Boston, a firm that both manufactures pre-assembled residential electrical systems and supplies the "conventional" electrical wiring trade in the New England region.

same evolutionary development and PLMTRE became a functional possibility only after COPDRN and PLADRN were widely available to the pipe trades.

The first metallic pipe in domestic DWV used was made of lead, a material whose Latin name, plumbum, gave the local pipe makers their name -- plumbers. After about 1840, most pipe was factory-made, eliminating most of the shop operations of plumbing contractors. Lead working skills were nevertheless required for on-site fittings and joints. By the 1870's, however, cast iron pipe supplanted lead in DWV uses, replacing the tedious "wiping" of joints with the faster method using oakum caulking sealed with molten lead.¹⁸ Although some steel pipe was used in the twentieth century, the last metallic pipe material innovation of commercial consequence was copper and "[a]lthough copper pipe is more expensive than others, it saves on labor time, is lighter in weight, and is easier to cut, bend and join."¹⁹ These, of course, are the identical reasons, save one, adduced for COPDRN's successor, PLADRN. The exception is that the plastic materials in 1970 were

¹⁸Segal, The Rise of the National Association, pp. 1-9.

¹⁹Haber and Levinson, Labor Relations and Productivity in the Building Trades, p. 128.

already only one-fourth the cost of copper and falling in price.²⁰ In 1970, homebuilders reported that on-site fabrication using PLADRN in place of cast iron piping yielded a \$17.00 saving per residence.²¹ What part of this saving is attributable to less costly materials or to a reduced amount of time required for (highly-paid) skilled plumbers to complete an installation is a complicated issue which we now examine. Proponents of plastic--notably the Plastics Pipe Institute of the Society for the Plastics Industry (PPI/SPI)--concede to the groups that cluster in opposition--a shifting alliance of speciality contractors, pipe trade suppliers, union and building officials rallied by the Cast Iron Soil Pipe Institute (CISPI)--that when materials are fabricated at the installation site, there is no time advantage for either plastic pipe or

²⁰In 1970, comparable waste-line piping in various materials was priced as follows: ABS, 20¢/foot; steel, 40¢/foot; copper, 80¢/foot. Reported in the Testimony of Rom Rhome, President, ABS Institute, before the House Committee on Banking and Currency, Subcommittee on Housing, Hearings on Housing and Urban Development Legislation, 1970, 91st Congress, 2nd Session, p. 675. Hereinafter referred to as 1970 HUD Hearings.

²¹Ibid., p. 634. Whether or not this saving is passed on to the consumer is not known and, for the present analysis, it is of no consequence. The anti-plastics forces relay their skepticism in this point in the testimony of John P. Frank, general counsel, Arizona Pipe Trades Industries Program, Phoenix Arizona, before Subcommittee on Small Business Problems in Smaller Towns and Rural Areas of the Select Committee on Small Business, Hearings on Rural and Urban Problems of Small Businessmen, House of Representatives, 91st Congress, 2nd Session, p. 129. Hereinafter referred to as Rural and Urban Problems Hearings. The Director of the Plastics, Pipe Institute placed a per-dwelling savings at about \$300 during an interview on 17 December 1972 with the present author.

cast iron²² and that the savings in materials cost are the decisive factor. Moreover, the absolute amount of already less expensive plastic is less than 100 pounds per residence.²³

In conventional plumbing practice--that is, on-site fabrication--the "economics" of metallic pipe and plastic pipe are close: no labor advantage accrues to either and a material cost advantage extends over only small absolute amounts of material. What then accounts for the local adoption of PLADRN being the most contentious local building code issue of recent years?²⁴ The answer is found in the light-weight quality of pipes and fittings of plastic and the increased feasibility of preassembling DWV plumbing trees at some remove from the point of installation. This practice is embodied in PLMTRE. The economics of PLMTRE are significantly different from those of PLADRN, which is PLMTRE's functional though not its logical antecedant.

²²Haber and Levinson, cited earlier on the labor saving effects of copper pipe, were writing in 1956, before plastic pipe was widely used in construction.

²³1970 HUD Hearings, p. 677. Later in the same Hearings, on p. 684, the National Association of Home Builders (NAHB), an advocate of PLADRN, noted that the typical single family residence requires a mere 80 pounds of plastic for DWV purposes. This compares, incidentally, with 20,000 pounds of wood in the typical unit.

²⁴Ventre, Technological Currency in the Local Building Code, p. 11. The "Battle of Plastic Pipe" is given fuller treatment later in this section.

PLMTREs can be fashioned in a variety of ways and can incorporate a fuller or lesser degree of completeness. At one extreme is the pre-assembled plumbing wall with fixtures, as manufactured, for example, by American-Standard, the nation's leading producer of vitreous china bathroom fixtures.²⁵ The American-Standard version of the "wet wall"--so-called because all water service as well as DWV piping is confined to one plane, with savings in piping as a result--contains, in addition to the DWV piping, fixture carrier plates and service taps all supported by a light gauge sheet metal frame. Coordinated fixtures and fittings are included and installed in the traditional sequence at the site. But PLMTRE can be as elemental as the raw, pre-assembled piping itself, with no loss of essential economy. It might be noted that American-Standard's elaboration of the wet wall, including carrier plates and coordinated fixtures, is a natural one for a fixture manufacturer.

The cost-savings associated with PLMTRE issue from its enormously reduced labor requirement, for "when these

²⁵A description of American-Standard developments in this area was provided by Sherman L. Bell, Manager, Labor Relations of that firm at one meeting of the MIT-Harvard Study of the Construction Industry. Interestingly, Kohler of Kohler, another leading producer of bathroom fixtures never ventured into the pre-assembled plumbing line. This information was relayed in an interview of Sam H. Davis, Group Vice President for Plumbing Products and Precision Controls of that firm at a recent meeting of the MIT-Harvard Joint Center Policy Advisory Board. But Kohler does market an assembly called "Walls 'n All", a one-piece fibreglas bath module that saves 50 square feet of on-site plaster or tile and "half a day's work". Any reference to the plumbers' routine is avoided in Kohler's description of "Walls 'n All".

[preassembled] units come in," a plumbing contractor revealed to the Select Committee on Small Business, "a plumber has something like an hour and a half work [per house]...on these assembly line houses...[A] contractor cannot make money on labor only. He also has to have something else there. He has to have some material to sell. He has to have an overall contract to make up."²⁶ The shrinking labor requirement per installation, of course, further encourages the specialty contractor to supplement his services with the sale of materials. But, as was pointed out in Chapter 4's discussion of materials supply chain--especially the local merchant wholesaler and the specialty contractor--the increased value to weight ratio characteristic of semi-finished goods--such as PLMTRE's--alters the economics of distribution in a way that reduces the need for a system of highly localized distributorships that the specialty contractor has traditionally operated. The specialty contractor is caught in a pincers. Labor requirements--hence a demand for his services--are shrinking at the same time the number of sales outlets--his erstwhile "ace in the hole"--is declining. This is precisely the effect of the current expansion policies of the larger manufacturers of plumbing and mechanical equipment who are acquiring ownership or control of local outlets for their lines and then consolidating local operations with regional

²⁶Testimony of James J. Tobin, Plumbing and Heating Contractor, Peoria, Illinois, in Impact of Crime Hearings, p. 203. Note the similarity of this testimony to the remarks of Mr. Degen, the mechanical equipment manufacturer and distributor, in Chapter 4, fn. 57.

outlets.²⁷ This consolidation would not be functionally feasible--elasticities of demand for transport aside for the moment--were not the Interstate Highway System substantially in place, nor the techniques of materials handling and methods of inventory control developed to their present sophistication.²⁸ Thus the local specialty contractor and local materials distributor face aggressive manufacturers who can threaten to bypass them with newer materials (e.g. PLADRN) and components (e.g. PLMTRE) that call forth the formation of new channels of distribution and new modes of marketing. It will be shown later how local building codes figure in the threatened bypasses and new forms of marketing of building materials.

COPDRN is hardly a contentious item. It is accepted for local use in over 95 percent of the localities that regulate building. For the most part, this extensive acceptance is a consequence of familiarity. COPDRN has been around a long time. As we shall later demonstrate, in building materials innovations, nothing induces success like a lengthy (and favorable) track record, regardless of the nature of the

²⁷ A favored tactic, one New England jobber reported to an interviewer, is for the manufacturer to extend considerable credit, in the form of inventory, to the local supply firm cum specialty contractor and then to foreclose for payment due

²⁸ Reavis Cox, et. al., Adaptation to Markets in the Distribution of Building Materials, Vol. I, "Introduction and Recommendations for Management", (Washington: The Producers' Council, Inc., 1963), p. 19.

material or of the adequacy of the design of the component, or of the efficiency of the work method.²⁹

The acceptance for PLADRN and PLMTRE, being more recent innovations, is less widespread. PLADRN is acceptable in just over half (53.0 per cent) and PLMTRE, an innovation seemingly more disruptive of industry routine, is more popular and accepted in even more (61.5 percent) jurisdictions that regulate building construction.³⁰ As just related, longevity, ceteris paribus, has a positive effect on an innovation's diffusion. But, as will later be developed, ceteris non paribus in the case of PLADRN, where a tremendous marketing effort by the proponents of plastics--the Plastics Pipe Institute of the Society for the Plastics Industry with large assistance from the National Association of Homebuilders--pushed PLADRN to its present prominence in the face of strenuous resistance (rallied by the Cast Iron Soil Pipe Institute) within fifteen years of its introduction to residential DWV uses.

Although it can be argued that PLMTRE can be disruptive of present arrangements in the plumbing and pipefitting industries (hence, provoking resistance which makes it less likely to

²⁹This observation could be readily tested in connection (no pun) with a new plumbing system being promulgated by the Copper Development Association for 12 leading copper companies. The system designated "Sovent" by its European developers, is a single stack venting drainage system engineering for multistory structures, capable of handling the same load as a conventional stack of the same diameter, but without the need for a separate stack for venting (The V of DWV). Using the same materials as already accepted by virtually all localities, employing the same trades and too large for off-site fabrication, Sovent would have a high probability of rapid adoption by plumbers and by code authorities.

³⁰Table 3-18.

diffuse rapidly), a study of the pipe trades reveals that the returning of operations to the off-site shop actually revivifies an historic tradition in plumbing that was all but extinct by the turn of the century.³¹ Thus, more precedent had existed for PLMTRE than for WRHRNS, the seemingly more modern innovation,³² and this precedent might have accounted for the more rapid diffusion of the former than the latter.

The preceding section with a discussion of three innovations that shared a common involvement of the pipe trades and the plumbing industry. But of the building industry generally it may be truly said that every interaction quickens in acuteness when more than one union's jurisdiction is involved, doubly so when the skilled trades are involved, and triply so when the substantial issue is an innovation that "makes work" for one trade at the expense of another.³³ But in discussing jurisdictional disputes, Dunlop's Caveat bears repeating; competition among unions may mask underlying

³¹ Segal, The Rise of the National Association, p. 9.

³² Allison reports that the electrical trade unions did not come into being until after 1890, by which time much of the American economy was already industrialized. Electrical equipment, almost from the first, was produced in centralized manufactories of oligopolistic corporations; this is in contrast to the ancient handcraft and small shop tradition of plumbing.

³³ George Strauss, Unions in the Building Trades, University of Buffalo Studies, Vol. 24, No. 2 (June 1958), p. 119; Bertram and Maisel, Industrial Relations in Construction, p. 55; and Robert A. Christie, Empire in Wood (Ithaca: Cornell Studies in Industrial and Labor Relations, 1956), who in this history of the United Carpenters and Joiners of America observed on p. 107 that "[w]ith each innovation, a mad scramble for jurisdiction [among existing unions] ensues."

fighters among rival specialty contractors.³⁴ Bertram and Maisel would extend this notion of contractor-union conspiracy in the specialty trades too, among other issues, enforcing restrictions on entry of new firms.³⁵ Either way, the innovation we turn to next involves three trades in a single installation and has a unique developmental history because of that fact.

Bathrooms or toilet facilities equipped with ducts for natural or mechanical ventilation, in lieu of operable windows or skylights) (BTHDCT) .

BTHDCT typically takes the form of a metal sleeve often with an electric exhaust fan inserted, whose outside end is equipped with a built-in damper open only when the fan is on and shut at other times to minimize heat and moisture loss or gain. BTHDCT is capable of wall or ceiling installation, the latter being the more "efficient" location. The trade-off the designer faces in making this choice is that ceiling installations require ductwork--introducing another trade to the job--rather than the simple sleeve. Variations on BTHDCT

³⁴John T. Dunlop, "The Industrial Relations System in Construction," in Arnold R. Weber (ed.), The Structure of Collective Bargaining (New York: Free Press, 1961), p. 260, January 4. Dunlop should know, having served as the first chairman of the National Joint Board for the Settlement of Jurisdictional Disputes, which is composed of labor, management and public representatives.

³⁵Bertram and Maisel, Industrial Relations in the Construction Industry, pp. 19 55.

incorporate heaters and/or lights. Again, these variations, as with ceiling locations, may require the services of additional trades.

BTHDCT, as described above, is installed by an electrician if the fan and/or light unit is called for; if special framing problems occur (which is almost always the case when BTHDCT is installed in existing structures, a frequent occurrence) then a carpenter's skills (if not services) are required. In a ceiling or other-than-outside wall installation is called for, sheet metal workers must size, cut, shape and install ductwork. It is conceivable then that one basic (carpentry) and two specialty (electrical and sheet metal) trades are needed for a single installation of a relatively inexpensive piece of mechanical equipment used in place of an operable window--no wonder electrical subcontractors charge \$45 for an installation (not counting the cost of the unit).³⁶

BTHDCT brings with it yet another consideration that attends the incorporation of building components partially fabricated off-site yet still preserving work historically performed by on-site construction craftsmen--the issue of "label unionism." Label unionism stipulates that materials handled by union members on the job site be union-made and so branded. It is an old tradition in the construction trades and has been a part of labor agreements since the 1880's.³⁷

³⁶Gary Mosell (ed.), National Construction Estimator; Eighteenth edition, 1970-71 (Los Angeles: Craftsman Book Company, 1970, p. 52.

³⁷Christie, Empire in Wood, p. 70. Most of what follows draws on Christie.

Label unionism was acceded to by manufacturers who could then organize oligopolies, and rely on union-organized consumer and producer (secondary) boycotts of the "hot" goods (as the non-union or "scab" items are called) to curb non-union competition. Anti-boycott forces sued continually over these alleged restraint-of-trade conspiracies, but Progressive-era courts (in an ear of trust-busting and muck-raking Populism) found otherwise: boycotting workers were protecting fairly won economic positions and were not boycotting to extend themselves into new jurisdictions.³⁸

Label unionism can be practiced in at least two degrees of completeness, either a general "union-made" requirement or a more stringent test that the products be made by members of not merely the same union that installed those products, but that those union members belong to the same local as the installers.³⁹ This was precisely the issue in 1964 between Local 18, Sheet Metal Workers International Association and New York City sheet metal and mechanical contractors. The original local labor agreement, acknowledging industry practice at the time of its drafting, committed the contractors to install only those dampers (counterparts to BTHDCT dampers

³⁸The end of legal secondary boycotts came with the passage in 1947 of the Taft-Hartley Act. Of which more later.

³⁹To the 19th century cry: "union made, city made" which was invoked to restrain importing millwork and exporting jobs. Christie, Empire in Wood, p. 70.

described above) fabricated in local shops (thus, ipso facto by Local 28 workers. By 1964, a "low-leakage damper" was perfected and introduced to the national market. The higher performance device, however, required a production set-up beyond the means of local sheet metal fabricators--a not uncommon occurrence in the evolution of mechanical technologies. On the advice of Local 28 business agents, New York City sheet-metal and mechanical contractors refused to accept shipments of the components fabricated by members of the Sheet Metal Workers International Association, but members affiliated with locals other than Local 28. When suit was brought seeking relief from this restraint of trade, the U.S. Circuit Court of Appeals found that the local union officials were legitimately engaged in preserving work historically done within the jurisdiction of their local.⁴⁰

These, then, are the compound hazards of innovations that are composites of two or more sub-assemblies. In the BTHDCT instance, an electric power, requiring a structural accommodation and connected to an air convection system. The potential involvement of several trades (in BTHDCT, carpenters, electricians and sheet-metal workers) each of which brings to the task a different way of organizing the work (as did the

⁴⁰This illustration is drawn from the statement of L. N. Hunter, Managing Director, Air Conditioning and Refrigeration Institute, presented to the subcommittee on Housing of the House Committee on Banking and Currency, Hearings on Housing and Urban Development Legislation - 1971, 92nd Congress, first Session, pp. 940-943. Hereinafter referred to as 1971 HUD Hearings.

members of Local 28 in the New York experience just cited).

This is not to say or even to imply that means for adjudicating differences arising from "composite" innovations do not exist. They do. Jurisdictional boundaries are formally established by the national leadership of the unions involved, often with government or other public encouragement. However, these negotiations are time-consuming, frequently extending for periods of a year or more, and are not always universally respected once enunciated by the national signatories. Moreover, once the dispute is resolved by national leaders, local union officials have at their disposal several dilatory tactics of varying legitimacy.⁴¹

With all the forgoing a part of BTHDCT's background, the fact is that BTHDCT is accepted for local use in almost all

⁴¹ Some examples of adjudicatory devices are the already mentioned National Joint Board for the Settlement of Jurisdictional Disputes (see fn. 34); for a description of several recent agreements authorizing "composite crews" of different trades and other settlements of a jurisdictional rivalry prompted by the heightened interest in "factory building" and other forms of rationalization in construction "Labor Looks at Breakthrough and Speaks Its Mind, HUD Challenge, Vol. 11, No. 3 (March, 1971), pp. 4-10; Reese Hammond, "The Labor Movement in Industrial Building in Albert G. H. Dietz and Lawrence Cutler (eds.), Industrial Building Systems for Housing (Cambridge: M.I.T. Press, 1972), pp. 243-250. (Hammond is on the Washington staff of the International Union of Operating Engineers, a group that, compared to most other construction specialties, has the least to fear from industrialization of the industry: they operate power equipment and cranes). "Prefab Buildings Buoyed by a Pact", New York Times, November 7, 1979, n.p.: The article describes the first of the "tri-trades" agreements between carpenters, electricians and plumbers providing for, among other things, equal pay regardless of which union the building-factory employee joins and "cross-union work" wherein, for example, a plumber can do electrical work. However, this agreement must be re-negotiated on a firm-by-firm basis (one of the legal dilatories alluded to in the text above).

the local building codes in the nation: 97.4 percent. Do not the problems of jurisdiction and label unionism pose a real threat? The answer is that BTHDCT itself is too little a threat in terms of potential work loss if jurisdiction over it is taken by another trade. Occupying as it does the overlap of three trade jurisdictions, BTHDCT is peripheral to each and central to none, and in this respect is quite unlike NMTCBL or WRHRNS for the electricians or COPDRN or PLADRN or PLMTRE for the plumbers.

Another reason for its almost universal acceptance is that of all the 14 innovations under review, BTHDCT most closely approximates an item of consumer discretion or choice rather than it does a piece of technical exotica or minutiae, which is characteristic of the remaining 13 items. BTHDCT can be seen by the final consumer, the residents, whereas all but two of the remaining items comprising the index of technological currency are enclosed and inaccessible to view. The consumer doesn't even know they're there. This visibility has prompted the manufacturers to market BTHDCT in the manner of a household appliance, directing advertisements to the increasingly marketing-conscious merchant builder who is searching for a device with which to make his product--the house--distinctive⁴² and to the status-seeking agents of

⁴²A justification and recommendation for this turn on the part of homebuilder is found in Cox, et. al., Adaption to Markets. How their trade press services this new orientation is discussed in Francis T. Ventre, "An Introductory Comment on the Periodical Literature in Architectural Design and Construction", Journal of the American Institute of Planners, Vol. 33, No. 5, (September, 1967), pp.

conspicuous consumption--the prospected final purchaser. (What's visible to the homeowner is visible also to his guests).⁴³ Thus, in addition to the expected advocates promoting BTHDCT--namely, its manufacturer and supplier--the pull of market demand operates as well.

Prefabricated metal chimneys (MTLCHM) provide functional advantages and first-cost as well as operating cost advantages over masonry chimneys. Rapid installation accounts for lower first costs and the prefabrication eliminates any concern for vagaries of site and uncertainties with the quality of the on-site workforce. The National Association of Homebuilders' Research Foundation reports that MTLCHM can be installed for less than half the cost of a comparable masonry chimney.⁴⁴ Lower operating costs accrue from combination of factors: rapid warm-up of flue lining--which facilitates the

⁴³Students of the diffusion of innovation have identified the attributes of early adopters of consumer innovations. Generally the same psychological traits are found among "household" innovators as among "entrepreneurial" ones, mutatis mutandis. Although consideration of prestige and status affect innovation decisions in the two groups, they appear to carry greater weight among consumers. See, for individual professionals: John W. Loy, Jr., "Social Psychological Characteristics of Innovators", American Sociological Review, Vol. 34, No. 1 (February, 1969), pp. 73-81. For professional organizations: Lawrence B. Mohr, "Determinants of Innovation in Organizations", American Political Science Review, Vol. 63, No. 1, (March, 1969), pp. 111-126. (Each contains a useful literature review). And for household consumers: Thomas S. Robertson, "Consumer Innovators: The Key to New Product Success", California Management Review, Vol. 5, No. 2, (Winter, 1967), pp. 23-30.

⁴⁴Ralph J. Johnson, "Housing Technology and Housing Costs; Appendix B" in Kaiser Committee Technical Studies, Vol. II, p. 63.

upward flow of hot gases--eliminates the need for force-drafting devices; hot inner walls, an attribute of metal but not of ceramic flues, prevent condensation of tarry by-products of combustion; and the primary cause of draft loss and costly preventive maintenance--namely the erosion of mortar joints--is eliminated. The problem of thermal expansion and contraction of metal--much more a problem in metal than in masonry--is off-set by more precise jointing that usually incorporates air-setting, high temperature cement. Greater safety can be achieved with MTLCHM because clearances between metal and adjacent combustible construction are specified precisely by the manufacturer after suitable testing. Finally, MTLCHMs are tested for all-round performance and certified before shipment whereas masonry chimneys, when tested at all, are only smoke-tested in the field.⁴⁵ MTLCHM is acceptable for residential use in 88.9 percent of the jurisdictions responding to the survey of local building departments.⁴⁶

This widespread acceptance is attributable partly to the persuasive economy of MTLCHM and the disparate organizational strengths of those industry actors that benefit and those that

⁴⁵These attributes are drawn from promotional literature and from the National Fire Protection Association, Fire Protection Handbook, 13th Edition (Boston: NFPA, 1969), p. 9-60. Of course, NFPA--like all commercial testing organizations would have a built-in bias in favor of laboratory-tested as opposed to field-tested devices. Organizations like NFPA derive their livelihoods in part from testing and certification program. See Chapter 5.

⁴⁶Table 3-18.

are disadvantaged. Utilization of MTLCHM provides new work opportunities for sheet metal contractors (who double as suppliers) and sheet metal workers. As is the case with most contractors, labor and management often share common backgrounds and trade union affiliation. Masons, masonry suppliers and masonry contractors do not share these common bonds (no pun). This occurs because the basic trades (carpentry, masonry and hod-carriers) are usually recruited on a pick-up basis by masonry contractors (much the way general building contractors recruit their gangs.)⁴⁷ (In fact, masonry contracting is a fall-back activity of many smaller general building contractors.) Bricklayers and stone-masons are among the most regressive of all the building trades in that the supply industry groups with which it is most closely associated, brick and structural clay tile (1957 SIC 3251), concrete block and brick (3271), cut stone and stone products (3281) are among the slowest growing, lowest value-added per man hour, and lowest in capital expenditure per employee of all the building products industries, and the latter--the building products industries as a group--are low and continue to decline in overall proportional share in the nation's economy.⁴⁸ Bricklayers are also insulated from external

⁴⁷ Bertram and Maisel, Industrial Relations in the Construction Industry, p. 43.

⁴⁸ William R. Loftus, "Performance of 40 Construction Materials and Related Industries in the 1967 Census [of Manufactures]", Construction Review, Vol. 15, No. 7 (July, 1969), pp. 4-12.

stimulation in that they are an "indigenous craft", one that recruits entrants often along kinship lines who then acquire their skills exclusively in internal apprentice or other up-from-the-bottom upgrading.⁴⁹

Lacking impetus from their suppliers--for it is the building materials supply industries themselves who sponsor most building research and who campaign hardest for expansion of sales--and secure from the threat of too easy entry of other workers, the trowel trades have not resisted this innovation.

Wood roof trusses, placed 24" on center (WDTRUS); in wood frame construction, sheathing at least 1/2" thick, in lieu of corner bracing (WDSHTH); use of 2" x 3" studs in non-load-bearing interior partitions (2X3STD); wood frame exterior walls in multi-family structures of three stories or less (WDFRMF); use of single top and bottom plates in non-load bearing interior partitions (SNGLPL); placement of 2" x 4" studs 24" on center in non-load-bearing partitions (2X4STD).

These code changes all affect the usage of wood in residential construction; all the work involved is done by carpenters. This material and these craftsmen are of great importance to the residential construction industry, and vice versa. Four of the nine lumber and wood products

⁴⁹ Howard G. Foster, "Non-apprentice Sources of Training in Construction", Monthly Labor Review, Vol. 93, No. 2 (February, 1970), pp. 21-26.

industries (millwork, sawmills and planing mills, prefabricated wood structures and veneer and plywood) account for 27.3% of all the material inputs to single family residential construction⁵⁰ and 41.0% of all lumber and wood-products (except containers) are sold directly to the construction industry.⁵¹ Taking a view of the labor input side, single family residences consume more carpenter labor than does any other type of building.⁵² Similarly, of all craft occupations involved in homebuilding, carpentry is the major craft used.⁵³ Finally, more merchant homebuilders, general contractors and construction foremen have advanced from the ranks of the carpentry trade than from any other of the basic or specialty trades. All of which is to demonstrate the central role of lumber and wood products and their principal associated trade, carpentry, in the construction enterprise.

Although the truss principle was first employed in timber construction during the Renaissance, the widespread use of this device as a substitute for rafter and joist work in residential construction did not occur until after World

⁵⁰ Computed for Young and Ball, "Industrial Impacts of Residential Construction and Mobile Home Production", Table 1, pp. 14-15. Surprisingly, three of the nine supply 25.8% of the material inputs to mobile home production.

⁵¹ Kinsie, "Constructions Input-Output Profile", Table 3, p. 7.

⁵² Sara Behman, Productivity Change for Carpenters and Other Occupations in the Building of Single-Family Dwellings and Related Policy Issues, (Berkeley: Center for Labor Research and Education, Institute of Industrial Relations, University of California, April, 1971), p. 9.

⁵³ Ibid., citing Bureau of Labor Statistics, Labor and Material Requirements for Private One-Family House Construction, Bulletin No. 1414 (Washington: USGPO, June, 1964).

War II. WDTRUS has not been widely adopted for use by smaller builders--which is to say most builders who typically build one-of-a-kind houses. WDTRUS is simply not worth the time spent setting up the jigs required for assembly.⁵⁴ For those builders whose volume of work justifies the investment in plant--whether on-site or off--the savings are appreciable, reducing costs by just over 30 percent.⁵⁵

Of the five techniques only WDTRUS brings with it the prospect of an accompanying change of building method; all the others involve the traditional materials assembled in timetested ways. Perhaps this accounts for the fact that WDTRUS was considered a controversial building code change by far than the remaining four items involving wood.⁵⁶ These four changes would induce an expansion or a reduction in the usage and subsequent demand for lumber and wood products.

The changes designated 2X4STD, SNGLPL and 2X3STD would all result in a diminished use of lumber. In the case of 2X4STD, the elimination of every third stud or one stud removed for every four lineal feet of interior non-load bearing partition; and, in the case of SNGLPL, halving the required lumber used as top or bottom plates in the same type

⁵⁴ Johnson, Constraints to Builders Use of Cost Saving Innovations and New Products, p. 4.

⁵⁵ Johnson, "Housing Technology and Housing Costs; Appendix B", In Kaiser Committee Technical Studies, Vol. II. p. 63.

⁵⁶ Figure 4-1. Four times as many local officials reported WDTRUS as a "most difficult" code change as reported the runner-up, WDFRMF.

of wall. Yet the most aggressive proponents of these very changes are the largest suppliers of lumber and wood products to the building industry. Acting through such private trade associations as the American Plywood Association (APA) and the Western Wood Products Association (WWPA), and the National Lumber Manufacturers Association (NLMA) firms strive both to widen total markets and to reallocate market shares among competing products. An analysis along these lines makes clear why lumber and, particularly, wood products manufacturers support building code changes that at first seem to diminish the market for lumber.

To begin, a threat to expansion of markets for wood-framed non-load-bearing interior partitions has appeared it is the growing use of light-gauge metal studs. Although only 2% of homebuilders responding to a recent national survey report using steel studs,⁵⁷ lumber industry leaders have acknowledged that the threat of metal studs, distant though it is at present, was one of the large considerations behind the industry's MOD 24 campaign.⁵⁸ Steel studs, used in tandem with gypsum board and installed as a unit by lathers, have the

⁵⁷Johnson, Constraints to Builders Use of Cost Saving Innovations and New Products, Table 30, n.p.

⁵⁸Interview with Harry E. Morgan and Clyde Kallahan, senior vice-president and vice-president for corporate planning, respectively, The Weyerhaeuse Co., 6 June 1972. The MOD 24 Building Guide (subtitled, Introducing a new building system that uses less material, less labor and less money) was produced by the APA and the WWPA. NLMA produced the Unicom Manual on the same subject.

"woodies" (lumber and wood products suppliers and carpenters) worried. Responding to this threat, lumber interests, and particularly the larger firms that make plywood as well, re-engineered the structural systems found in single-family residences--floor, roof, and wall framing--with the result that less lumber is required (all framing is now spaced 24" on center rather than 16") and less labor as well (because of fewer pieces to order, inventory, handle and install). Less lumber, is used, but more expensive lumber is now required because only lumber of high and consistent quality will sustain the loadings imposed in MOD 24 designs. Moreover, only plywood will satisfy the loadings on the sheathing material, thus displacing the 1" x 6" boards traditionally used. Not surprisingly, the members of the Western Wood Products Association who did not manufacture plywood, supported the MOD 24 campaign with greatest reluctance. Nor have the lumber dealers embraced MOD 24 with enthusiasm: participation in the system requires them to stock higher grades of lumber and plywood, usurping space from other, traditional lines of wood products.⁵⁹

Another source of antipathy between the basic forest products producers and the dealers who distribute the materials to the home-builders (as represented, for instance, by the National American Wholesale Lumber Association, the National

⁵⁹ Ibid.

Lumber and Building Material Dealers Association, and the National Wholesale Lumber Distributing Yard Association) is the fact that the channels of distribution are being redrawn and a new division of labor is emerging between producers and distributors of building materials. This phenomenon was treated in detail in the Chapter 4's discussion of building industry participants in local code change decisions.

The move to 2X3STD is representative of the type of apparently insignificant technical amendment to a building code that has ramifications beyond the practice of carpentry or the sales of lumber (either in volume of sales or the manner of selling). A local jurisdiction that wished to rule out either mobile homes or a large class of manufactured buildings could do so by denying the code change herein abbreviated to 2X3STD, because 2" X 3" studs have wide use as framing members in the latter types of construction.⁶⁰

Furthermore, many construction supply industries and their counterpart building trades would be affected by the wider use of 2X3STD even in "conventional", on-site construction. This seemingly far-fetched assertion is

⁶⁰ Interview with Professor Arthur D. Bernhardt of MIT, a student of the mobile home industry. An otherwise very thorough study of the impacts of building code requirements on the manufacturing and marketing of industrialized housing was rendered slightly less helpful by the unfortunate omission, through typographical error, of just this 2"x3" standard. See Charles G. Field, Home Manufacturing and Building Codes: The Confrontation Between Technology and Industrial Regulation (unpublished Ph.D. Thesis, Harvard University, 1971).

grounded in testimony introduced in opposition to the substitution of 3-1/2" as the size standard for the nominal 2" x 4", replacing the traditional 3-5/8":

It is this last dimension of 3-1/2 inches about which we are particularly concerned. The standard 2 by 4, or stud, is the place into which contractors must install pipes, plumbing, vents, wires, electrical fittings, cabinets, and all the other items which are hidden in the walls of a home. The reduction in size means that all these items which have been traditionally designed to fit in the 3-5/8 inch wall space will no longer fit readily into the smaller space. The Result: Increased cost of homebuilding.⁶¹

The Cast Iron Soil Pipe Institute (CISPI) was even more alarmed, saying the change "will have a catastrophic effect on the future marketability" of cast iron soil pipe because such pipe cannot fit into even the then-current size of the nominal 2 x 4 stud wall, owing to the bell and spigot construction of the pipe.⁶² (What CISPI did not say was that the plastic pipe--which does not have the ball-and-spigot jointing conformation--can readily fit within the reduced space. CISPI has since promulgated a "hub-less" pipe that has a narrower profile.)

⁶¹Testimony of the Chairman of the National Conference of the Plumbing-Heating-Cooling Industry in Report of the Subcommittee on Regulatory Agencies, House Select Committee on Small Business, New Softwood Lumber Standard and its Impact on Small Business, 91st Congress, 2nd Session, Report No. 91-1750 (Washington; USGPO, 1970), p. 19.

⁶²Ibid., p. 20.

No such controversy applies to the remaining wood-related innovations, WDSHTH or WDFRMF. There may be some apprehension about the latter from the fire protection community (state fire marshalls and insurance companies), but of no great consequence. WDFRMF engendered very little controversy at the time of its incorporation in the building codes of the nation.⁶³

In the case of our final technical amendment, PRTYWL, there is no prima-facie cause for disruption or controversy among the dozens of actors and institutions represented in our discussion thus far. Walls with or without air spaces would seemingly involve the same suppliers, contractors and tradesmen. Apparently only the air space lobby would be discomfitted, but they have not as yet been very vocal.

A Typology Of Building Innovations

In order to identify regularities in and, hence, generalizations about change in construction technology, and to avoid the bane of empirical studies, particularism, the 14 items comprising the index of technological currency are now analyzed as representatives of certain types or classes of changes. The innovations are classified with respect to the physical technology they embody and the requisite changes in organization of work on the construction site that are latent in the changes in physical technology. But other

⁶³Figure 4-1.

considerations are also weighed; notably, the important affects on the distribution and marketing of construction materials, services that account for one-fifth of the value of residential construction put in place. Table 6-1 assigns each of 14 innovations that comprise the index of technological currency to an analytical category, the sources of which are now explained.

A priori categories of classification, of course, are necessarily tentative, this does not imply, however, that they are useless. They reveal more about the intellectual perspective of the author than they do anything else.

The categories of classification used below emerge from the author's background in architectural design theory as modified and extended by the hypotheses of this research on the nature and role of the building department's clientele.

By an intellectual tradition dating to the 12th century the study and practice of architecture is organized about three subjects: 1) the nature of construction materials, 2) the methods of their combination into durable structures, 3) as directed by purposive design.⁶⁴ The main classifications by which the present analysis proceeds are an historic three: materials, methods and design.

⁶⁴Lionel Brett, Architecture in a Crowded World: Vision and Reality in Planning, (New York: Schocken, 1971), p. 44.

TABLE 6-1: CLASSIFICATION OF ELEMENTS OF THE INDEX OF TECHNOLOGICAL CURRENCY

Identification Number	SYMBOL	TYPE OF CHANGE		
		MATERIAL		METHOD
CODE CHANGES		SUBSTITUTION	ELIMINATION	DESIGN
1. Nonmetallic Sheathed electrical cable	NMTCBL	X		
2. Prefabricated metal chimneys	MTLCHM	X		X
3. Off-site preassembled combination drain, waste, and vent plumbing system for bathroom installation	PLMTRE			X
4. Off-site preassembled electrical wiring harness for installation at electrical entrance to dwelling	WRHRNS			X
5. Wood roof trusses, placed 24" on center	WDTRUS			X
6. Cooper pipe in drain, waste, and vent plumbing systems	COPDRN	X		
7. ABS (acrylonitrile-butadiene-styrene) or PVC (polyvinyl-chloride) plastic pipe in drain, waste, and vent plumbing systems	PLADRN	X		
8. Bathrooms or toilet facilities equipped with ducts for natural or mechanical ventilation, in lieu of operable windows (or skylights)	BTHDCT	X		X
9. Party walls without continuous air space	PRTYWL			X
10. Use of single top and bottom plates in non-loading vearing interior partitions	SNGLPL		X	X
11. Use of 2" x 3" studs in non-loading bearing interior partitions	2X3STD		X	X
12. Placement of 2" x 4" studs 24" on center in non-load-bearing interior partitions	2X4STD		X	X
13. In wood frame construction, sheathing at least 1/2 inch thick, in lieu of corner bracing	WDSHTH		X	X
14. Wood frame exterior walls in multi-family structures of three stories or less	WDFRWF	X		X

Changes in Materials

Several of the 14 code changes, if widely adopted, would drastically alter the material inputs to the residential construction industry: these are the construction advances that call for the substitution of one building material for another. Other changes would eventually lead to the utter elimination of selected building materials and constituents of those building materials. Both are subsumed in the designation "material". Most "material" innovations are substitutions of improved products for an existing one rather than responses to new functional requirements. This is the most typical technological change in the building industry.⁶⁵

Referring to Figure 6-1, two clear-cut cases of material substitution are items 6 and 7 both of which involve the plumbing industry, in the extended sense of that term: plumbing contractors; plumbing craftsmen; suppliers of plumbing materials, who also distribute them and occasionally incorporate contracting operations; and manufacturers of plumbing materials. On inspection it appears that the substitution of copper for ferrous piping (item 6) or the substitution of plastics for metallic piping (item 7) would have serious consequences for the industry when deprived of exclusivity in the lucrative residential construction market. Although all elements of the

⁶⁵Marion Bowley, Innovations in Building Materials: An Economic Study, (London: Gerald Duckworth, 1960), p. 402.

plumbing industry are involved, on first appearance it is primarily the producers and distributors of the pipe themselves who bear the brunt of this change. The rational response on the part of the just-deprived industry would be, of course, to expand their product line to include the newly enfranchised building material. This is precisely what has occurred for example among elements of the cast iron industry who have simply added facilities to produce plastic piping.⁶⁶ Such recourse, however, is not available for those manufacturers who have had their product eliminated from consideration altogether. Take for example item 12 which effectively eliminates every third stud in non-load-bearing (NLB) interior partitions. Put another way, this code change effectively eliminates one stud for every four lineal feet of interior NLB partition. The amount of lumber that could be saved if this were to become standard practice for all on-site residential construction in the U.S. is over 85 million board feet.⁶⁷

⁶⁶ A roster of metal pipe producers who have diversified into plastic production is contained in the 1970 HUD Hearings, Part I, p. 680 ff. They include the nations largest producers of cast iron pipe.

⁶⁷ The estimate is calculated as follows: in recent years, typical government-insured single family houses contained 1200 square feet. Assuming 30 x 40 feet single story construction and at least four rooms per unit, about 80 lineal feet of interior partition is created; assuming 800,000 such units per year (adapted from HUD Trends, May 1970), 64,000,000 lineal feet of interior partition. Elimination every third stud saves 16 million studs or about 85,120,000 board feet of lumber. See also, "Ecology cuts timber supply as demand rises says (Secretary of Agriculture) Butz," Boston Globe, 3 December 1972.

One can imagine the Sierra Club advocating such a change in contrast, the lumber industries in the U.S.--40% of whose output goes to construction--might be expected to greet this eventuality with some dismay. Reality turns out to be slightly more complicated in this case, however, because as we have shown, the principal advocates of precisely this building code reform--placement of 2" x 4" studs 24" on center in NLB interior partitions--are in fact the large scale lumber producers themselves.

An important effect of code changes that permit the substitution of one building material for another is that they can affect the amount of work available to competing trade unions. (This effect is to be distinguished from the use of building code definitions in the assignment of work between trades, a matter taken up in Chapter 5.) The constitutions and bylaws of the member unions of the Building and Construction Trades Department often assert jurisdictional claims by reference to specific building materials.⁶⁸ One such assertion was made by the carpenters who declared, in their 1914 Convention, jurisdiction over "All that's made of wood..." and, in the very next phase, pre-empted "all future practioners of technologies yet unborn," ... or that was ever made of wood".⁶⁹

⁶⁸ Haber and Levinson, Labor Relations in the Building Trades, p. 178.

⁶⁹ Christie, Empire in Wood, p. xvi.

Building codes are not the primary recourse of those adjudicating jurisdictional disputes. There are, as has been pointed out, national appeals mechanisms for these decisions. But building code provisions can provide a corroborative reference among local disputants, only a small fraction of which bring grievances up to the national appeals mechanism (which, incidentally, has no powers of proscription or enforcements of its own decisions).⁷⁰

Trades whose traditional materials have been displaced have resorted to imaginative responses in order to "preserve work". Let this example, drawn from the present author's own construction experience, illustrate. Three trades are required to install acoustical ceiling tile that replaced traditional lath and plaster ceiling treatments. A carpenter unpacks the 12" x 12" tiles and does any necessary cutting a lather then dabs mastic on the backside of each tile and, finally, a plasterman presses each tile into place. Each trade, of course, retains that portion of the work that he was responsible for in the antecedent technique. It is practices like this that frustrate efforts to redesign building components so that lower skill levels can be used to achieve the required level of performance. A more imaginative craft union response is to create trade specializations (at contingent pay scales) that are more closely matched to the level of skill (and necessary training) required for the new technique. The

⁷⁰ Interview with Clyde Johnson, Retired President, Millmen's Local 550 of the United Brotherhood of Carpenters and Joiners of America, 4 August 1972.

several "pipe trades" are differentiated in just this way.

Finally, material changes which result in substitution lighter weight materials for heavier ones have important consequences for transportation and, consequently, warehousing and distribution. This will be explained in greater detail below.

Changes in Method

Efficiency-minded industry critics have turned attention toward the possibilities of on-site fabrication practices in the residential construction industry. And justifiably so. For site assembly is demanding work, easily distracted by vagaries of weather and scheduling. Two of the 14 items in Table 6-1 are of the pure "methods" type which require a change in traditional practices that often prompt a change in the location of the work. The materials handled may be the same, although often they are not. And the building tradesmen involved are more often than not from the same building trades as would be occupied on-site. The labor-management problem in these "methods" cases is the relation of worker productivity to wages in the off-site situation and the threat to the craft-consciousness of the building tradesmen for whom the routine of assembly line work is aesthetically and ethically unpleasant. More mundanely, off-site work is frequently rewarded at the lower wage rates associated with manufacturing employment.

Industry critics argue that high wage rates of on-site craftsmen have compelled just this substitution of capital for labor, which is the main reason for moving work off-site.⁷¹ Of course, construction managers and designers must select which elements of the work can be effectively moved off-site. This decision is contingent on several factors, some which reach beyond the industry itself and to such seemingly remote concerns as the quality of a region's transportation network. Construction management does not universally embrace off-site fabrication, either, since there are disadvantages associated with it. On-site management must weigh with care the requirements of increased pressure to perform its own tasks on schedule and with precision in order to accommodate components which stream on to the building site according to a schedule established weeks if not months in advance.⁷² Moreover, Mandelstamm reports that even economy-conscious builders feel that greater savings can be realized more from improvements in overall planning, management and supervisions than from improved methods of fabrication--on-site or off.⁷³ Designers, too, must face the implications of off-site assembly of components-- detailing of joints to permit adjustments to

⁷¹The arguments on such moves are reviewed in Mandelstamm, *The Effects of Unions of Efficiency*", p. 513.

⁷²Cox, *The Supply-Support Requirements of Homebuilders*, p. 1.

⁷³"*The Effects of Unions on Efficiency*", p. 519.

meet unanticipated site conditions and the aesthetically questionably limited variation that accompanies serial production.

Off-site pre-assembly continues to expand in use, particularly in lightweight elements requiring particular precision, windows, stairs and doors and door frames.⁷⁴ The extent to which operations are "pushed back" up the supply chain depends also on the economies of scale involved--larger volume builders and their specialty contractors can afford to finance and operate shops to service their own needs and then market excess production to other builders⁷⁵--and the economics of transport. The latter bears special attention.

Traditional construction materials--stone, wood, metals--are, by and large, of relatively low unit value and have consequently exhibited a greater elasticity of demand for transport. A stone quarry cannot afford to ship its product a long distance and remain price competitive. This pricing behavior--increases delivery costs relative to costs to a market-oriented pattern of location.⁷⁶ The historic construction supply industry manifests this behavior wherein

⁷⁴ Behman, et. al., have shown the largest productivity gains by carpenters in the last 35 years has been in operations moved to off-site preparation, specifically the elements mentioned above. In Productivity Change for Carpenters, p. xvii.

⁷⁵ Cox, The Supply-Support Requirements of Homebuilders, p. 17.

⁷⁶ Edgar M. Hoover, The Location of Economic Activity, (New York: McGraw-Hill, 1948), p. 169.

relatively high transfer costs (i.e. procurement plus distribution costs) resulted in a certain self-sufficiency of local areas that discouraged the invasion of local markets by out-of-town suppliers or the usurpation of traditionally localized building industry service functions like warehousing, transportation, wholesale and retail trade. (Functions that account for one-fifth of the value of construction put in place.)

But off-site preassembly of building components, by changing the structure of transfer costs, alters the significance of distance and volume in shipments of construction materials. This occurs because the preassembled building components now have increased value compared to raw or semi-finished goods, "value added by manufacture", to use the nomenclature of business economics, is now significant. In the process of manufacturing weight is lost at the same time that value is added by the application of labor and capital, as a result, the components are more valuable in relation to their weight. With goods of higher value per unit (usually, but not always, a unit of weight), the transfer charge comprises a smaller relative addition to the total cost of the delivered article. In contrast with the case of raw or semi-finished construction materials, the elasticity of demand for the transfer service is less in the case of off-site preassembled components and proximity of the plant to final market declines in relative importance. In Professor Hoover's words, "(t)he consequent recasting of the over-all location

patterns makes some locations economically obsolete but opens up investment opportunities (elsewhere)..."⁷⁷ As the use of pre-fabrication of all types enlarges, the isolation and "protected" nature of the economist's "imperfect" local building materials market erodes. Increasingly, construction expenditures flow outside the local economy. The prospect of this loss energizes the local building materials producers, suppliers and distributors to check this erosion by proscribing the use of prefabricated components in their local market areas. As we shall see, an administrative device that is used to achieve this objective is the local building code. But there are also strong industry interests, some of them local, that favor opening codes to permit the use of off-site preassembled components.

Industry support for wider use of off-site pre-assembled components issues from two sources, one local and the other national, each moving in opposite directions on the same path. The basic national construction materials industries appear to be moving down the supply channel from extraction and/or manufacture towards distribution, intermediate sales, installation, and final sales. This is the classical "forward integration" of maturing industries. The recent corporate histories of such primary materials firms illustrate: Boise-Cascade has moved from wood products to the manufacture and sale of houses in its own planned communities; National Gypsum (an old-line supplier of hydrous calcium sulfate for building

⁷⁷Ibid., p. 166.

and agricultural uses) now supplies 400 building products. By means of its 1970 acquisition of DMH Corporation, a manufacturer of mobile homes and developer of mobile home communities, National Gypsum boasts a capability to "develop and produce all types of factory-built housing by use of (DMH's) know-how and facilities...to modify our Company's present product line and to develop new building products suitable for use in production of all types of factory-built shelter."⁷⁸

On the other hand, as the material-suppliers "forward integrate", enterprising local builders and material distributors integrate in the opposite direction by securing control of earlier stages of the supply channel by making their own assemblies rather than distributing or installing those made "upstream".

The result of both these thrusts--rearward and forward integration--will be to energize members of the building departments clientele to support or resist moves to permit the use of off-site preassembled components.

Changes in Design

Design changes are those that neither require new material inputs nor alter traditional on-site deployment of construction

⁷⁸1970 Annual Report, p. 3.

tradesmen. More often than not, changes of this type involve the physical configuration of the parts in order to effect more economical fabrication and/or shorter assembly time; or for aesthetic reasons such as conformity to images in current vogue. The principle actors in design changes are the design professionals: architects and engineers, technicians whose professional pride is based on an ability to keep up with and to occasionally advance the state-of-the-art in his field. Compared to the two previous types of change--material and method--there are fewer actors who have a prima-facie argument against changes in design. This, plus the progressive ethos of the design profession, suggests that design changes should diffuse the fastest.

Changes Involving Generic or Proprietary Products

The final possible classification is a legalistic rather than an economic or technological one. Roughly, a distinction is made between those innovations that are proprietary as opposed to generic in nature. Proprietary innovations are those innovations whose exclusivity of application is protected by patents or other restrictive devices. Generic innovations are those technical advances marketed freely, without patent protection. Governments have devised patent systems to encourage inventors to develop useful new technology by providing successful inventors with periods of exclusive privilege in the manufacture, sale and distribution of the

invention. But, as is shown later, the construction industry is characterized by a diffusion lag that far exceeds the period of exclusivity granted by the U.S. Patent Office: 17 years. Little wonder that so little use is made of patent exclusivity in the construction products field. This being so, a more helpful classification would be that utilized by Cox: specialty products, that are not mass marketed and are often made to order for each installation and which offer high margins to middlemen (specialty products are almost definitionally beyond the scope of this analysis, which pertains to less exotic techniques. Hence, this class is dropped from further discussion); standard products (proprietary items) that are mass distributed under recognized brand names; and commodities (generic items) in which no significant brand differentiation exists, although trademarks are used. These last items compete most often on a price or availability basis rather than as a distinctive service or product.⁷⁹

There is a cycle in the life of construction products wherein a new item first appears as an expensive specialty-- often contributed by and avant-garde architect. One thinks of Frank Lloyd Wright's use of indirect lighting or the Bauhaus-designed tubular lighting fixtures of the 1920's;

⁷⁹Cox, Adaptation to Markets in the Distribution of Building Materials, Vol. I, (Washington: The Producer's Council, 1963), pp. 5, 332-3.

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⁷⁹ Cox, Adaptation to Markets in the Distribution of Building Materials, Vol. I, (Washington: The Producer's Council, 1963), pp. 5, 332-3.

they then became standard products of existing producers. Lightolier and, in the case of furniture, Knoll International and Herman Miller have turned these specialty products into standard items that now can be ordered out of catalogs and delivered virtually anywhere in the U.S. They are commodities no longer offer distinctive styling or other status markings. Another example: in just less than twenty years the glass and metal curtain wall has gone from a specialty item introduced in the Lever Building by Gordon Bunshaft in 1953, through a period of restricted production by a handful of steel fabricators throughout the 50's and 60's, to the situation at present where curtain walls represent neither originality nor differentiation but rather compete on the basis of their cheapness and availability.

This evolution--from specialty item through standard product to commodity--makes precise categorization along generic-proprietary lines risky. Without an exhaustive search of patents, no definitive assignment could be made; and patent searches are beyond the resources of the present study. But bearing more directly on the issue is the fact that patent statistics are of less utility to the student of building technology; they are almost irrelevant in fact, for historiographic purposes. This is so for the following reasons.

In the first place, the evolution and diffusion period is so long that patent exclusivity would have expired. For instance, commercial availability of fluorescent luminaires occurred 36 years after the original patents were issued⁸⁰-- this is more than twice the period of patent exclusivity. How is one to establish the correct proprietary status of the devices?

Secondly, in the realm of technology, as opposed to science which relies on formal publication of ideas, diffusion occurs as technological prototypes beget technological prototypes: things beget things; forms, forms. Historians of technology point out that the mere existence of a working prototype seems to provoke a spurt of ingenious facismiles that deviate from the original sufficiently to avoid infringement of rights in property. In fact, some notable technological advances--to the greater service of mankind, no less--have occurred in just this way.⁸¹

The point of this discussion is that classification along generic-proprietary or standard product-commodity is more a matter of choice of a point on a continuum than assignment to a strictly bounded cell. Hence in the following discussion, this property of the innovation under review will be handled something like an epiphenomenon rather than a primary datum.

⁸⁰ Reyner Banham, The Architecture of the Well-Tempered Environment, (Chicago: University of Chicago Press, 1969), p. 16.

⁸¹ Derek J. deSolla Price, The Historiography of Technology, unpublished lecture delivered at MIT, 7 December 1971.

Although the classification problem is exacerbated in the assignment of proprietary status, it occurs throughout the analysis, for none of the categories stated above are perfectly "clean": the classification scheme is not exclusive. This is so because the intermediate method of production, fabrication, erection, installation, and servicing of any physical building component is related to the materials available, and methods and materials affect modes of distribution as has been explained already. Finally, changes in building materials and methods alter design practices themselves. For the functional tradition embraced by modern architecture has intensified the sensitivity of design to building materials technology to the level of an aesthetic imperative.⁸²

Refined Hypotheses on Diffusion of Innovations in Building Technology

The descriptions of the innovations comprising the index of technological currency that occurred earlier in this chapter and Chapter 4's description of the constituents of the building department's clientele have prepared the way for an evaluation of several hypotheses on the diffusion of innovation in building technology based on the classification scheme just completed. Before we begin, it is well to restate

⁸²Peter Collins, Changing Ideals in Modern Architecture: 1750-1950, (Montreal: McGill University Press, 1967), passim.

the fundamental objectives of this research:

to demonstrate that industry interests rather than agents the general public interest dominate the deliberations of local building departments and that those industry interests are manifested in the pre-emption of communications channels that inform the decisions of local building officials in the accommodation of the local code to changes in construction technology. What energizes and directs those interests into action is one of two potential effects of innovative technology. That technology constitutes either a perceived threat to the favored positions that some interests currently occupy in the building enterprise; or, that technique carries the promise of an opportunity to improve a less-favored position with the constellation of building industries.

These objectives are met by testing a series of propositions derived from them that relate the rate and level of adoption enjoyed by a series of technological innovations to the technological characteristics of those innovations and to the constituency that comes forward to support or to resist the further diffusion of those innovations. The two phenomena--characteristics of diffusion and nature of the constituency--are related in our model of collective decision-making wherein the local agency personnel rely on the constituency as sources of ideas, for discussants and legitimizers of and support and resistance to the prospective changes.

Proposition One: the extent of controversy attending an innovation's diffusion is a function of the type of change that innovation embodies.

A comparison of Figure 4-1 and Table 6-1 is sufficient to validate this assertion. Material changes cluster in the "greatest difficulty" region and design changes in the "least difficult" region of a continuum of controversy mapped in

Figure 4-1. Method changes are distributed in the middle. The controversy mapped is that reported by local building departments that have actually adopted the selected innovations. It will be recalled that Figure 4-2, mapping the expectation of controversy among agencies yet to adopt the changes under review, showed no correlation, innovation by innovation, with the actual controversy experienced by sister agencies. However, that ranking of categories of change--material, method and design--is generally consistent from Figure 4-1 to Figure 4-2. This persistence of the categories' standing, despite the inconsistent rankings of the individual innovations, suggests that the categories do apprehend something significant about the innovations that induces greater or lesser amounts of controversy. The categories, in order of decreasing controversy engendered, are Material Change, Method Change and Design Change.

Proposition Two: the greater the difficulty that attended the adoption of an innovation, by an agency, the less is the likelihood of its widespread acceptance among other agencies.

The data suggest that the situation is more or less the opposite. The roster of innovations ranked by extent of controversy experienced in their adoption is weakly and negatively correlated with the roster of innovations ranked by degree to which they are prohibited by the local building codes of the Nation.⁸³ This occurs despite the fact that

⁸³Spearman's $R = -0.37$; significance, $0.005 < p < 0.01\%$ that this correlation would occur by chance alone.

"votes" for the "most difficult" change were solicited only from those agencies that had already adopted the change. The data are presented in Table 3-18 and Figure 4-1.

Proposition Three: if the "climate of fear" is prevalent among local agencies contemplating acceptance of innovative technology, then the greater the controversy expected with the acceptance of a prospective innovation, the less is the likelihood of its widespread acceptance among other agencies.

This expectation of controversy--although shown in Chapter 4 to be not correlated with the controversy actually experienced--is a restraint on innovation. This assertion is substantiated by the strong, positive and significant correlation between a ranking of innovations by the degree of controversy they are expected to generate and a ranking of innovations by the degree to which local agencies prohibit their application.⁸⁴ The situation of the survey respondents might require a rather important reservation to this finding. To wit: responding agencies assigned "most difficulty expected" to only one of those innovations they did not permit at the time of the survey. Therefore, there is a systematic bias towards the concordance of the two rosters. However, the same bias, but in the opposite direction as it were, operated in the testing of Proposition Two--which failed of confirmation. Thus the two biases have the effect of cancelling one another out and the tentative reservation can be relaxed. The climate

⁸⁴Spearman's $R = 0.78$, significance = $0.005 < p < 0.0005$.

of fear among the local building officials is a factor to be dealt with in public policies in the area of building technology.

Proposition Four: If an innovation diffuses at a too rapid rate, then agency constituents representing disadvantaged techniques engineer a holding action by precipitating a controversy.

This proposition corresponds to a widely-made allegation in the building code community that the technologies on the wane "buy time" to adapt their production and distribution facilities to accommodate the newer techniques.⁸⁵ To test this proposition, data from the 1968 national survey of local building departments conducted by the Douglas Commission was compared with that from the present survey taken three years later. There was a considerable overlap in the two samples. Contrary to the allegation, controversy did not vary with rates of change. Correlations were weak and not statistically significant. In the course of this analysis, however, it was discovered that absolute amounts of change in the inter-survey period did correlate positively, moderately strongly and significantly with controversy experienced in the local agencies.⁸⁶ This leads to the suggestion that the social system of the building enterprise is resilient and can absorb a certain amount of change, no matter what the "velocity", until a critical

⁸⁵How this occurred in the Battle of Plastic Pipe is recounted in detail later.

⁸⁶Spearman's $R = 0.49$; significance = $0.025 < p > 0.05\%$.

threshold or "tipping point" is reached. At that point, defensive actions come into play, resulting in the provocation of a controversy.

This proposition condenses what is probably the most prevalent misunderstanding about change in the building enterprise, that there is what almost amounts to a conspiracy against general advance in building technology. Most frequently alleged as co-conspirators are 1) the local, traditional or conventional building industry,⁸⁷ and 2) the trade unions that serve the industry.⁸⁸ These allegations of long standing are mischievous not principally because they indict one or another set of culprits. Rather, the error resides in the propagation of a conspiratorial theory at all. Analysis of the participation of industry elements in the decision to modernize the local building code reveals that not only does "everybody want to get into the act" but that the extent and nature of that participation of most of the actors alternates from high to low, pro to con, varying with the specific technology under review. The number of actors who are both persistent (in that their participation is of a given level on all issues) and consistent (either always for or always against) in their advocacy are few; moreover, neither the

⁸⁷ Field and Ventre, "Local Regulation of Building"; Field, Home Manufacturing and Building Codes; Ventre, Technological Currency in the Local Building Code.

⁸⁸ M. R. Lefkoe, The Crisis in Construction, (Washington: Bureau of National Affairs, 1970) "The Unchecked Power of the Building Trades", Fortune, December 1968.

local building interests or labor unions figure significantly as retarders among these few. Ambivalence is the dominant trait of the building department's constituency in the face of change. Their participation in the code change deliberations is marked by opportunism. The following analyses substantiate these generalizations.

The departments clientele was partitioned by the extent to which they were prominent in decisions on code changes of one of the three types. Table 6-2 reveals sufficient divergence among some of the rosters to merit further analysis. In sum, Table 6-2 suggests there are no "king makers" among the constituents across all technological specialties. Take the important role as initiator of changes.

Figure 6-1 reports considerable change in the rosters of actors ranked in terms of prominence as initiators of code changes. Far from being atavists, local interests take prominent roles in initiating change--all types of change. The broken lines in Figure 6-1 connect actors whose type to type shifts were of sufficient moment to affect inter-roster concordance. Most of the larger shifts are predictable from the arguments establishing the a priori changes categories: home manufacturers and out-of-town builders pressing for method changes that create marketing opportunities for off-site pre-assembled components; architects and engineers moving into prominence on design changes. Conversely, non-local suppliers receded as originating sources of method changes while moving in the opposite direction on materials changes.

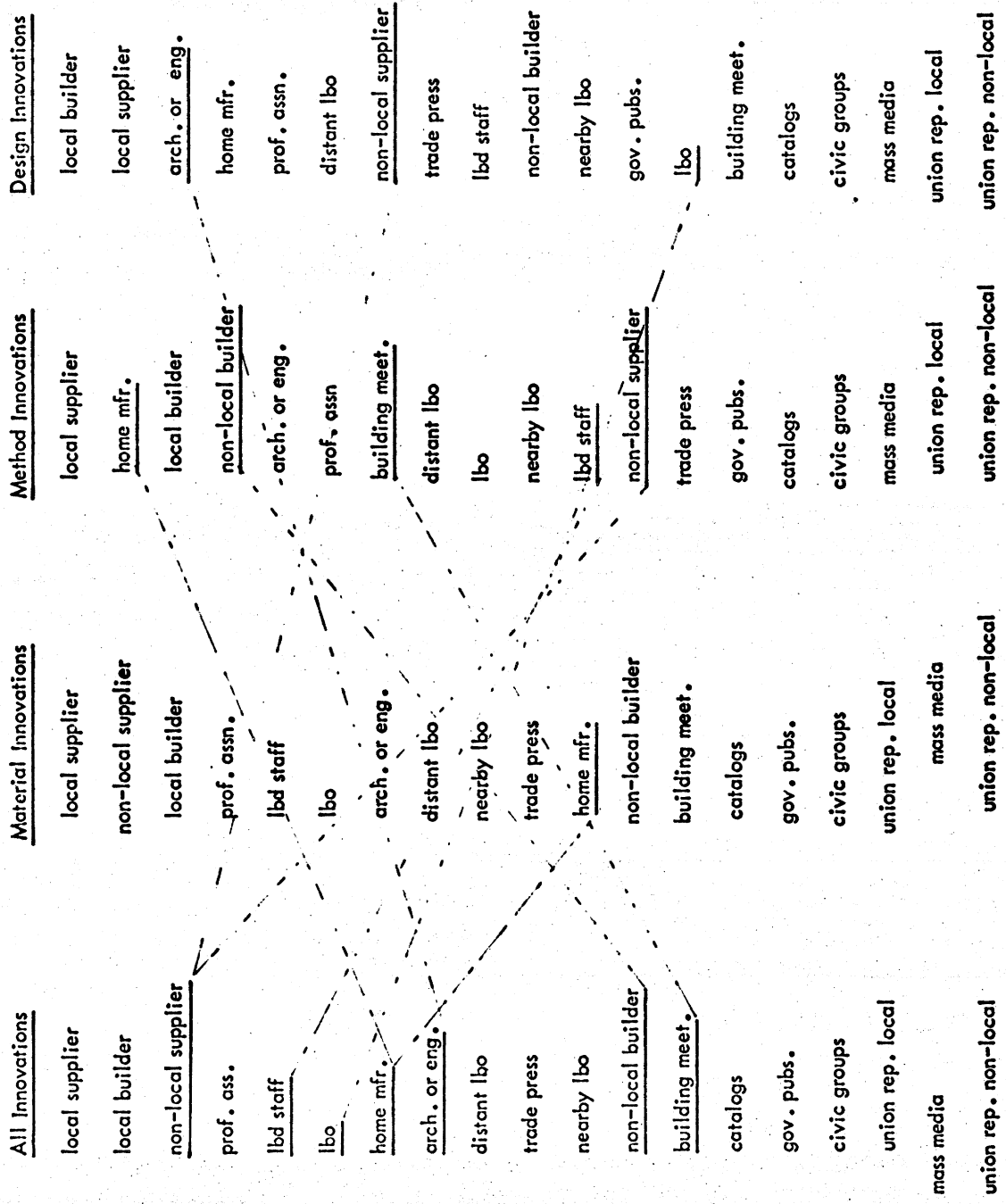
TABLE 6-2 CONCORDANCE BETWEEN RANK-ORDERED ROSTERS OF ACTORS
 PROMINENT IN LOCAL BUILDING DEPARTMENT DECISIONS, BY
 TYPE OF INNOVATION AND ROLE*

<u>Rosters Compared</u>	<u>Role in Collective Decision-Making</u>		
	Origin	Trust	Net Support
All Change vs: Material Substitution	0.97	0.98	0.99
NMTCBL			
MILCHM			
COPDRN			
PLADRN			
BTHDCT			
WDFRMF			
All Changes vs: Method Changes	0.08**	0.95	0.97
MILCHM			
PLMTRF			
WRHRNS			
WDRUS			
All Changes vs: Design Change	0.88**	0.94	0.08**
WDRUS			
BTHDCT			
PRTYWL			
SINGLPL			
2X3STD			
2X4STD			
WDSHTH			
WDFRMF			

* All R's statistically significant, with p 0.005%.

** Had the rosters been truncated by eliminating that quarter of of the actors who only slightly ventured from obscurity (a technique in fn 112 of Chapter 4), these R's would have been far lower, dropping from R = 0.88 to R = 0.73, and from R = 0.80 to R = 0.52. As presented the R's are kept high by the retention in the roster of this consistently "inactive" five actors. Furthermore, the categories of changes are not mutually exclusive and the overlapping categories also seem to keep the R s higher than otherwise.

Figure 6-1 Rosters of Actors in Local Building Department Decisions on Innovative Technology Ranked by Relative Participation as Originators, By Type of Innovation.



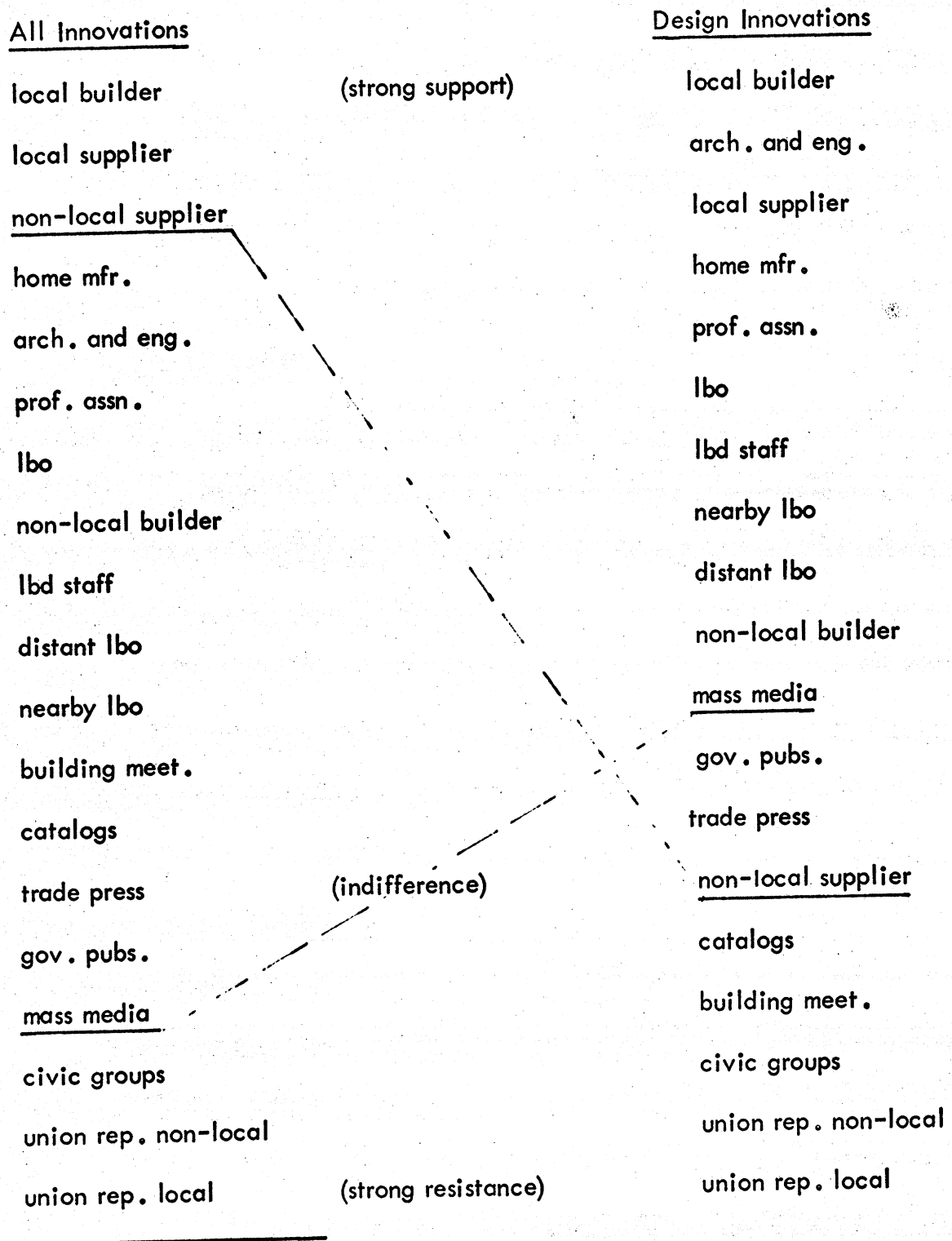
A sizeable lack of concurrence is noted between actors prominently supporting or resisting design changes and "all" changes and reported in Figure 6-2. The shift of moment occurs here with the non-local supplier who moves from strong partisanship on material and method changes. Whereas new market possibilities accompany materials and method changes--meriting the suppliers' strong support--design changes, as defined herein, involve no new materials, no new methods and, as a consequence, the supplier is indifferent to those changes.

The association of certain actors with certain types of change is readily seen when Tables 6-3, 6-4 and 6-5 are examined in succession. These tables identify those actors whose participation varies significantly⁸⁹ from one type of change to another. Note this does not refer to absolute level of participation; rather, the reference is to more (+) or less (-) participation in a stated role in behalf of the particular type of change under review than was noted in that for "all" changes.

These tables make clear the pervasive ambivalence of the building "industry" as a collectivity. Most individual sets of actors are partisans of one type of change only. Notice that out-of town suppliers withhold support from method and design changes and lavish it on material changes. Conversely, home manufacturers husband their support for material changes and

⁸⁹Kendall's T_{auB} was significantly large ($p < 0.05$) in tests of association.

Figure 6-2 Rosters of Actors in Local Building Department Decisions on Innovative Technology Ranked by Relative Participation as Net Supporters*, By Type of Innovation



* Defined as Support Activity ← Resist Activity

Table 6-3: Variation of Actor Mobilization with Respect to Material Changes

Where did the idea for this change originate? (1)	With whom was it discussed? (2)	Which were the most trustworthy sources of information? (3)	Which groups most supported the change? (4)	Which groups most resisted the change? (5)
Building Material Producers or Supplier Representatives:				
Local			+	+
Out-of-town	+	+	+	+
Builder Representatives:				
Local			+	
Out-of-town	+			
Prefabricated Home Manufacturer Representatives	-	-	-	-
Union Representatives: (identify by trade)				
Local	+			+
Out-of-town	+			+
Building Officials from Cities:				
Within your county	+			+
Outside your county	+			
Civic or Voter Groups				+
Building Product Catalogs or Brochures	+	+	+	
Trade or professional magazines or Journals		+	+	
Mass Media (TV, Magazines, Newspapers)				
Government Publications	-	+	+	
Meetings of your Professional Ass'n.	+			
Meetings or Conventions of Materials Producers			+	+
Your staff	+	+		
Yourself				
Architects or Engineers	-	-	-	
Other (specify)				

Table 6-4: Variation of Actor Mobilization with Respect to Method Changes

Where did the idea for this change originate? (1)	With whom was it discussed? (2)	Which were the most trustworthy sources of information? (3)	Which groups most supported the change? (4)	Which groups most resisted the change? (5)
Building Material Producers or Supplier Representatives:				
Local	+	-	-	-
Out-of-town	-	-	-	-
Builder Representatives:				
Local	-	-	-	-
Out-of-town	-	-	-	-
Prefabricated Home Manufacturer Representatives	+	+	+	+
Union Representatives: (identify by trade)				
Local	-	-	-	-
Out-of-town	-	-	-	-
Building Officials from Cities:				
Within your county	-	-	-	-
Outside your county	-	-	-	-
Civic or Voter Groups				
Building Product Catalogs or Brochures	-	-	-	-
Trade or professional magazines or Journals	-	-	-	-
Mass Media (TV, Magazines, Newspapers)	-	-	-	-
Government Publications				
Meetings of your Professional Ass'n.	-	-	-	+
Meetings or Conventions of Materials Producers	+	+	-	-
Your staff				
Yourself				
Architects or Engineers	+	+	-	-
Other (specify)				

Table 6-5: Variation of Actor Mobilization with Respect to Design Changes

	(1) Where did the idea for this change originate?	(2) With whom was it discussed?	(3) Which were the most trustworthy sources of information?	(4) Which groups most supported the change?	(5) Which groups most resisted the change?
Building Material Producers or Supplier Representatives:					
Local		-		-	-
Out-of-town		-	-	-	-
Builder Representatives:					
Local				-	-
Out-of-town				-	-
Prefabricated Home Manufacturer Representatives			+		
Union Representatives: (identify by trade)					
Local		-			-
Out-of-town		-			-
Building Officials from Cities:					
Within your county		-			-
Outside your county		-			-
Civic or Voter Groups					
Building Product Catalogs or Brochures		-	-	-	
Trade or professional magazines or Journals		-	-	-	
Mass Media (TV, Magazines, Newspapers)					
Government Publications			-	-	
Meetings of your Professional Ass'n.		-			
Meetings or Conventions of Materials Producers			-	-	-
Your staff		-			
Yourself					
Architects or Engineers	+		+	+	
Other (specify)					

turn all efforts to method changes. It is clear that material changes are of surpassing importance to the building interests and attract most of their effort. This is where the greater mobilization of labor union resistance to building code changes occurs and is now isolated for further analysis.

While it is true that unions are consistently in the resisting role, their level of activity varies and is much stronger in opposition to materials changes than to method and design changes combined (stronger in the ratio of 1.6:1 for local union representatives and 5.5:1 for union representatives from out-of-town). This is a curious turn of events since one would expect that, on the basis of craftsmen's declared concern for maintaining high skill requirements and control over work, union energies would be concentrated on method changes; a change in method, after all--as defined herein and including cases of substituting off-site preassembled components in the electrical and plumbing specialties--can be directly related to vital union interests such as levels of productivity, working conditions, compensation and the organization of the work force. Yet activity in behalf of these changes is slighted in favor of mobilization in resistance to changes in the materials handled. As explained in the earlier discussions of PLMTRE, this method change is contingent on the availability of high value to weight materials, mostly PLADRN. Thus by resisting the latter change, the former is effectively--though not completely--vitiating. But why not tackle the objectionable change more

directly? Why the circuitous route? This quandary is to be resolved in the case study of The Battle of Plastic Pipe which follows shortly.

So much for the more mercurial elements of the clientele, those members whose participation in local code decisions is highly contingent on the specific nature of the change under review. What of their counterparts, the members of the clientele whose interests are not confined to a restricted set of changes. Presumably, it is here that one would find that avant- or arriere-garde, elements unalterably supportive or resistive of change. Table 6-6 reveals that, except for the local building officials, no party appears persistently and consistently to thwart or advance change across the board in all phases of the collective decision. The agents who are persistently and strongly positive toward change are the very agents indicted of the opposite tendency in the "local-building-code-as-tariff" analogy: local builders and suppliers. All other persistent and consistent actors are characterized by low levels of over-all mobilization. One of the persistent and consistent supporters of change--granted, at a very low level of involvement--is the local union representative!

Proposition six: if client mobilization strongly affects agency decisions on building code modernization, then those innovations that mobilize the largest supporting clientele should diffuse the widest and at higher rates. Conversely, those innovations that mobilize the largest resisting clientele should diffuse least and at lower rates.

Table 6-6: Actor Mobilization Invariant with Respect to Type of Change

	Where did the idea for this change originate? (1)	With whom was it discussed? (2)	Which were the most trustworthy sources of information? (3)	Which groups most supported the change? (4)	Which groups most resisted the change? (5)
Building Material Producers or Supplier Representatives:					
Local			17		
Out-of-town					
Builder Representatives:					
Local	30		14		
Out-of-town	10				
Prefabricated Home Manufacturer Representatives					
Union Representatives: (identify by trade)					
Local				2	
Out-of-town					
Building Officials from Cities:					
Within your county	10			13	
Outside your county	12		22		
Civic or Voter Groups	2	6	1		
Building Product Catalogs or Brochures					1
Trade or professional magazines or Journals					3
Mass Media (TV, Magazines, Newspapers)					
Government Publications					1
Meetings of your Professional Ass'n.	17		24	13	
Meetings or Conventions of Materials Producers					
Your staff					
Yourself	14	15	20	14	3
Architects or Engineers					
Other (specify)					

Data condensed in Tables 6-3, 6-4 and 6-5 depict the differential mobilization of agency clients and reference groups by type of change. In decreasing order of mobilization these types are Material, Method and Design. Figures 6-3, 6-4 and 6-5 map the characteristic signatures of cumulative diffusion of each change type. A comparison of the three Figures concedes that differences in either rate or level of diffusion are not attributable to the type of innovation. To isolate possible differences in rates of diffusion among single innovations the same data is "normalized" as follows. Each signature is re-mapped to the same vertical scale in order to isolate the different trajectories each innovation traversed in reaching its 1970 level of acceptance by local agencies. A composite of the signatures appear as Figure 6-6.

Studies of the diffusion of innovations have established a "normal" signature for diffusion curves whatever the social setting and regardless of the particular technology being diffused: this is the familiar "s-curve" or "learning curve" phenomenon. Diffusion theorists assert that a society "learns" to use a technology in much the same manner that an individual learns and uses a new skill: slowly at first, then with increased efficiency and facility until a plateau or phase of stability is achieved and performance levels off.⁹⁰ In the societal situation, the early users of an innovation appear

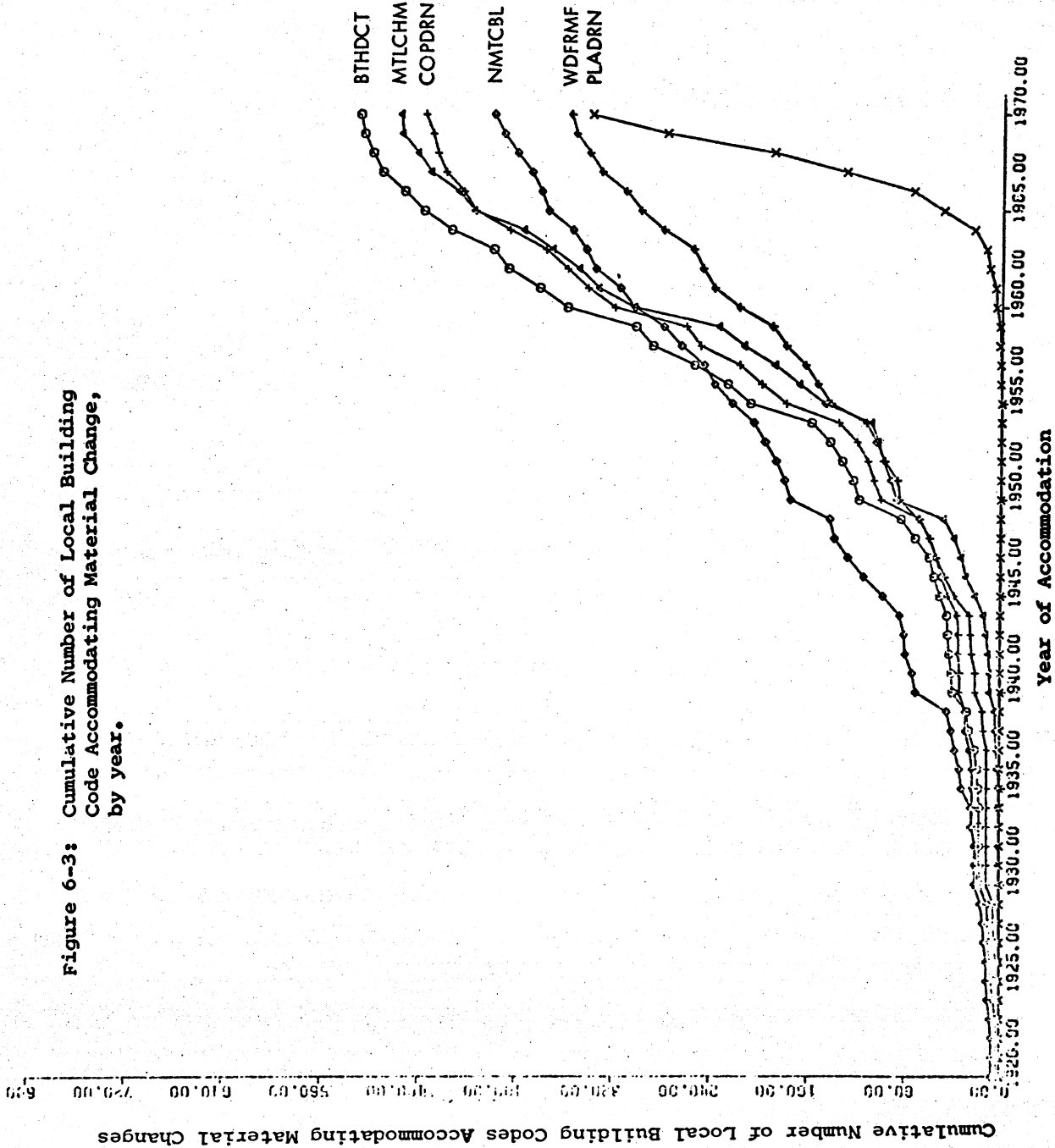
⁹⁰Rogers, Diffusion of Innovations, passim, and Rogers and Shoemaker, Communication of Innovations, passim.

A NOTE ON THE FOLLOWING ILLUSTRATIONS

The rates of diffusion of the 14 innovations are mapped in Figures 6-3, 6-4 and 6-5. The curve associated with each innovation geographically characterizes that innovation's unique path toward the level of acceptance that it now enjoys. It is this characteristic signature that is of importance at this point in the analysis. Hence, the shape of each curve is more revealing for present purposes than is its terminal point. Thus in Figure 6-3, although WDFRMF and PLADRN had by 1970 achieved nearly the same extent of diffusion, the former is not likely to diffuse much further while the latter is still very much in the "take-off" stage. This may be deduced from the shape of the respective curves.

The close reader may note a discrepancy between the absolute extent of diffusion reported on the vertical axis in the following Figures and that reported in Table 3-18. This occurs because many more cities responded to the "yes-no" portion of the questionnaire, reported in Table 3-18, than responded to those portions seeking information as to precise dates of accommodations, reported in the following Figures. However, the numbers reported in the Figures and the Table are roughly rank-order correlated.

In any event, the "shape" of the curve, its characteristic signature, is far more illuminating than is its terminal level. Table 3-18 is the source for information on the extent of acceptance.



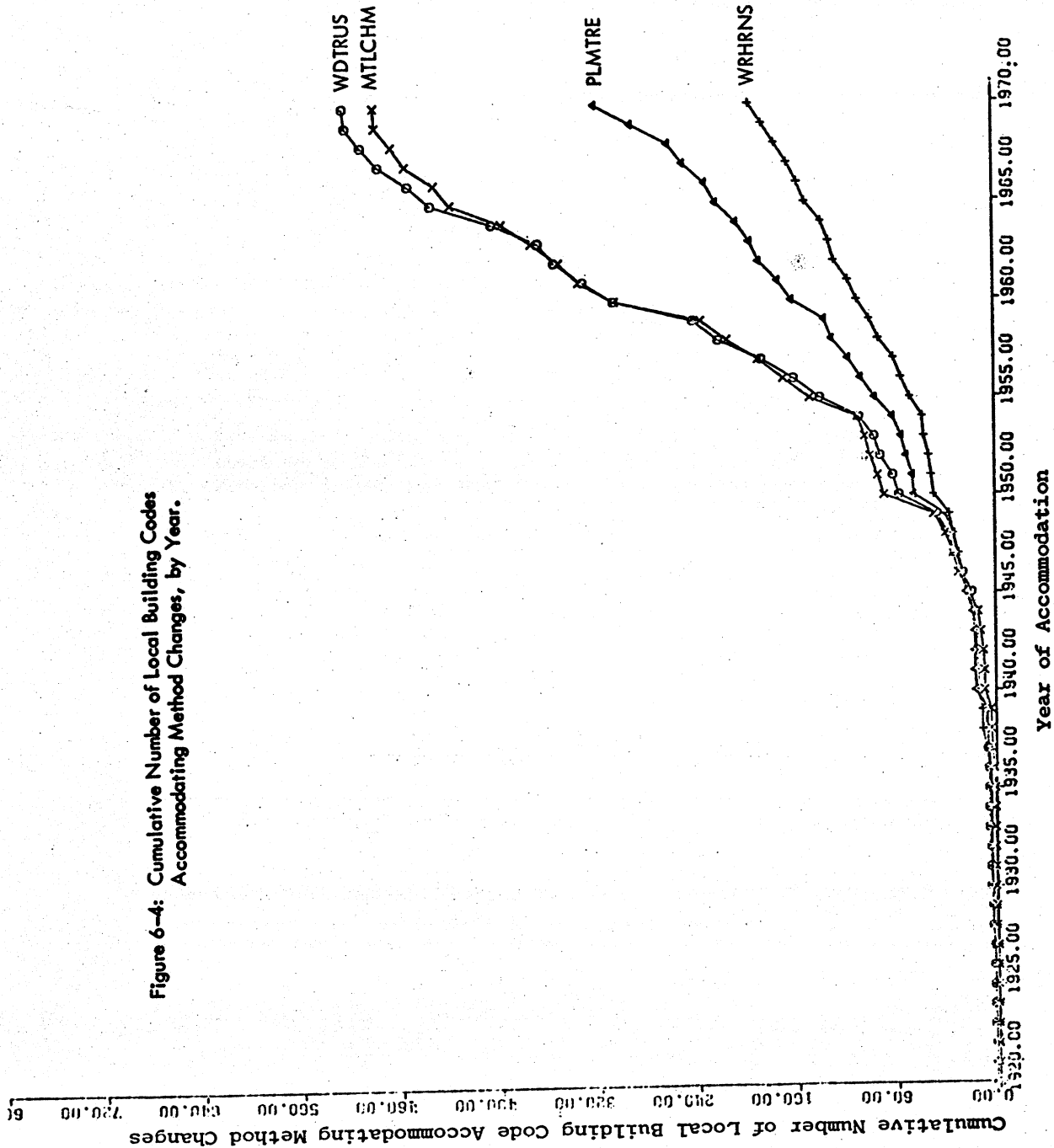


Figure 6-4: Cumulative Number of Local Building Codes Accommodating Method Changes, by Year.

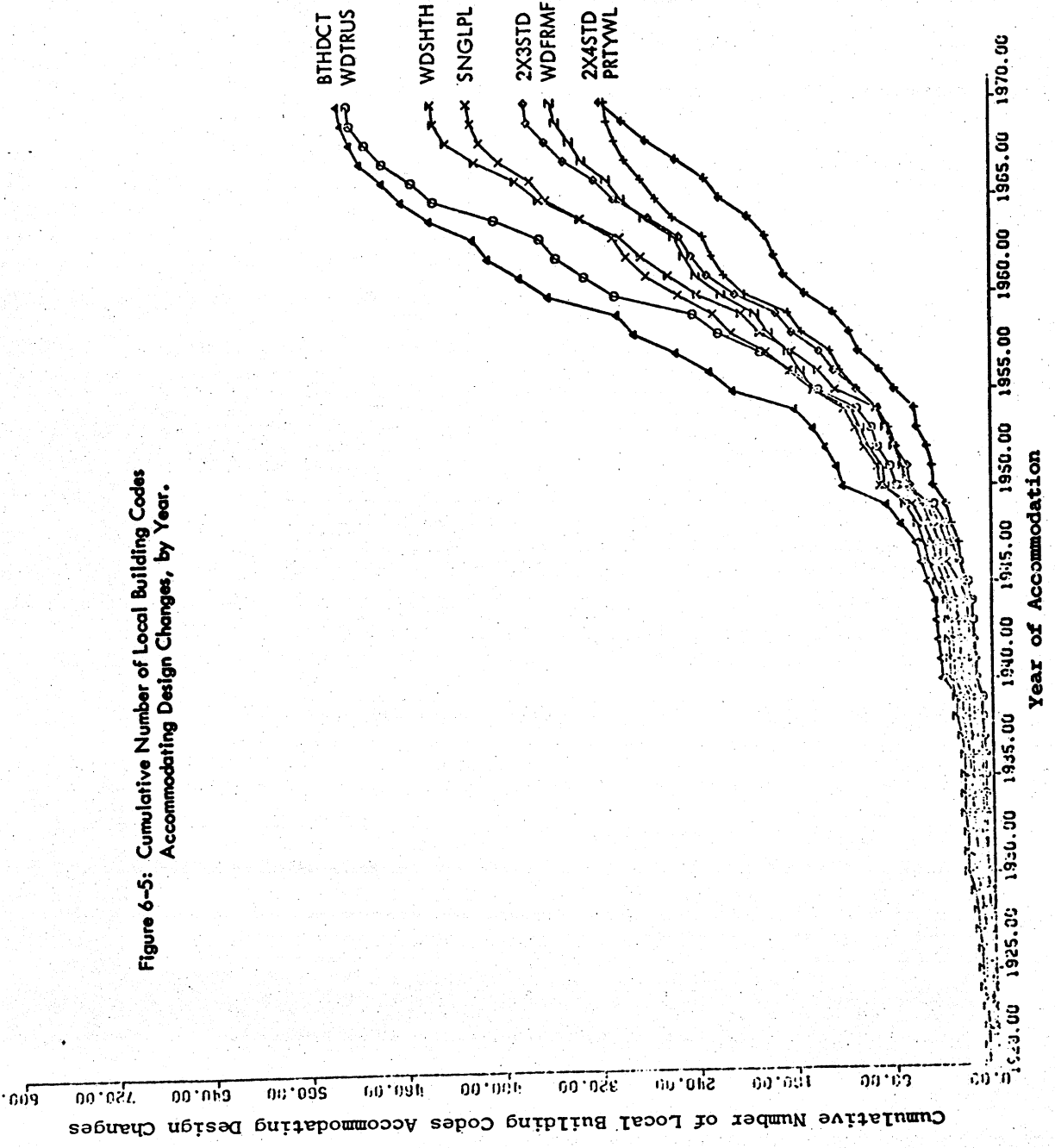


Figure 6-5: Cumulative Number of Local Building Codes Accommodating Design Changes, by Year.

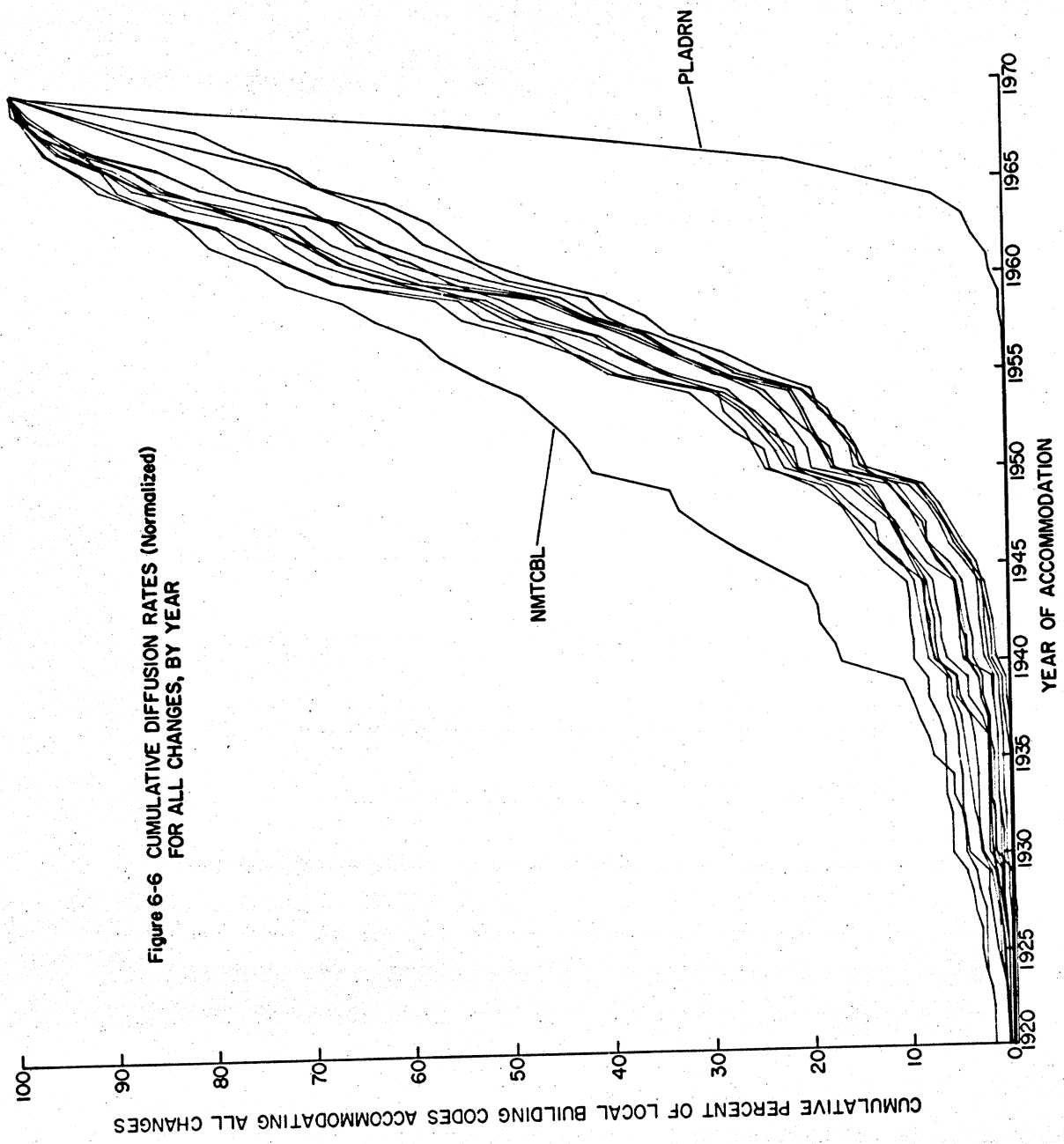


Figure 6-6 CUMULATIVE DIFFUSION RATES (Normalized)
FOR ALL CHANGES, BY YEAR

in the lower left-hand portion of the curve where the curve is almost flat. As these persons communicate the innovation to their peers, either verbally or by example, and their peers take up the new practice, then the pool of potential communicators increases as well. The result is that the diffusion "takes off" at an accelerated rate and this is what accounts for the steep rise of the "s-curve": it is the effect of the swelling number of communicators. Eventually, all the potential adopters of the new practice are made aware of the innovation and the increase in the number of new adopters declines, a saturation of sorts having been achieved. This occurrence is indicated by the slope of the diffusion curve decreasing until it eventually flattens, the diffusion process having run its course.

Deviation from this normal course of events occur as the result of an impetus from some powerful source from outside the social system in which the diffusion occurs. And it is to these deviations that will hold our attention for the remainder of this chapter.

The most arresting finding is that 12 of the 14 innovations comprising the index of technological currency have very similar signatures. The two deviants--NMTCL and PLADRN--are both of the material type and they deviate in essentially the same direction. NMTCL achieved an early take-off and appears to have moved inertially without a single perturbation. PLADRN, on the other hand, entered late--it was not commercially available to building uses until the late 1950's--but evidenced an uncommonly rapid diffusion. PLADRN

achieved in about 10 years a level of acceptance within 20% of that enjoyed by NMTCL, which has been commercially available for almost 50 years!

The implications of these findings are manifold. Some confirm and others disestablish earlier hypotheses of this study. Of immediate significance is the diminished utility of partitioning the several innovations along the dimensions called for in the Material-Method-Design categories. However serviceable this division may be for assigning building department client and reference groups into cohesive groupings, it holds much less promise as a predictor of levels or rates of diffusion of technological innovation. These findings, on the other hand, solidify the impression of ambivalence among diverse building industry interests in the face of technological innovation and their consequent defiance of facile categorization.

Two things remain to be accounted for in the present study. One is the impetus that altered the trajectories of the two deviating materials changes. The second, which will contribute to the first, is an understanding of the career of plastic pipe.

The Battles of Plastic Pipe

Recounting the career of a single innovation provides a recapitulation of the cumulative participation in building innovation of the several actors and institutions identified and described separately in the study thus far. It is in this

longitudinal study, this biography of an innovation as it were, that the public, private and voluntary sectors of the building enterprise can be examined as constituents of a collective decision mechanism. Moreover, important divisions of labor between local, regional and nation entities can be perceived, which perception leads to more subtle partitioning of the sets of actors previously identified.

Theoretically, the biography of any innovation would do. But special qualities adhere to plastic pipe that prompt its choice as the example. Foremost is its prominence as the most controversial innovation in residential construction technology in recent years, a controversy precipitated by the threats borne by that innovation. Both threats to establish relations between labor and management, between manufacturer, transporter, distributor and installer and threats to lucrative markets enjoyed by purveyors of both metallic piping and of plumbing services. The controversy was joined by those who saw promise where others saw threat: pipe manufacturers; producers of raw plastics; and the intermediate consumers of metallic piping and plumbing services: the homebuilders. The controversy has had the effect of making salient (and, hence, accessible to the outside researcher) issues that arise in all cases of technological innovation but are often too subtle to be apprehended and mapped by anyone but the participants themselves. For our purposes, controversy has functioned as a disclosing medium, much as the ingestion of a barium solution renders a fluoroscope of

the gastro-intestinal tract more readable. Far from distorting relations among actors, controversy clarifies them and casts them into high relief.

Other reasons for centering on PLADRN suggest themselves: its phenomenal growth in importance as an input to construction, displacing materials of hundreds--if not thousands--of years experience. One comparison suffices. Between 1963 and 1967--as Figures 6-3 and 6-6 reveal, years of great growth for PLADRN--the value of shipments to the construction industry of plastic pipe, fittings, and unions grew 139.5% as compared with 15.0 percent change for their metallic counterparts.⁹¹ Finally, its familiarity. Everyone, it seems, has heard of plastic pipe. Its inclusion or prospective inclusion in local building codes across the nation has prompted declamations in the Congressional Record, a public referendum in Kansas City, editorials in major newspapers, special sessions of Congressional hearings. "Plastic pipe" had become a symbol for all involved in the evolution of building technology and for laymen as well. One's attitude toward technological innovation, it seemed, could be gauged

⁹¹William R. Loftus, "Performance of 40 Construction Materials and Related Industries in 1967 Census," Construction Review, Vol. 15, No. 7 (July, 1969), Table 2, p. 8, and Franklin E. Williams, "The Use of Plastics in Construction," Construction Review, Vol. 16, No. 6 (June, 1970), Table 1, p. 5. Consistent with our earlier observation that consumer tastes lag producers' choices in building materials, the incursion of plastics into "visible" plumbing equipment (like bath tubs and showerstalls) was much slower. E.g.; growth for plastics in these uses in this period was 34.8 percent vs. 12.8 percent for metal sanitary ware and 10.9 for vitreous plumbing fixtures. Ibid.

by how one stood on plastic pipe.

Origins of Plastic Pipe

Two types of thermoplastics pipe account for all the plastics in use in drain, waste and vent (DWV) systems. They are acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC). ABS was invented by Uniroyal, Inc. in 1944; PVC, in Germany in the late 1920's. These dates are significant only in that they establish that the materials were adapted to DWV construction purposes--in the late 1950's--after years of development and use in other applications. PLADRN, too, was an "innovation by invasion," to use Schon's designation. 120 firms now manufacture plastics pipes and fittings--usually both PVC and ABS--and a fifth of these firms distribute nationally from two or more plants.⁹² Of this ABS-PVC output, 17.5 percent (169,000,000 lbs. in 1971) goes to DWV uses.⁹³ This figure in 1958 was virtually zero. The move from zero began in 1956 with the following train of events.⁹⁴

⁹² A. Stuart Wood, "Pipe Confounds Doubters...up 25 percent in '70," Modern Plastics, September, 1970.

⁹³ Memorandum of 12 May, 1972, from Plastics Pipe Institute, Table IX.

⁹⁴ Recounted in Hal Colling, "Why Today's Model Codes Lag Behind Construction Technology," House and Home (April, 1964), p. 148.

In that year, Monsanto, one of the largest producers of chemicals that comprise the raw materials for PLADRN, established and built a research laboratory in Creve Coeur, MO. The building was designed by an local architect, who served also as Creve Coeur's building commissioner. To permit the use of plastics, the architect-building commissioner had arranged an aldermanic resolution bypassing the town's BOCA-based building code so that by the end of 1956 Monsanto had both a building and a precedent-setting use for plastics piping. The episode illustrates the closeness of the local building department and the local building enterprise in the person of Architect Kenneth I. Wischmeyer. Also demonstrated is the need to advance technological change not only by a priori argument but by a certifiable, satisfactory application of the new technology, in this case a functioning building. Also instructive is Monsanto's role, they, to this day, make no pipe. Rather, Monsanto's interest lay in developing new markets for their raw material customers. This prompted the initiative in Creve Coeur.

At about the same time other suppliers of basic plastics materials also wished to extend markets for piping in construction. But the pipe-makers--their prospective customers--were small, numerous and were oriented to relatively local markets. The pipe-makers themselves had neither financial capacity nor the organizational resources to lead a campaign to establish new markets in the field of construction. Markets, moreover, that were already well-served by established firms

whose marketing was aided by a system of industrial relations and public regulation inimical to invasion from without. The producers of raw materials for the pipe makers--Allied Chemical, Borden, Celanese, du Pont, B. F. Goodrich, Goodyear, Gulf, Hooker, Mobil, Monsanto, Sinclair-Koppers, Tenneco, Union Carbide, Uniroyal--were among the largest business enterprises in the world; firms whose collective revenues are in the hundreds of billions. These supply firms, whose planning horizon is measured not in years but in decades, were eager to encourage their manufacturing customers to enter construction markets. An organizational vehicle was needed capable of merging the manufacturing and marketing know-how of over a hundred small, locally-oriented pipe manufacturers with the technological and financial resources of about a dozen giant petro-chemical industries. This came with the establishment of the Thermoplastics Pipe Division (TPD) of the Society of the Plastics Industry (SPI); later TPD became the Plastics Pipe Institute (PPI).⁹⁵

The first job of the TPD of SPI was to consolidate the few local precedents, like Creve Coeur, and to campaign in wider theaters "protecting the industry against or removing, artificial regulatory barriers to the sale and installation of suitable plastics materials".⁹⁶ The next logical step was

⁹⁵The foregoing, and that which follows, is based on an interview with Mr. Ray Durazo, Executive Director, PPI, on December 19, 1972.

⁹⁶Confidential Memorandum of Jerome H. Heckman, SPI General Counsel to the PPI, March 27, 1972.

to approach those entities that would influence subsequent local decisions on plastic pipe: the model code groups and the Federal government. The first model code approval came in 1957 with the recognition of a plastics "package", including piping, by the International Conference of Building Officials, proprietors of the Uniform Building Code, a model code widely used in the West. This recognition came over the opposition of steel and lumber interests and the California Fire Chief's Association. Bear in mind, plastics for structural and finishing uses were part of the "package" not just pipe. It was clear from this early experience, though, that plastics in DWV uses would have the most difficulty in gaining local and other model code approvals. Henceforth, in order not to jeopardize approval of plastics materials generally, pipe approvals were separated from the remainder of SPI code efforts and consolidated in a new entity, the PPI. Such was the early resistance encountered by plastics pipe.

The federal government was the next objective for PPI. Strictly speaking, there is no federal agency that "approves" building materials for sale on open markets. But an acknowledgment that certain materials are acceptable in federally-funded or-insured construction can be used by enterprising marketers as something akin to a product endorsement.

The Federal Housing Administration (FHA) is required to accept all technically suitable building materials. The determination of suitability lies with FHA's Architectural Standards Division which, having no test facilities of its

own, could contract to others, notably the National Bureau of Standards, for testing services. Testing however, cannot be responsibly administered without reference to a standard of performance. In the late 1950's and early 1960's, however, no nationally recognized standard for plastic DWV existed, only interim standards of tentative status. As long as only tentative standards were available, the FHA required the manufacturers of plastic pipe--as with any product for which only interim standards existed--to provide a warranty for their new product. Once the warranty was proffered, plastic pipe was acceptable to the FHA.⁹⁷

The issuance of a Use of Materials Bulletin permitting the use of ABS plastic came in 1961; that affecting PVC, in 1966. These signaled the tacit "approval" of the Federal Government. Permission to use plastics DWV in FHA-insured housing opened great potential markets, a market far in excess of the 15 percent to 25 percent of new residences that were FHA-insured during this period. But an examination of Figure 6-3 concedes that FHA recognition was not immediately reflected in widespread local approval. Rather, it seems the new recognition firmed the resolve of the industry interests opposed to the wider use of PLADRN. If the Battle of Washington was lost, the local skirmishes had merely begun and

⁹⁷The foregoing is based on a 9 April 1973 interview with S. Porter Driscoll who was Director of the FHA Architectural and Engineering Division, successor to the Architectural Standards Division.

it was at the local level that the opposing interests had greater tactical advantage.

The principal parties aligned in opposition to plastic pipe in DWV were two, the Cast Iron Soil Pipe Institute (CISPI) and United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada (referred to as the United Association or the UA). Each were threatened by PLADRN in different ways and their different organizational traits melded nicely. CISPI-members produced 95 percent of the cast iron soil pipe and fittings used in the U.S., used largely in DWV. The cast iron pipe producers, though not a large industry, did have concentrations in a few localities, notably Anniston, a city described by its Congressman as "Soil Pipe Capital of the World,"⁹⁸ and Bessemer, Alabama. Of course, the pipe producers had something different at stake than did CISPI itself, for, when ultimately convinced of the commercial possibilities of plastic, pipe producers were free to expand their product lines to include the new material. What the producers required was time both to weigh the future and then to proceed with diversification. Over the years, many of them did so. By 1970, the largest producer of cast iron soil pipe, the largest producer of copper fittings and the nation's third largest basic steel producer

⁹⁸Remarks of Hon. Bill Nichols, "Near-Dictatorial Drive by HUD for Plastic Plumbing Materials," in Congressional Record--Extensions of Remarks, September 30, 1970, p. E 8763.

were not only engaged in the production of PLADRN but were members of the ABS Institute⁹⁹-- CISPI's opposite number. No such adaptation was available to CISPI. Hence, for CISPI, the Battle of Plastic Pipe was a matter of survival. CISPI's response to the threat of plastic was two-fold. One lay in the development of alternative joining techniques to cancel out one great advantage of PLADRN, namely, the speed and facility of its installation at the job site. The second was an alliance with the United Association to delay, if not to stem, the diffusion of PLADRN.

The UA brought to the alliance a membership of 280,000 plumbers and pipefitters deployed in 700 locals across the country. Less readily identified is the treasure made available to the effort. Bear in mind, CISPI's constituents--the producers--were ambivalent about arresting the development of what was for them a potentially lucrative market; hence, the UA "dowry" assumed greater significance because of possible industry demurrers when CISPI sought the inevitable "war chest" assessments. And, whereas CISPI could prepare technical and legal briefs with which to counter the claims of the plastics proponents, the UA was unable to articulate those briefs with a local accent in hearing rooms the country

⁹⁹Letter of Rom Rhome, President, ABS Institute to John J. Sparkman, Chairman, Senate Sub-committee in Housing, in 1970, HUD Hearings, p. 681.

over. This, of course, was a polemicists delight. The arcana of materials science rendered by local union leaders who were, given the career paths of most local building officials, their former co-workers in construction or, at minimum, persons with whom the official's had a nodding acquaintance. Let a true instance illustrate how the CISPI-UA alliance worked in a hearing in Boston:

The (Massachusetts) State Board of Examiners of Plumbers--numerically dominated by plumbers--held a required public hearing in December of 1971, to hear arguments on a revision of the state plumbing code to widen the currently permitted uses of PLADRN. So controversial had the matter become that the largest public auditorium in the State House has designated the hearing site. The array of witnesses were drawn from the immediate clientele--manufacturers and wholesale suppliers of building materials and plumbing contractors--and included, in succession, a representative of CISPI and the president of UA Local 4 in Quincy. The two were a contrast. Mr. CISPI, resplendent in double-breasted dark pinstripe suit, flared pants and modishly-styled hair covering his ears and collar; his presentation as polished as his appearance. Mr. Local 4, on the other hand, barrel-chested in an ill-fitting suit, spoke with broad "a's" used "aahs" for "r's" and invoked other Bostonisms. But he spoke with none of the sang-froid of Mr. CISPI, who preceeded Mr. Local 4 had not returned to his original seat but took a place near the lecturn, awaiting the Board's questions. Mr. Local 4 began an appeal in earnest, based on technology and augmented by references to public safety and the welfare of his men. But, apparently unaccustomed to public speaking, Mr. Local 4 began to waver in his exhortation and tapped the lecturn as if to rouse the Muse that had inspired his early remarks.

It was Mr. CISPI who was aroused, however, and seeing Mr. Local 4 foundering, he reached into his own briefcase, found a prepared statement, and placed it on the lecturn before Mr. Local 4, who then concluded his presentation without further disruption, as if reading from a script.

The Battle Joined

Through the 1960's, PLADRN worked its way into the industry much as a guerrilla band courses through the countryside, working as unobtrusively as possible and striking at targets of opportunity. The latter were those places and occasions where local building interests intent on innovating had organized themselves to initiate code change actions. The principal actors were first and foremost the local homebuilders, autonomous local units in the confederation doing business as the National Association of Homebuilders. Local plumbing contractors seemed never to assume a position in favor, they were either neutral or against. The reasons are those given in detail earlier in this chapter and in Chapter 4 and can be summarized as "not wishing to alienate the United Association".

Another of the tenets of guerrilla warfare is to avoid static combat, a battle wherein mobility--the great advantage of guerrilla--is abandoned as a tactic and both sides take fixed positions for a battle of endurance. This is precisely the advantage of the "conventional" army in our analogy, the CISPI-UA alliance, sought. Kansas City, Missouri was the site that CISPI-UA chose to undo the recent gains of the plastics proponents; they used weapons for which there were presumably no defenses in the plastics armory.

In October of 1966, and at the request of the local Home Builders Association, plastics industry personnel appeared at a Kansas City Building Code Appeals Board hearing to seek

approval for ABS-DWV. This initial approach resulted approval for ABS in February, 1968 and for PVC in August of that year--almost two years of negotiation. Presented with a fait-accompl the CISPI-UA responded not with a court suit--the historic modus operandi of aggrieved parties--but with the filing of a referendum petition on the next general ballot to undo the plastics victory. This more was strategically impeccable, for the UA, in concert with other members of the local Building Trades Council, moved the battle into a new theater--electoral politics--in which the UA had an advantage not available to the plastics interests: disciplined numerical support sufficient to outvote an indifferent general electorate.

Victory for the alliance seemed assured once the referendum petition was filed, for this action alone required the collection of 18,000 signatures--mainly of union members and their families, most likely. The wording of the referendum was sufficiently obscure to reinforce general voter indifference to the issue. Moreover, the Nixon-Humphrey presidential contest was sufficiently narrow to attract major voter attention in 1968. Both these factors--an obscure issue and a distracted electorate--coupled with a disciplined turn-out of at least the 18,000 pro-labor petition signers seemed sufficient to assure a defeat for PLADRN.

But the plastics camp made up in a "voter education" advertising campaign what they lacked of a "natural" constituency. Industry sources documented an expenditure of \$46,000 and report an estimated \$60,000 counter-effort by the CISPI-UA

alliance.¹⁰⁰ The Kansas City electorate responded by approving the modernized code by a 69,538 to 57,772 vote. There followed an array of legal stays testifying to the tenacity of the CISPI-UA alliance. Chronologically:

Code Acceptance of ABC	6 February 1968
Code Acceptance of PVC	9 August 1968
Voter Referendum	5 November 1968
Plumbers seek injunction prohibiting enforcement of new code and sale of PLADRN	7 November 1968
Injunction terminated	23 April 1969
UA Local 8 fines members who install plastic and hubless pipe	May - June 1969
Order restraining and enjoining union fines brought	31 July 1969
Union ordered to show cause why it not be enjoined	18 August 1969
UA Local 8 and Plumbing Contractor's Association settle out of court	Fall 1969

The Kansas City episode marked a watershed in several respects and its repercussions have affected technological change in the plumbing and pipefitting industry to this day. From this point onward, plastics proponents took the offensive in pipe battes and functioned increasingly from a position of dominance. Shortly thereafter, PPI began an aggressive, open campaign to secure approval of PLADRN, prompting rather

¹⁰⁰ Heckman Memorandum to SPI, p. 14.

than responding to homebuilder initiatives. And at an annual cost of \$400,000-\$500,000.¹⁰¹ CISPI-UA, on the other hand, would now function as guerrillas; namely, to harrass, to nip at the heels, as it were, of the PPI juggernaut and seeking redress through the intervention of sympathetic legislators and office-holders, and arguing ad hominem: e.g. plastics interests were "big business", cast iron producers were small businesses and required the intervention of governments to stave off malefactors of great wealth.¹⁰² After Kansas City, CISIP-UA alliance was itself at stake. Recall that Local 8 Plumbers refused to install not only plastics pipe but also hubless pipe. "No-Hub" pipe was the great white hope of CISPI itself in its technological offensive against PLADRN. And now their erstwhile allies--the Plumbers--had deserted them in Kansas City as they would in local after local across the country.¹⁰³

By the late 1960's, PPI consolidated numerous local victories and had gained the recognition of the model code organizations. The fillip came in the form of a series of

¹⁰¹ Estimate of Mr. Ray Durazo, Executive Director of PPI.

¹⁰² This is a paraphrase--but not an exaggeration--of CISPI arguments in Congressional and Senate Hearings cited throughout the study.

¹⁰³ Interview with Robert McMillen, counsel to CISPI and former counsel to the United Association, 27 January 1971.

inquiries made by the U.S. Department of Housing and Urban Development into the technological currency of local building codes in cities in receipt of urban renewal, housing and other Federal community improvement funds. Pursuant to the Housing Act of 1954, localities must periodically certify to the Federal government that they maintain a Workable Program of Community Improvement as a condition of funding. Among the elements of the Workable Program is a requirement that localities enforce a building code that incorporates "nationally recognized standards governing the use of materials and methods of installation and construction".¹⁰⁴

PLADRN, largely through the influence of PPI on the model code associations, has achieved the status of a "nationally recognized standard" and HUD, enforcing workable program requirements, insists the PLADRN be not disallowed categorically.¹⁰⁵ Some cities are incensed at HUD's insistence on codes open to all materials capable of meeting performance standards as a condition of receiving Federal community improvement funds. San Francisco provides an interesting situation. Its September 1971 request for \$19 million in HUD funds "would not even be considered until

¹⁰⁴U.S. Department of Housing and Urban Development, A Workable Program for Community Improvement: Handbook, (September, 1970, MPD 7100.1a) The workable Program is not popular; the U.S. Conference of Mayors, in its 1970 meeting, called for its repeal.

¹⁰⁵See 1970 HUD Hearings, passim.

the codes were modified".¹⁰⁶ The Mayor faced a difficult choice: alter the codes and risk the plumbers and electricians (NMTCLB was also in contention) ire in what was expected to be a close election one month later; or not change the codes and risk \$19 million. Mayor Alioto changed the code and won re-election in one of the stronger "union towns" of the country.

An irony in HUD's advocacy of a technological innovation is that the material displaced--cast iron--figures prominently in the economics of Anniston (the "Cast Iron Soil Pipe Capital of the World") and Alabama. This is the political base of John J. Sparkman, Chairman of the Senate Sub-Committee on Housing and principal author of HUD's legislative fortunes. It is a tribute to the Senator's statesmanship that he has not succumbed to blatant protectionism for his allegedly discomfitted constituents. It also indicates that the cast iron pipe manufacturers themselves are not despondent for if they were, it is certain they would have compelled relief from Senator Sparkman. And if they had, it is unlikely that HUD would persist in its technological advocacy.¹⁰⁷

¹⁰⁶ House and Home, Vol. 40, No. 6 (December 1971), p. 20.

¹⁰⁷ For a Sparkman-CISPI colloquy on HUD's activism see 1970 HUD Hearings, pp. 645-652.

Instructive Pairwise Comparisons

It will be recalled that two anomalies appeared among the signatures of 14 innovations whose rates of diffusion were mapped in Figure 6-6. Both were materials changes--non-metallic sheathed electrical cable and plastic pipe--and their deviance from the norms were in the same direction but one (NMTCBL) moving inertially, the other (PLADRN) explosively. They bear further examination.

United Association officials were more exercised over the introduction of plastic pipe--an innovation that directly affects the marketing position of wholesalers, retailers and manufacturers of metallic pipe and only indirectly affects plumbers' productivity--than they were over the off-site preassembly of plumbing trees; this despite the fact that the latter has immediate for consequences for the union members. Similarly, it was not the introduction of off-site preassembled wiring harnesses that provoked the resistance of electrical union officials; rather, it was the introduction of non-metallic sheathed electrical cable which, like its counterpart in piping, displaced a traditional material. In other words, the greater union mobilization of resistance occurred with those innovations in which a change in the material technology pretends a change in the underlying social technology, in the marketing, distribution and transportation requirements of the new product.

This finding results from a comparison of the frequency with which local officials identified one or another innovation

as being the "most difficult" of local adoption. Under the assumptions of the present study, an adoption is "difficult" or "controversial" to the extent that it has provoked resistance among the agency's clientele. Since union representatives are the premier visible resisters (observed from Figure 4-4e), they can "make" an adoption controversial and difficult.

The following table, adapted from Figure 4-1, reveals the selectivity of visible resistance to code changes and some striking regularities, holding constant the type of change, changes affecting the plumbers were reported the most difficult change in eight times as many localities as were the changes affecting the electricians. Also, regardless of the specialty trade involved, materials changes were nominated the "most difficult" in nine times as many jurisdictions as were the methods changes.

Table 6-7

<u>Type of Change</u>	Specialty Trade	
	<u>Electricians</u>	<u>Plumbers</u>
Material	6.4 (NMTCBL)	51.7 (PLADRN)
Method	0.7 (WRHRNS)	5.7 (PLADRN)

Hence, materials changes are capable of mobilizing a wider coalition of resisting interests than a method change. This is one reason for their prominence in the collective recall of the nation's building officials. When a material

change is contemplated, more components in the building enterprise apparently have more at stake. Not to be slighted is the fact that materials changes are more "imageable" even to building professionals than are method changes. This issues from the fact that, where method changes are evolutionary and capable of partial application (greater or lesser amounts of off-site preassembly occurs in all of presentday building any way), materials changes are immediately discerned by even the least informed. Put another way, whereas, a method change is an interval on a continuum of possible changes material changes are unambiguous, binary choices--it is either plastic or cast iron and nothing in-between. Resort to Manichaeian extremes is a favorite device of polemicists of whatever cause. It has, at least, the virtue of clarity. The suggestion here is that the success of materials changes in their ability to draw the attention of the building community may be due in part, at least, to their relative lack of complexity and the ease with which they may be communicated.¹⁰⁸ This last is not an inconsiderable advantage in a dispersed and detached industry like construction.¹⁰⁹

The changes affecting the electrical trades were found

¹⁰⁸This also explains the preponderance of "plus signs" in Figure 6-3.

¹⁰⁹Rogers and Shoemaker, in Communication of Innovation, report that complexity of a innovation is negatively related to its rate of adoption, p. 154.

to have engendered far less controversy than did those affecting the plumbers. Certainly the acrimony of the immediately recent plastic pipe controversy accounts for most of this seeming amicability of the wiremen. But the plumbing method change also precipitated the most controversy in eight times as many localities as had the counterpart electrical change. And both these method changes (WRHRNS and PLMTRE) date from so far back to discount their saliance being attributable solely to the recency of the controversy. The key difference is the existence in the electrical contracting industry of the Council on Industrial Relations (CIR) comprising the labor and management forum convened at the national level to "remove the causes of friction...by providing a forum for...settlement of controversies between IBEW locals and NECA Chapters."¹¹⁰ To be sure, the UA also maintains a national joint committee to oversee training programs (as does the IBEW) but it has no counterpart of the CIR. There may, of course, be other sources for this difference between the plumbers and electricians but a comparison of two accessible studies of their respective unions¹¹¹ suggests little else. Electricians, it is true, do identify with the world of electronics and high technology and, it is also

¹¹⁰ See Chapter 5 of this study for further descriptions of the CIR and its work.

¹¹¹ Allison, Union Administration, (a Study of the IBEW) and Segal, The Rise of the National Association, (a study of the forerunner of the UA).

true that the IBEW does organize workers in those fields. But the implication that "osmosis" is possible between the electronic and construction departments of the international union is a delusion, a too simple reading of a complex technology diffusion process. There are other factors counting against the osmosis theory as well. In the first place, the electronic and the construction workers are enrolled in different locals of the IBEW and more importantly the leadership of the international union is wholly in the hands of the construction wing (even though the construction accounts for less than 20% of IBEW enrollment).¹¹²

A more plausible explanation is that the 55-year old CIR formalizes and makes permanent the ad hoc coalitions necessary for the diffusion of technological innovations in the dispersed building industries.

¹¹²Allison, Union Administration, pp. 2-10--2-26.

Chapter 7

CONCLUSIONS, ASSESSMENTS AND PROSPECTS

Neither the dynamics of building construction nor the dynamics of building regulation are well understood. The relationship of the regulator to the industry under regulation is not understood at all. The ignorance that surrounds the building enterprise and its regulatory system, traceable to the paucity of academic analysis and scholarly documentation of these activities, has prompted considerable cynicism toward these institutions. It is a cynicism that mounts when the subject of innovation in building technology is under discussion.

This study was devised to isolate for analysis the behaviors of these entities--industry and regulator alike--by tracing their responses to several discrete technological innovations, and only after so doing, to determine whether the cynicism was prescient or mischievous. An attempt was made to formulate insights into the problems of social control of technology, for in a wider reference, this is what building codes really are: a political means of social control of building technology.

The local government officials responsible for regulating the building industry in the United States do, in fact, accommodate the regulations they enforce to the changing requirements of an industry in continuing technological evolution. Progress, however, is neither uniform nor consistent, and is not without its occasional recalcitrants: the celerity of that process varies greatly, contingent on the technology being diffused. But this is true of manufacturing enterprises too, as Chapter 1 documented. The building industries are not greatly different from manufacturing industries in this respect.

The manner of residential construction's regulation is as highly idiosyncratic as is the enterprise itself. Regulatory practices are congruent to the organization and process of the traditional rather than the advanced wing of the industry; this is an effect not so much of conscious public policy choice as it is a result of intense industrial lobbying, devised in national councils and deployed with great effect in the city halls of the Nation. Building technology does advance and building codes do accommodate that advance but only to the extent that several key actors concur--several, not all, for the consent of only a sufficient coalition of the building department's clientele, not its unanimous assent, is required for building code modernization. Decisions of the local building department with respect to administration and interpretation as well as amendment to or overhaul of the code itself occur by reference to client groups for two reasons: (1) because of the agency staff's need for information about the technology under review and, (2) in order for the agency itself to maintain political legitimacy and viability. True to the model of pluralistic polyarchy, posited at the close of Chapter 1, the diversity of the building department's clientele--reflecting the diversity of the construction enterprise, itself--leaves no group with the advantage of sole access to the staff during the decision on innovative technology. As Table 6-6 indicates, no single agency client dominates communications access and potential influence for more than one type of code change. And with potential influence fragmented among so many actors--each with a small part to play--decisions

are influenced by ad hoc coalitions that aggregate influence fragments relevant to the issue at hand.¹ Of course, much the same could have been deduced from the generalizations of a decade of studies of change in public service bureaucracies.² But when the building department is isolated for detailed examination, maddening irregularities appear that do not conform to those comfortable generalizations. And what appear at first to be irregularities are but a manifestation of the extremely diverse nature of the department's clientele and the variability--even contrariness--of their separate interests. Consider the unions for instance.

The present study substantiates the widely-made allegation that building trades unions are the most vociferous resisters to building code accommodation of innovative technology. But three further findings reveal much more: (1) a great craft-by-craft and innovation-to-innovation variation in union response, for construction labor is not monolithic

¹ A paraphrase of Andrew S. McFarland's discussion of political power in Power and Leadership in Pluralist Systems (Stanford: Stanford University Press, 1969), p. 39. McFarland, in turn, paraphrased Dahl, Polsby and Wildavsky.

² Francis E. Rourke, Bureaucracy, Politics and Public Policy (Boston: Little, Brown, 1969); Lawrence B. Mohr, "Determinants of Innovation in Organizations", American Political Science Review, vol. 63, No. March 1969), pp. 111-126; Ira Sharkansky, Public Administration: Policy Making in Government Agencies. (Chicago; Markham 1970); Victor Thompson, "Bureaucracy and Innovation", Administrative Science Quarterly, Vol. 10, No. 1 (June, 1965), pp.

with regard to innovative technology; (2) an emergence of ad hoc coalitions of unions, building materials producers (and, less commonly, with speciality contractors) in support of resistance to specific technological changes; and, most instructive of all, (3) an inability of even the most vociferous coalition of recent years to stem or even to delay the diffusion of an innovation to which they were most strenuously opposed. Instances of these generalizations were, of course, recounted in the Battle of Plastic Pipe and they were salient when the respective careers of plastic pipe and non-metallic sheathed electrical cable were compared at the close of the preceding chapter.

The question then arises: if the most vociferous and most effectively deployed element of the clientele is incapable of precipitating decisive action by the agency, is the concept of the clientele viable and is its role in agency decision-making significant? Far from rendering the concept of the clientele invalid, the lack of singular domination reinforces that concept by underscoring the fact that the collective importance of the clientele as a whole is greater than that of any of its constituents, even the strongest of them. In the very diversity of the clientele and in the fragmentation of power and influence that any single element commands, there is no counterpart in the building enterprise to the singular "veto groups:" whose existence and mobilization in other polyarchic political systems--

notably large American cities--is sufficient to stymie innovation.³ This finding, that the whole is greater than the sum of its parts, might seem a slight contribution indeed were it not for the pervasive of belief among industry critics in one or two key "obstructions" to technological progress in the building enterprise, the most frequently alleged single obstructions being the labor unions and the tradition-bound local building community. These beliefs are shown to be incorrect; unions may be vocal resistors, but they do not always or even often prevail; and the local building interests--material purveyors, builders--are the primary agents of change in the local building departments regulations. This, too, is a lesson of plastic pipe, an innovation whose wide and rapid diffusion occurred despite the determined oppositions of a national alliance of plumbers and pipe manufacturers. A more important lesson is that assumptions behind the "obstruction" school of thought--revealed in the inconstance and inconsistency of the clientele--are wrong. They are seriously wrong since they can lead to the identification of specific "obstructors" which in turn can lead to wrong-headed and, consequently, mischievous reforms.

³ Wallace S. Sayre and Herbert Kaufman, Governing New York City: Politics in the Metropolis (New York: Norton-Russell Sage, 1960) pp. XLV-XLVI, 717.

The foregoing are grounds for rejecting monism and other reductionist explanations of regulatory practices of local building departments. But with what are they replaced? The general systems view that, almost ineffably, "everything's connected to everything else"? This argument is especially seductive at the conclusion of the present study. Consider again Figure 6-6, where, the systemic properties of the diffusion process in building technology appear strong enough to impose a discipline of sorts over the careers of twelve extremely heterogeneous building techniques. The homeostatic properties of the building system are the result of countervailing forces among that system's components, functioning as sets of actors weighing one against the other, sets whose composition changes from one innovation to the next. Some of the actors--unions and builders for example--may be necessary to achieve one or another code change, but none by itself is sufficient, there being such a fragmentation of the local building department's constituency. With no single sufficient causes, there can be no predicting an innovation's fate by the activities of one part of the building department's constituency.

This generalization holds, however, only so long as the conflict surrounding the code change is confined to the local constituency. For the two exceptions to the overall trend mapped in Figure 6-6 are those very innovations--PLADRN and NMTCBL--whose rapid diffusion can be ascribed to the most vigorous of application of influence from beyond the local community.

Strong as the homeostatic properties of the building enterprise are, the system does respond to external perturbations. The perturbations in the instant cases took two forms: the code acceptance of plastic pipe (PLADRN) responded to coordinated efforts ^{of} articulate local groups, reinforced by technical support and advertising and lobbying assistance from without, under the auspices of the Plastic Pipe Institute (PPI). The diffusion of non-metallic sheathed electrical cable (NMTCBL) responded to the restricted availability of metal during World War II and the efforts of the Council on Industrial Relations (CIR) of the National Electrical Contractors Association and the IBEW, two external events.

The return to wartime materials restrictions, of course, would be a high price to pay for the timely diffusion of a substitute building material. But the efficiency of the CIR is demonstrated in the extent to which CIR-like bodies are being established among the building industries. And these new joint labor-management councils now specifically refer to their role as monitors of emergent technology.⁴ The efficacy of PPI in the pipe case demonstrates that voluntary trade associations can be instrumental in accelerating progressive change in the regulatory system. This suggests that all trade associations are not monolithic in their

⁴ The Sheet Metal Workers International Association (SMNIA) have announced the establishment of a Technological Change Committee with 10 members representing labor and 10 members representing management. See "Unions, Contractors Report Progress" Air Conditioning, Heating and Refrigeration News, April 30, 1973, p. 1+.

defensiveness and reactionary attitudes. This finding calls into question the veracity of most published accounts of industrial special interest politics; accounts like those referred to in Chapter 5, specifically.

The exceptional careers of PLADRN and NMITCBL provide heartening precedent for creative roles for both industry and government: roles, moreover, that can be pursued separately or jointly. Industries can continue to serve their historical function as informed advocates of technological change in the traditional "lobbying" mode: bringing analysis and arguments to the attention of local regulators. But with this difference: and increased awareness and concern for the needs of the final users of environments. The problems inherent in this approach will be discussed shortly.

The second role would be a novel one to most elements of the building enterprise: the establishment under government auspices of joint consumer-producer-labor councils for technological innovation in each segment of the building enterprise. These joint councils could adapt methods used with great effect in the CIR of the electrical construction industry. Government administration of the broad public participation in such an enterprise has several advantages. The foremost of these is that collusion that might result in restraint of trade would be pre-empted. Moreover, the joint endeavors could be subjected to the requirements of due process and to appropriate legislative oversight. The addition of direct consumer participation would gain for the councils a political legitimacy and impose a broader mandate than the traditional wages, hours and working conditions, the usual preoccupations of joint labor-management boards. Issues like environmental impact, minority hiring and other broad issues might find a place on the council agenda. Labor and management would participate if

the council could bring a measure of stability to what is now a turbulent environment. This consumer role on such a council would be problematic here, too, for a council of technical specialists dealing with a technical agenda might leave the consumer representatives in a cloud of jargon. Yet, a means of consumer participation must be devised if the public interest is to be advanced.

The diverse building department constituency, gives a place but no prominence to what is in a sense the ultimate public interest. Except for the low-paid and low-status local building official, the public as a whole does not enjoy the services of an advocate in deliberations attending the regulation of building. The nominal propounders of non-industry views--civic or voter groups--attend (in the several senses of that term) the building department infrequently and are accorded little standing when they do. This, of course, is one of the inherent hazards of a pluralist political enterprise: only the organized have access to the forums of decision.⁵ Other actors more prominent in code change deliberations assume, on their own initiative, the mantle of advocacy for the consumer. Homebuilders, for instance, are eloquent in behalf of low- and middle-income families, arguing from their familiarity with social needs and economic demands of their customers as expressed in the market. Architects and engineers, as professionals, profess an interest beyond their own in matters environmental. But this second-hand, left-over and residual advocacy by agents whose primary allegiance is with the suppliers not the demanders of buildings, the makers not the users of environments, is now tarnished. The

⁵ See Chapter 5, fn. 18

Report of the National Commission on Product Safety, cited earlier, at several places drew attention to the moral equivocation and tergiversation inherent in industrial self-regulation and enumerated several examples of this failure of custodianship in relation to the built environment.

In fairness, it must be noted that some of the standards-making bodies that service the building industries have attempted to widen direct consumer participation. The American Society for Testing and Materials (ASTM) is notable in this respect: ASTM is seeking out consumer advocates and then subsidizing their attendance at ASTM meetings where this representation is needed.⁶

To the extent that consumer activism continues and that the environment remains a salient public issue, it is likely that the public interest will require greater representation in building regulatory deliberations. Newly-established governmental departments for consumer affairs already are serving as foci for this interest. In one instance, it is reported that "new Housing problems comprise the largest category of consumer complaints today."⁷ This tendency, assuming it is realized, will be challenged by the increasing complexity that is said to characterize evolving technology.⁸ This complexity suggests that if public attention is to be paid to issues of building regulation,

⁶ John A. Rauber, "ASTM and the Building Industry", The Construction Specifier, vol. 26, no. 4 (April 1973) p. 32

⁷ Report of the Fairfax County (VA) Consumer Protection and Public Utilities Commission, cited in Potomac Magazine of the Washington Post, April 22, 1973, p. 24

⁸ William Kuhns, The Post-Industrial Prophets, (New York: Weybright and Talley, 1971)

then a corps of informed advocates must be recruited. Building technology and, especially its regulation, will never be as simple as it now is; and we have shown it to be a subject of interest to specialists only. Moreover, as performance standards replace specification standards, for instance, building codes will be all but indecipherable to the lay public and their advocates who are not conversant with engineering testing technology and methods.

This condition--that advocacy be couched in the arcana of one or another professional speciality--occurs with increasing frequency as public (therefore, political) purposes are pursued by avowedly technical means. Knowledge-based advocacy has emerged as the principal method of achieving a social control over technology (including, of course, its consequences) and the judiciary, not the society of experts (Veblen's "engineers"). emerges the principal arbiter of this control function. Neither the courts nor the legislatures have the relevant expertise: that resides in the regulatory agency operating as the legislature's delegate, in the industry under regulation, and in the public interest advocates acting as amicus curiae. However, the body of knowledge on which all these experts draw--those facts and their significant relation knowledge of which distinguishes the professionals from the laity--is the residue of years of both systematic research and development and the collective experience of professional specialists. And this is the source of the

inexorable "industry-orientation"⁸ to which virtually every regulatory agency has been accused of conforming, for the industry itself is the dominant source of the shared knowledge base required for its own regulation. Industry subscribes for almost all and conducts most of the research pertaining to the civil sector of the U.S. economy. This applies a fortiori in construction, where only a few building materials industries provide most of the support for studies that eventually inform public policy on the physical aspects of the built environment. Little wonder then that industry spokesmen--builder, suppliers, architects and engineers, for example--dominate the information channels of both the local building department and the national building technology councils--public and private--such as the Building Research Advisory Board of the National Academy of Science--National Academy of Engineering--National Research Council, the American National Standards Institute and the American Society for Testing and Materials.

And, if one seeks the future of "the social control of technology"--a phrase acknowledging both Mumford's scepticism of autonomous technology and Dewey's sense of doing something practical about it--then one must be prepared to deal with more than just the mundane concerns identified and analysed in this study: the politics, pressures, the institutional economics, and the local bureaucrats, all of these in their homely detail. One must also search in the epistemological substrate as well. For the problem of knowledge--origin, validity and use--is itself the base problem of an informed social control of technology. This is the subject of another dissertation.

⁸ Louis L. Jaffe, Judicial Control of Administrative Action (Boston: Little, Brown, 1965) p. 26

APPENDIX

EXHIBIT A
SURVEY INSTRUMENT

1140
Connecticut
Avenue
Northwest
Washington DC
20036

Area Code 202
293-2200

**International
City
Management
Association**



Dear Sir:

Enclosed is a questionnaire regarding municipal building code procedures which we would like you to forward to the individual responsible for building code and inspection procedures in your municipality for his response.

This survey is being conducted in cooperation with the Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University. The results will appear in the 1971 Municipal Year Book and as a monthly statistical report for Urban Data Service scheduled for Fall, 1970, publication.

Without the valuable aid of individuals such as yourself, ICMA's information exchange program would be incomplete and I would like to thank you at this time for your continued cooperation on our behalf.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Mark E. Keane", with a long horizontal flourish extending to the right.

**Mark E. Keane
Executive Director**

Encls.

6. How frequently do you have *official business* contact with the following individuals? (Please check)

	OFTEN (1)	OCCASIONALLY (2)	RARELY (3)	NEVER (4)	
Building Material Producers and Suppliers Personnel:					55
Local	_____	_____	_____	_____	56
Out-of-town	_____	_____	_____	_____	57
Prefabricated Home Manufacturer or his Representative.....	_____	_____	_____	_____	58
Builder Personnel:					59
Local	_____	_____	_____	_____	60
Out-of-town	_____	_____	_____	_____	61
Building Trade Union Personnel	_____	_____	_____	_____	62
Building Officials from Cities:					63
Within your county	_____	_____	_____	_____	64
Outside your county	_____	_____	_____	_____	65
Building Official from State Building Agency	_____	_____	_____	_____	66
Representative of a Model Code Group	_____	_____	_____	_____	67
Architects or Engineers	_____	_____	_____	_____	68

7. How frequently do you see the following individuals *after work hours*? (Please check)

	OFTEN (1)	OCCASIONALLY (2)	RARELY (3)	NEVER (4)	
Building Material Producers and Suppliers Personnel:					16
Local	_____	_____	_____	_____	17
Out-of-town	_____	_____	_____	_____	18
Prefabricated Home Manufacturer or his Representative	_____	_____	_____	_____	19
Builder Personnel:					20
Local	_____	_____	_____	_____	21
Out-of-town	_____	_____	_____	_____	22
Building Trade Union Personnel	_____	_____	_____	_____	23
Building Officials from Cities:					24
Within your county	_____	_____	_____	_____	25
Outside your county	_____	_____	_____	_____	26
Building Official from State Building Agency	_____	_____	_____	_____	27
Representative of a Model Code Group	_____	_____	_____	_____	28
Architects or Engineers	_____	_____	_____	_____	29

8. Your present building code is based upon which of the following? (Please check)

- 27- _____ 1) AIA, National Building Code _____ 5) State or county building code
 _____ 2) ICBO, Uniform Building Code _____ 6) Locally drafted code
 _____ 3) Southern Standard Building Code _____ 7) No code in effect
 _____ 4) BOCA, Basic Building Code

9. In what year was your code *adopted*? 19 _____ 28-29

10. In what year was your code *last comprehensively revised*? 19 _____ 30-31

11. In what year was your code *last amended*? 19 _____ 32-33

12. Does variation in interpretation of identical code requirements exist between communities in your state? YES () NO () 34

If "YES,"

a. How much variation do you think exists? (Please check)

- 35- _____ 1) Very much _____ 3) Some
 _____ 2) Much _____ 4) Very little

b. Do you think this degree of variation is desirable? YES () NO () 36

13. Generally speaking, do you think local codes around the state need modernizing? (Please check)

- 37- _____ 1) Very much _____ 4) Very little
 _____ 2) Much _____ 5) Insufficient information exists on conditions in other localities
 _____ 3) Some

14. Do you think your own code needs modernizing? (Please check)

- 38- _____ 1) Very much _____ 4) Very little
 _____ 2) Much _____ 5) None
 _____ 3) Some

15. Who inspects the following components? For each component check as many inspecting jurisdictions as apply.

Component	Jurisdiction				
	Your Office (1)	Other Local Office (2)	County (3)	State (4)	
Building					39
Boiler					40
Elevators					41
Electrical					42
Fire Safety					43
Plumbing					44
Refrigeration					45
Air Pollution					46
Water Pollution					47
Mobile Homes					48
Mobile Home Parks					49

16. Are some of your building inspectors assigned to specific building use-types (e.g., commercial, single-family residential, multi-family residential) or construction-type (e.g., steel-construction, wood frame construction) or does all your staff cover everything? (Please check)

- 50- _____ 1) Some staff specializes by building use-type
 _____ 2) Some staff specializes by construction-type
 _____ 3) Staff does not specialize

17. Please indicate which of the following changes in building codes you feel is *most* desirable by placing a 1 adjacent to the appropriate change listed below; *next most* desirable by placing a 2; and *least* desirable by placing a 3.

- 51- _____ Compulsory federal code which applies equally to all communities
- 52- _____ Federal code which sets minimum standards but allows local governments to impose stricter standards
- 53- _____ State building code which sets minimum standards but allows local governments to impose stricter standards
- 54- _____ Compulsory state building code which applies equally to all communities. Stricter standards can be set by local communities only with the consent of the state code agency
- 55- _____ More widespread adoption by local communities of one of the model codes
- 56- _____ Retain the system where codes are locally adopted and enforced

STAFFING

18. Provide the information for the following building officials by checking the appropriate boxes.

	Chief building official (1)	Building official with longest service other than chief (2)	Most recently appointed building official (3)	
Background				57
Union building trades				58
Non-union building trades				59
General contractor				60
Engineer				61
Architect				62
Other governmental				63
Other				
Years of school completed				16
1-8 grades				17
9-12 grades				18
Some college				19
College graduate				
Age				20
20-29				21
30-39				22
40-49				23
50-59				24
60 & Over				
Enter No. of years in this department	(25-26) Years	(27-28) Years	(29-30) Years	

19. Please list the beginning and maximum yearly salaries for building officials *other than the chief building official.*

\$ _____ beginning \$ _____ maximum
(31-35) (36-40)

41-45

20. Please indicate the current yearly salary of the chief building official. \$ _____

21. At present, how are building officials qualified for their job in your department? (Please check)

- 46- _____ 1) On-the-job training _____ 5) State exam
- _____ 2) Formal schooling _____ 6) Other (Please specify) _____
- _____ 3) Construction related experience _____
- _____ 4) Local exam _____

22. List *all* qualifications that should be required in the future. (Please check)

- 47- _____ 1) On-the-job training _____ 5) State exam
- _____ 2) Formal schooling _____ 6) Other (Please specify) _____
- _____ 3) Construction related experience _____
- _____ 4) Local exam _____

23. Is there a local or a state education program for building officials? (Please check)

- | | | | |
|-------------------------|--------------|-------------------------|--------------|
| 48- | <u>Local</u> | 49- | <u>State</u> |
| _____ 1) Yes, mandatory | | _____ 1) Yes, mandatory | |
| _____ 2) Yes, optional | | _____ 2) Yes, optional | |
| _____ 3) No | | _____ 3) No | |

UNIONS AND ASSOCIATIONS

24. Are your building officials covered by state or municipal Civil Service? YES () NO () 50

If "NO," would you favor coverage under state or municipal civil service? YES () NO () 51

25. Are your building officials *represented* by a union? YES () NO () 52

If "YES," what unions? (Please specify) _____ 53-54

26. If your answer to Question 25 is "NO," do the officials hold membership in *any* union? YES () NO () 55

If "YES," which unions? (Please specify) _____ 56-57

27. How many of your building officials are members of a nationally or regionally affiliated association of building officials? (This does not mean a union.) (Please check)

- 58- _____ 1) Most _____ 2) Few _____ 3) None

CODE MODERNIZATION

28. In your judgment, does your agency generally adopt code changes before, about the same time, or after other nearby communities? (Please check one)

- 59- _____ 1) Before
 _____ 2) About the same time
 _____ 3) After

29. Mark "YES" or "NO" to which of the following building products or procedures are permitted, under your regulations, for residential construction within your jurisdiction. If "YES," please list the year this item was first permitted in your jurisdiction. *Estimate*, if necessary.

Identification Number	CODE CHANGES	YES	NO	IF YES
		If all or certain types (1)	Entirely prohibited (2)	Year first permitted
1)	Nonmetallic sheathed electrical cable			60-62
2)	Prefabricated metal chimneys			63-65
3)	Off-site preassembled combination drain, waste, and vent plumbing system for bathroom installation			16-18
4)	Off-site preassembled electrical wiring harness for installation at electrical service entrance to dwelling			19-21
5)	Wood roof trusses, placed 24" on center			22-24
6)	Copper pipe in drain, waste, and vent plumbing systems			25-27
7)	ABS (acrylonitrile-butadiene-styrene) or PVC (polyvinyl-chloride) plastic pipe in drain, waste, and vent plumbing systems			28-30
8)	Bathrooms or toilet facilities equipped with ducts for natural or mechanical ventilation, in lieu of operable windows (or skylights)			31-33
9)	Party walls without continuous air space			34-36
10)	Use of single top and bottom plates in non-load-bearing interior partitions			37-39
11)	Use of 2" x 3" studs in non-load-bearing interior partitions			40-42
12)	Placement of 2" x 4" studs 24" on center in non-load-bearing interior partitions			43-45
13)	In wood frame construction, sheathing at least 1/2" thick, in lieu of corner bracing			46-48
14)	Wood frame exterior walls in multi-family structures of three stories or less			49-51

30. For those checked "NO, Entirely prohibited," above, list below the identification number of the items which were at one time permitted but are now prohibited.

52- _____

31. Which of the 14 code changes you marked "YES," in Question 29 were the *most difficult* to adopt in your jurisdiction? Please rank the three most difficult by their identification number.

- 54-55 _____ Most difficult
- 56-57 _____ Next most difficult
- 58-59 _____ Third most difficult

32. Provide the information for the *most* difficult code change listed in Question 31 by checking as many boxes as apply. (This is answered best by going down one column at a time.)

	Where did the idea for this change originate? (1)	With whom was it discussed? (2)	Which were the most trust-worthy sources of information? (3)	Which groups most supported the change? (4)	Which groups most resisted the change? (5)
Building Material Producers or Supplier Representatives:					
Local					
Out-of-town					
Builder Representatives:					
Local					
Out-of-town					
Prefabricated Home Manufacturer Representatives					
Union Representatives: (identify by trade)					
Local					
Out-of-town					
Building Officials from Cities:					
Within your county					
Outside your county					
Civic or Voter Groups					
Building Product Catalogs or Brochures					
Trade or professional magazines or Journals					
Mass Media (TV, Magazines, Newspapers)					
Government Publications					
Meetings of your Professional Ass'n.					
Meetings or Conventions of Materials Producers					
Your staff					
Yourself					
Architects or Engineers					
Other (specify)					

33. Which of the code changes marked "YES" in Question 29 was the *least* difficult to adopt in your jurisdiction?

33-34 _____ IDENTIFICATION NUMBER FOR *LEAST* DIFFICULT CHANGE

34. Provide the information for the *least* difficult code change listed in Question 33 by checking as many boxes as apply. (This is best answered by going down one column at a time.)

	Where did the idea for this change originate? (1)	With whom was it discussed? (2)	Which were the most trust-worthy sources of information? (3)	Which groups most supported the change? (4)	Which groups most resisted the change? (5)	
Building Material Producers or Supplier Representatives:						35
Local						36
Out-of-town						37
Builder Representatives:						38
Local						39
Out-of-town						40-41
Prefabricated Home Manufacturer Representatives						42-43
Union Representatives: (identify by trade)						44
Local						45
Out-of-town						46
Building Officials from Cities:						47
Within your county						48
Outside your county						49
Civic or Voter Groups						50
Building Product Catalogs or Brochures						51
Trade or professional magazines or Journals						52
Mass Media (TV, Magazines, Newspapers)						54
Government Publications						55
Meetings of your Professional Ass'n.						56
Meetings or Conventions of Materials Producers						
Your staff						
Yourself						
Architects or Engineers						
Other (specify)						

35. Of those code changes listed in Question 29 as "NO, Entirely prohibited," which *two* will be the most difficult to adopt in your jurisdiction? Please use identification number.

 Most difficult
(58-59)

 Next most difficult
(59-60)

(61)

(62)

(63)

(64-65)

Signed _____

Title: _____

EXHIBIT B

SURVEY RESPONSE TABLE

RESPONSE TABLE

1970 ICMA SURVEY OF MUNICIPAL BUILDING DEPARTMENTS

<u>Classification</u>	<u>Cities Surveyed</u>	<u>Cities Responding</u>
Total, all cities.	2,479	930
Population Group		
Over 500,000	27	13
250,000-499,999.	27	12
100,000-249,999.	96	61
50,000- 49,999.	477	226
10,000- 24,999.	1,213	432
500- 9,999.	325	62
Under 500.	82	10
Geographic Region		
Northeast	593	185
North Central	615	254
South	522	245
West.	342	245
City Type		
Central	290	154
Suburban	1,030	418
Independent	752	341
Form Of Government		
Mayor-council	868	244
Council-manager	998	631
Other	206	54

EXHIBIT C

BIOGRAPHICAL NOTE

BIOGRAPHICAL NOTE

Francis Thomas Ventre

Dr. Ventre was educated in the public schools of Old Forge, Pennsylvania and received a Bachelor of Architecture from Penn State in 1961, a Master of City Planning from the University of California, Berkeley, in 1966 and a Doctor of Philosophy from the Massachusetts Institute of Technology in 1973. He has taught in the Schools of Architecture and Planning at both MIT and UCLA, where he was an Assistant Professor. Dr. Ventre has worked as a staff and consultant architect and planner with public agencies and private firms in Pennsylvania, California, Kentucky, New York, Massachusetts and Washington, D. C.

Dr. Ventre has published articles in professional journals in the U.S. and abroad and was a co-founder and Associate Editor of Environment and Behavior, the first interdisciplinary scholarly journal of man-environment relations. He is a member of several professional societies.

He has received the Pennsylvania Society of Architects' Award/Architecture Thesis Prize at Penn State; was a Mellon Fellow at Berkeley; and was a Catherine Bauer Wurster Fellow of the MIT-Harvard Joint Center for Urban Studies.

Dr. Ventre completed his dissertation while serving as Assistant Chief, Office of Building Standards and Codes Services, Center for Building Technology, Institute for Applied Technology, National Bureau of Standards.

The statements contained herein do not necessarily reflect the policies of the National Bureau of Standards.

EXHIBIT D
ACKNOWLEDGEMENTS

ACKNOWLEDGEMENTS

Although the responsibility of a single author, this study could not have been developed without the contributions of several organizations and the cooperation of their staff members. Especially helpful were the International City Management Association and Mark E. Keane, David Arnold, J. Robert Havlick and Carol Pigeon; the now expired National (Douglas) Commission on Urban Problems and Alan Manvel (currently affiliated with the Advisory Commission on Intergovernmental Relations); the Office of Code Development of the Massachusetts Department of Community Affairs and Charles J. Dinezio and Pauline E. Stanton; the Office of Building Standards and Codes Services, Center for Building Technology, Institute for Applied Technology, National Bureau of Standards and Gene A. Rowland and Charles T. Mahaffey.

Too numerous to mention specifically were the scores of local building officials, building material suppliers, architects, builders, trade union officers and journeymen who shared their intimate knowledge of the building enterprise with this grateful chronicler.

Research colleagues who have reviewed all or portions of this work will recognize their contributions to the draft presented here. Thanks to Charles G. Field, with whom I mined a common data base and who proved a patient critic of several hasty hypotheses; Professor D. Quinn Mills, who shared his personal library and bibliography on the construction industry; Professor Albert G. H. Dietz, whose earlier studies of the

institution of building provided a first whack at the Gordian knot; Professor Donald A. Schon's thoughts on innovation are cited specifically in this draft; and Professor Bernard J. Frieden who not only was the closest reader of this draft but who also, by his article in the Metropolitan Enigma, piqued my own early interest in some of the larger issues in building regulation.

A special debt is owed the MIT-Harvard Joint Center for Urban Studies. That remarkable organization by some alchemy compounded the most cogent and cancelled out the least agreeable attributes of its institutional avatars. The Joint Center provided this project with physical, financial and intellectual support beyond its customary generosity. The staff members were completely cooperative and bent every effort in support of scholarship and the Policy Advisory Board of the Center was a source of insight and constructive criticism. My thanks to all of them.

The widest, deepest gratitude goes to an understanding and loving wife who provided more support than I can possibly convey in these brief lines.